

ANNEX A

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Overview

In this Annex, each test is named with a code defining the training scenes involved. In particular:

- **TR** = TRompone church scene: training and test performed on the symmetric scene



- **SMV** = Subset of the Benchmark used for training (11 scenes for training, 1 for validation, 1 for test). The test scene is the Pilato's building from the "Sacred Mount of Varallo"



- **SMG** = Subset of the Benchmark used for training (11 scenes for training, 1 for validation, 1 for test). The test scene is the building from the "Sacred Mount of Ghiffa"



- **B_SMV** = All the **Benchmark** scenes are used for training (14 scenes for training, 1 for validation, 1 for test). The test scene is the building from the "Sacred Mount of Varallo"
- **B_SMG** = All the **Benchmark** scenes are used for training (14 scenes for training, 1 for validation, 1 for test). The test scene is the building from the "Sacred Mount of Ghiffa"
- **RF** = **R**andom **F**orest trained on multiple scenes
- **FE** = **DGCNN** used as **F**eature **E**xtractor. Split into *pieces* and *slice*.
- **FT** = **F**ine **T**uning. Split into *pieces* and *slice*.
- **DA** = **D**ata **A**ugmentation
- **ATDG** = **A**utomatic **T**raining **D**ata **G**eneration

Where not specified, the hyperparameters used for the tests are:

- Batch size = 4
- Number of epochs = 1500 for the Trompone symmetrical scene; 500 for the other tests
- Learning rate = 0.001
- Momentum = 0.9
- Optimiser = Adam
- Decay step = 300000
- Number of subsampled points for each block = 4096
- Block size = 1x1 m, with endless height
- Stride = 1
- Subsampling method: space

Where 3D features were added:

- f1 = verticality, radius 0.1 m
- f2 = verticality, radius 0.4 m
- f3 = omnivariance, radius 0.2 m
- f4 = surface variation, radius 0.2 m
- f5 = planarity, radius 0.5 m

The *graph for the training evaluation* and the *Cumulative Match Characteristics (CMC) curve* were plotted for almost all the SMV and SMG tests, however, for visualisation purposes, they are included for just the SMV tests, since the trend for SMG is identical.

For the Random Forest trained with all the scenes, only the best result for each configuration is reported.

Trompone church (Symmetrical scene)													
Test	Block size	N. of points	Col.	<i>k</i> -NN	Scaler	Focal loss	noZ_norm	Time	Epochs	Test - OA	mIoU	Note	
TR_1	5x5	4096	R G B	x y z	-	no	no	30 min	100	0.6031	0.2463	old classes	
TR_2	5x5	4096	R G B	x y z R G B	-	no	no	30 min	100	0.6236	0.273		
TR_3	5x5	4096	R G B	x y z Nx Ny Nz	-	no	no	30 min	100	0.5873	0.2777		
TR_4	5x5	4096	R G B	x y z	-	no	no	1.5 hr	500	0.6468	0.3017		- subsampling method: octree
TR_5	5x5	4096	R G B	x y z	-	no	no	1.5 hr	500	0.6345	0.3031		
TR_6	5x5x5	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	5 hr	500	0.6356	0.297		- subsampling method: octree
TR_7	5x5x5	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	5 hr	500	0.6286	0.3183		
TR_8	2x2x2	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	38 hr	500	0.6301	0.3476		- subsampling method: octree - different device for computation (MSI)
TR_9	1x1x1	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	5 hr	500	0.6286	0.3294		- subsampling method: octree
TR_10	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	7 hr	500	0.7948	0.4751		
TR_11	1x1	8192	R G B	x y z R G B Nx Ny Nz	-	no	no	2 hr	60	0.7434	0.365		- batch: 2
TR_12	1x1	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	7 hr	500	0.809	0.4794		
TR_13	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	7 hr	500	0.7344	-		
TR_14	1x1	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	7 hr	500	0.7442	-		
TR_15	1x1	4096	L A B	x y z L A B Nx Ny Nz	-	no	no	7 hr	500	0.7148	-		
TR_16	1x1	4096	L A B	x y z B Nx Ny Nz	-	no	no	7 hr	500	0.6834	-	- only b* channel from L* a* b*	
TR_17	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	7 hr	1500	0.7301	0.3866		
TR_18	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	no	no	7 hr	1500	0.7313	0.3812		
TR_19	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	no	no	7 hr	1500	0.7256	0.3986		
TR_20	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	yes	no	7 hr	1500	0.7206	0.3825		
TR_21	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	yes	no	7 hr	1500	0.7172	0.3747		
TR_22	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	yes	no	7 hr	1500	0.7216	0.3759		
TR_23	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	yes	7 hr	1500	0.7335	0.4118		
TR_24	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	no	yes	7 hr	1500	0.7119	0.3667		
TR_25	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	no	yes	7 hr	1500	0.7201	0.3832		
TR_26	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	yes	yes	7 hr	1500	0.7252	0.3903		
TR_27	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	yes	yes	7 hr	1500	0.6894	0.3529		
TR_28	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	yes	yes	7 hr	1500	0.7211	0.369		
TR_29	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	-	no	no	7 hr	1500	0.8388	0.5743		
TR_30	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	7 hr	1500	0.8723	0.6313		
TR_31	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 2	no	no	7 hr	1500	0.8679	0.6279		
TR_32	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	-	yes	no	7 hr	1500	0.8412	0.5781		
TR_33	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	yes	no	7 hr	1500	0.8618	0.615		
TR_34	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 2	yes	no	7 hr	1500	0.8639	0.6168		
TR_35	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	-	no	no	7 hr	1500	0.7807	0.4893		
TR_36	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	7 hr	1500	0.8133	0.5346		
TR_37	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	no	7 hr	1500	0.7941	0.5172		
TR_38	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	-	yes	no	7 hr	1500	0.7646	0.4878		
TR_39	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	yes	no	8 hr	1500	0.829	0.5549		
TR_40	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	7 hr	1500	0.8116	0.5432		
TR_41	1x1	4096	R G B	x y z R G B Nx Ny Nz Ev1 Ev2 Ev3	-	no	no	13 hr	500	0.3498	-	- computed in MatLab through geoFEX	
TR_42	1x1	4096	R G B	x y z R G B Nx Ny Nz Ev1 Ev2 Ev3 Ev1_1 Ev2_1 Ev3_1	scaler 1	no	no	8 hr	1500	0.773	0.4631	- the first 3 Evs were computed with radius 0.5 m, the other 3 Evs with radius 0.1 m on Cloud Compare	
TR_43	1x1	4096	R G B	x y z R G B Nx Ny Nz Ev1 Ev2 Ev3 Ev1_1 Ev2_1 Ev3_1	scaler 2	no	no	9 hr	1500	0.8275	0.532		

TR_44	2x2 (stride 1)	8192	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	23 hr	1500	0.8712	0.6534	
TR_45	2x2 (stride 1)	8192	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	23 hr	1500	0.7755	0.5281	
TR_46	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	8 hr	1500	0.8792	0.6277	- addition of random point on the floor

Subset of the ArCH dataset (13 scenes: 11 for training, 1 for validation, 1 for test)												
Test	Block size	N. of points	Col.	k-NN	Scaler	Focal loss	Skip connection	noZ_norm	Time	Test - OA	mIoU	Note
SMG_1	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	4 hr	0.6814	0.3743	- 70 epochs - training set 6 scenes (TR_church, TR_cloister, SMV_chapel_1, SMV_chapel_24, VAL_room, CA_church) - only 5 classes (Arch + Vault, Column, Floor, Roof, Wall)
SMG_2	5x5x5	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	no	5 hr	0.7278	0.3241	- training set 9 scenes (TR_church, TR_cloister, SMV_chapel_1, SMV_chapel_2to4, SMV_chapel_10, SMV_chapel_24, SMV_chapel_28, VAL_room, CA_church)
SMG_3	2x2x2	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	no	33 hr	0.7701	0.352	- subsampling method: octree
SMV_1	1x1		H S V	x y z H S V Nx Ny Nz	-	no	no	no	45 hr	0.825	-	- 11 total scenes
SMV_2	1x1	4096	-	x y z	-	no	no	no	45 hr	0.5607	0.2767	
SMV_3	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	46 hr	0.8212	0.3974	- other class
SMV_4	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	46 hr	0.8294	0.4588	
SMV_5	2x2 (st 2)	8192	R G B	x y z R G B Nx Ny Nz	-	no	no	no	46 hr	0.7466	0.3255	
SMV_6	1x1	4096	H S V	x y z H S V Nx Ny Nz	-	no	no	no	46 hr	0.8351	0.4847	
SMV_7	1x1	4096	L A B	x y z L A B Nx Ny Nz	-	no	no	no	46 hr	0.8278	0.4931	
SMV_8	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	no	no	no	46 hr	0.8038	0.4075	
SMV_9	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	no	no	no	46 hr	0.8087	0.4305	
SMV_10	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	yes	no	no	46hr	0.8108	0.4343	
SMV_11	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	yes	no	no	46 hr	0.8152	0.4364	
SMV_12	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	yes	no	no	46 hr	0.8004	0.4023	
SMV_13	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	yes	33hr	0.8188	0.4081	- other class
SMV_14	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	48 hr	0.8024	0.4096	
SMV_15	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	48 hr	0.7926	0.3916	
SMV_16	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	46 hr	0.8082	0.4693	
SMV_17	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	47 hr	0.6332	0.3685	
SMV_18	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	yes	no	no	46 hr	0.7841	0.4378	
SMV_19	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	46 hr	0.7881	0.4374	
SMV_20	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	46 hr	0.8352	0.4962	
SMV_21	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	46 hr	0.6882	0.3112	- no layer 4
SMV_22	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	46 hr	0.8445	0.5038	
SMV_23	2x2 (stride 1)	8192	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	108 hr	0.8364	0.5135	
SMV_24	2x2 (stride 1)	8192	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	108 hr	0.8265	0.4845	
SMV_25	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	yes	no	no	47 hr	0.8441	0.5089	
SMV_26	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	46 hr	0.8452	0.5187	
SMV_27	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	yes	no	46 hr	0.835	0.505	
SMV_28	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	yes	no	47 hr	0.8448	0.5148	
SMV_29	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	-	yes	yes	no	46 hr	0.7744	0.3767	
SMV_30	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	yes	yes	no	46 hr	0.8409	0.5076	

SMV_31	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler2	yes	yes	no	47 hr	0.8469	0.5049
SMV_32	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler2	yes	yes	yes	47 hr	0.8491	0.5231
SMV_33	1x1	4096	H S V	x y z H S V Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler2	yes	yes	yes	46 hr	0.8403	0.4935
SMV_34	1x1	4096	L A B	x y z L A B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler2	yes	yes	yes	46 hr	0.8628	0.5405
SMG_4	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	46 hr	0.886	0.5058
SMG_5	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	no	no	no	46 hr	0.8562	0.3907
SMG_6	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	no	no	no	46 hr	0.7386	0.3339
SMG_7	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	yes	no	no	46 hr	0.8951	0.4965
SMG_8	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 1	yes	no	no	46 hr	0.8887	0.444
SMG_9	1x1	4096	R G B	x y z R G B Nx Ny Nz	scaler 2	yes	no	no	46 hr	0.7813	0.4061
SMG_10	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	46 hr	0.8736	0.5428
SMG_11	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	46 hr	0.9092	0.9092
SMG_12	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	yes	no	no	47 hr	0.9121	0.5947
SMG_13	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	46 hr	0.9135	0.5869
SMG_14	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler2	yes	yes	yes	46 hr	0.9161	0.5941

ArCH benchmark											
B_SMV_1	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	65 hr	0.8368	0.4699
B_SMV_2	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	66 hr	0.8318	0.5078
B_SMV_3	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	66 hr	0.8535	0.5579
B_SMV_4	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	yes	yes	66 hr	0.8656	0.5619
B_SMV_5	1x1	4096	H S V	x y z H S V Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	yes	yes	66 hr	0.8587	0.5642
B_SMV_6	1x1	4096	L A B	x y z L A B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	yes	yes	72 hr	0.8647	0.5364
B_SMG_1	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	66 hr	0.8958	0.5348
B_SMG_2	1x1	4096	R G B	x y z f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	66 hr	0.8719	0.5479
B_SMG_3	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	63 hr	0.9144	0.5997
B_SMG_4	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	yes	yes	73 hr	0.9157	0.6097

RF parameters					
Feature Extractor*					
Test	Scaler	Impurity	N. of trees	Depth	Test - OA
FE_pieces_1	-	Entropy	100, 150, 200	None	0.6912
FE_pieces_2	-	Gini	100, 150 , 200	None	0.6904
FE_pieces_3	scaler 1	Entropy	100, 150, 200	None	0.6739
FE_pieces_4	scaler 1	Gini	100, 150, 200	None	0.6833
FE_pieces_5	scaler 2	Entropy	100, 150 , 200	None	0.6947
FE_pieces_6	scaler 2	Gini	100, 150 , 200	None	0.6968
FE_slice_1	-	Entropy	100 , 150, 200	None	0.8152
FE_slice_2	-	Gini	100, 150, 200	None	0.813
FE_slice_3	scaler 1	Entropy	100, 150, 200	None	0.8063
FE_slice_4	scaler 1	Gini	100, 150, 200	None	0.8063
FE_slice_5	scaler 2	Entropy	100, 150, 200	None	0.8098
FE_slice_6	scaler 2	Gini	100, 150, 200	None	0.8089

* The features have been extracted from a DGCNN-Mod+3Dfeat trained on the subset of the ArCH benchmark with scaler 2 and Focal Loss

RF trained with multiple scenes					
Test	Scaler	Impurity	N. of trees	Depth	Test - OA
RF_1	-	Gini	100, 150, 200	None	0.663
RF_2	-	Entropy	100, 150, 200	None	0.6782
RF_3	scaler 1	Gini	100, 150 , 200	None	0.3665
RF_4	scaler 1	Entropy	100, 150 , 200	None	0.3966
RF_5	scaler 2	Gini	100, 150 , 200	None	0.176
RF_6	scaler 2	Entropy	100, 150 , 200	None	0.184

Fine tuning												
TEST	Block size	N. of points	Col.	<i>k</i> -NN	Scaler	Learning rate	Focal loss	Skip connection	noZ_norm	Test - OA	mIoU	
FT_pieces_1	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f5	scaler 2	0,0001 (1/10)	no	no	no	0.668	0.4101	
FT_pieces_2	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	0,0001 (1/10)	yes	no	no	0.7067	0.3993	
FT_pieces_3	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	0,0001 (1/10)	yes	yes	no	0.7145	0.4295	
FT_slice_1	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f5	scaler 2	0,0001 (1/10)	no	no	no	0.8395	0.523	
FT_slice_2	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	0,0001 (1/10)	yes	no	no	0.8365	0.5105	
FT_slice_3	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	0,0001 (1/10)	yes	yes	no	0.8109	0.4769	
FT_slice_4	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	0,0001 (1/10)	yes	yes	yes	0.8276	0.4653	
FT_slice_5	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	0,0001 (1/10)	yes	yes	yes	0.8401	0.5049	
FT_slice_6	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	-	0,0001 (1/10)	yes	yes	yes	0.2355	0.0763	

Data augmentation												
TEST	Block size	N. of points	Col.	<i>k</i> -NN	Scaler	Focal loss	Skip connection	noZ_norm	Time	Test - OA	mIoU	
DA_1	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	44 hr	0.796	0.4007	
DA_2	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	-	no	no	no	44 hr	0.8384	0.4989	
DA_3	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 1	no	no	no	44 hr	0.8397	0.4935	
DA_4	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	no	no	no	43 hr	0.8542	0.5104	
DA_5	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	no	no	44 hr	0.8458	0.4801	
DA_6	1x1	4096	R G B	x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6	scaler 2	yes	yes	no	44 hr	0.8533	0.5094	

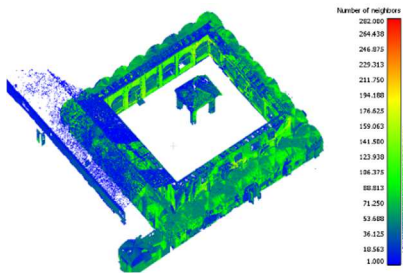
Automatic training data generation												
TEST	Block size	N. of points	Col.	<i>k</i> -NN	Scaler	Focal loss	Skip connection	noZ_norm	Test - OA	mIoU	Note	
ATDG_KAS_1*	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	0.9183	-	M_Heracles	
ATDG_KAS_2	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	0.9246	0.3379	Manual annotation	
ATDG_SMG_1	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	0.6332**	0.3036	M_Heracles	
ATDG_SMG_2	1x1	4096	R G B	x y z R G B Nx Ny Nz	-	no	no	no	0.7292**	0.3825	Manual annotation	

* Kasepuhan is the name of the pavillion used for testing

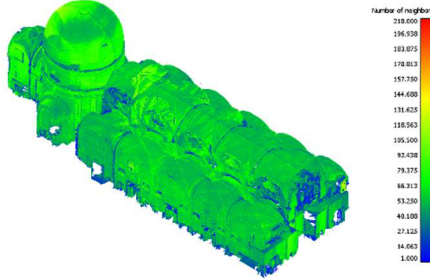
** Since the focus was the *column* category, to perform these tests only 5 scenes (with the highest number of columns) were selected as training dataset, therefore, the OA should not be compared with the other tests

Example of point cloud densities

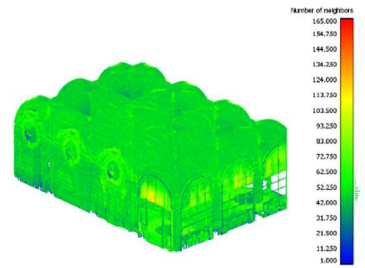
TR_cloister



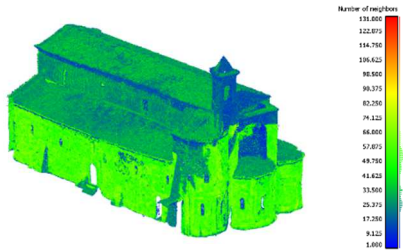
TR_church



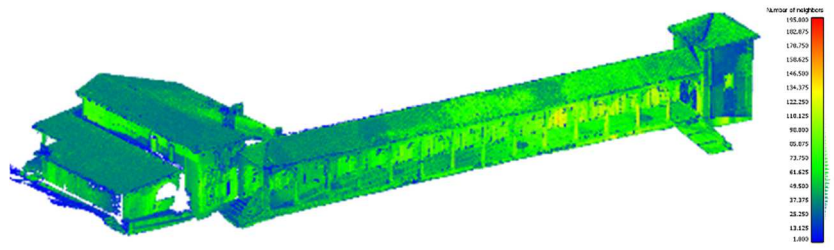
VAL_room



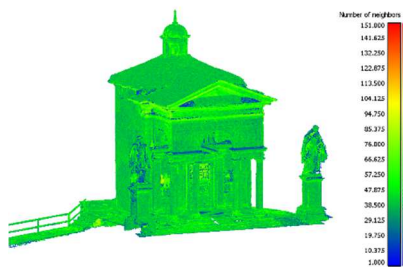
CA_church



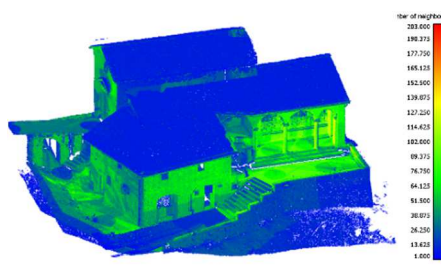
SMG_portico



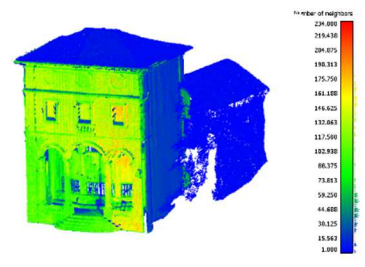
SMV_chapel_1



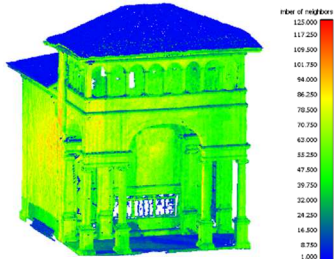
SMV_chapel_2to4



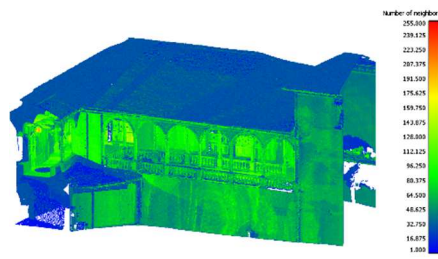
SMV_chapel_24



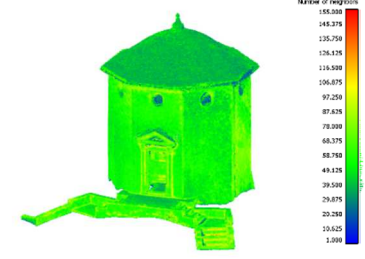
SMV_chapel_28



SMV_chapel_27to35



SMV_chapel_10



Tests on the Trompone church scene

TEST: TR_1

Overall Accuracy: **0.6031**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z

Block size: 5x5 m

Stride: 5

Epochs: 100

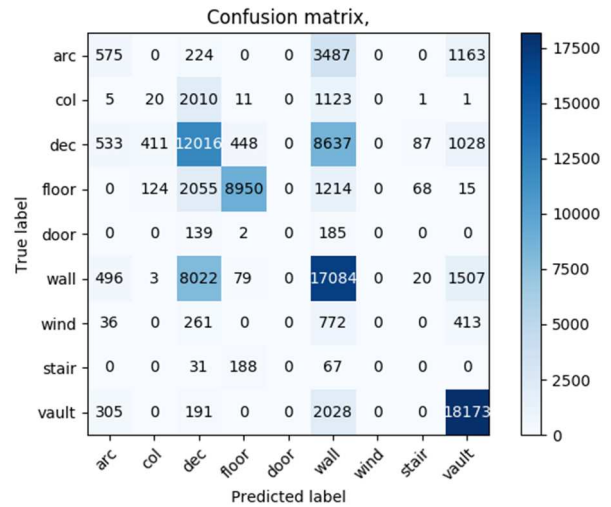
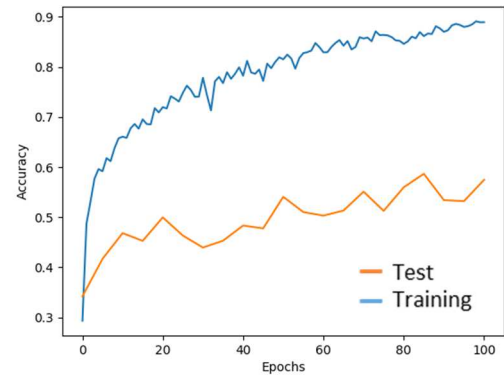
Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.543355
eval accuracy: 0.603112
report:

	precision	recall	f1-score	support
arc	0.2949	0.1055	0.1554	5449
col	0.0358	0.0063	0.0107	3171
dec	0.4816	0.5188	0.4995	23160
floor	0.9248	0.7203	0.8098	12426
door	0.0000	0.0000	0.0000	326
wall	0.4938	0.6278	0.5528	27211
wind	0.0000	0.0000	0.0000	1482
stair	0.0000	0.0000	0.0000	286
vault	0.8149	0.8780	0.8453	20697
micro avg	0.6031	0.6031	0.6031	94208
macro avg	0.3384	0.3174	0.3193	94208
weighted avg	0.5803	0.6031	0.5844	94208



IoU

arch: 0.0842

column: 0.0053

decoration: 0.3329

floor: 0.6804

door: 0.0

wall: 0.3819

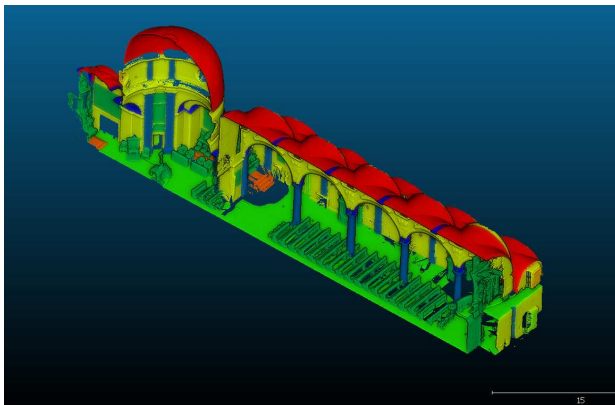
window: 0.0

stair: 0.0

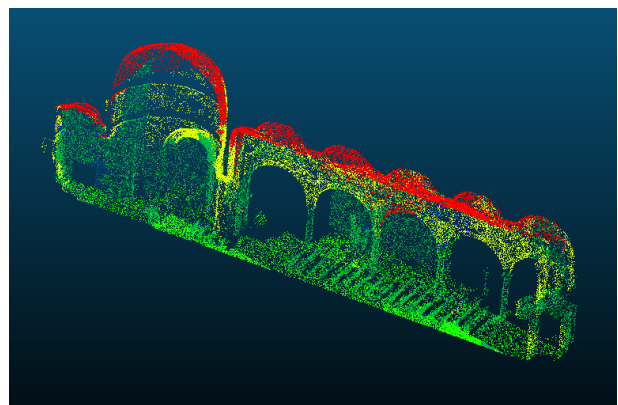
vault: 0.7320

Average IoU: 0.2463

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_2**

Overall Accuracy: **0.6236**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z R G B

Block size: 5x5 m

Stride: 5

Epochs: 100

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.842650

eval accuracy: 0.623694

report:

	precision	recall	f1-score	support
arc	0.3309	0.2644	0.2940	5533
col	0.2585	0.1201	0.1640	3181
dec	0.5272	0.4154	0.4647	23008
floor	0.8087	0.9410	0.8699	12694
door	0.0000	0.0000	0.0000	332
wall	0.5266	0.7067	0.6035	26821
wind	0.0000	0.0000	0.0000	1433
stair	0.0000	0.0000	0.0000	289
vault	0.8507	0.7867	0.8174	20917
micro avg	0.6237	0.6237	0.6237	94208
macro avg	0.3670	0.3594	0.3570	94208
weighted avg	0.6047	0.6237	0.6068	94208

IoU

arch: 0.1723

column: 0.0893

decoration: 0.3026

floor: 0.7697

door: 0.0

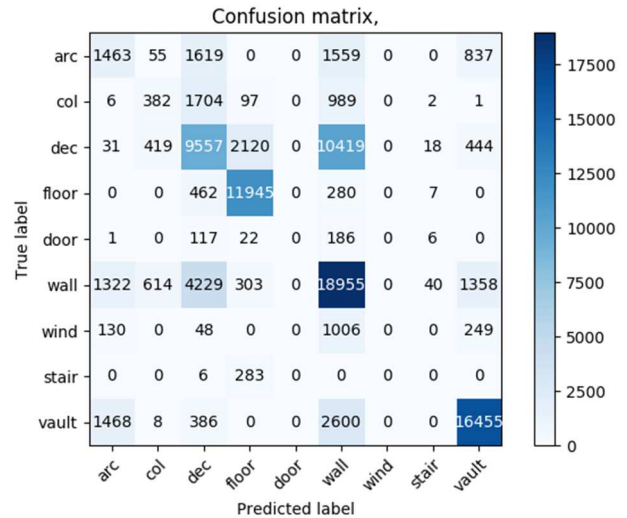
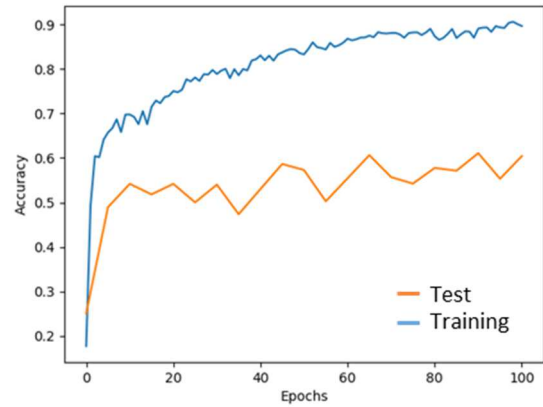
wall: 0.4321

window: 0.0

stair: 0.0

vault: 0.6912

Average IoU: 0.2730



TEST: TR_3

Overall Accuracy: **0.5873**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k -NN features: x y z Nx Ny Nz

Block size: 5x5 m

Stride: 5

Epochs: 100

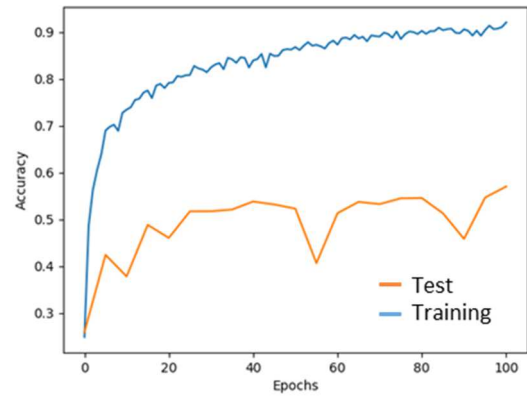
Scaler: -

No Z normalisation | Focal loss | Skip connections

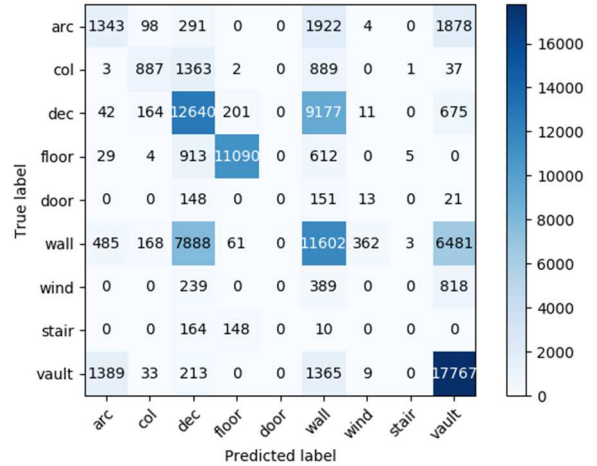
TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.446126
eval accuracy: 0.587307
report:

	precision	recall	f1-score	support
arc	0.4081	0.2426	0.3043	5536
col	0.6551	0.2788	0.3911	3182
dec	0.5298	0.5517	0.5405	22910
floor	0.9642	0.8765	0.9182	12653
door	0.0000	0.0000	0.0000	333
wall	0.4442	0.4289	0.4364	27050
wind	0.0000	0.0000	0.0000	1446
stair	0.0000	0.0000	0.0000	322
vault	0.6419	0.8552	0.7334	20776
micro avg	0.5873	0.5873	0.5873	94208
macro avg	0.4048	0.3593	0.3693	94208
weighted avg	0.5736	0.5873	0.5729	94208



Confusion matrix,



IoU

arch: 0.1794

column: 0.2430

decoration: 0.3703

floor: 0.8488

door: 0.0

wall: 0.2791

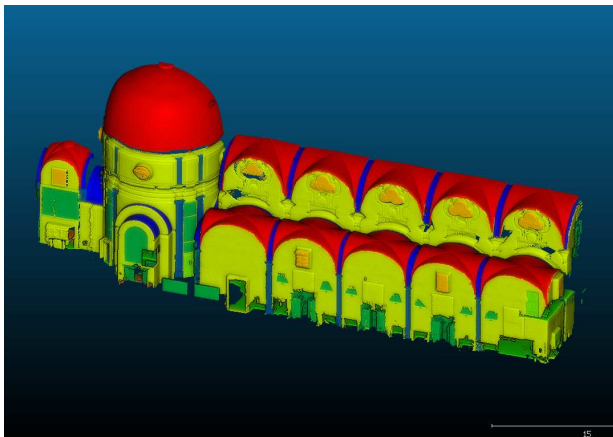
window: 0.0

stair: 0.0

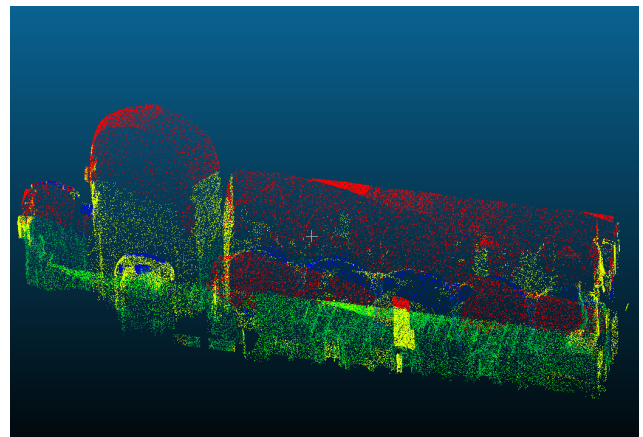
vault: 0.5789

Average IoU: 0.2777

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: TR_4

Overall Accuracy: **0.6468**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z

Block size: 5x5 m

Stride: 5

Epochs: 500

Scaler: -

Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 2.214028
eval accuracy: 0.646898
report:

	precision	recall	f1-score	support
arc	0.4309	0.3114	0.3615	5055
col	0.3457	0.5755	0.4319	3178
dec	0.7892	0.5369	0.6391	21437
floor	0.8013	0.9264	0.8593	13606
door	0.0000	0.0000	0.0000	278
wall	0.5442	0.5762	0.5597	27468
wind	0.0000	0.0000	0.0000	1564
stair	0.4000	0.0125	0.0242	160
vault	0.6850	0.8200	0.7464	21462
micro avg	0.6469	0.6469	0.6469	94208
macro avg	0.4440	0.4176	0.4025	94208
weighted avg	0.6455	0.6469	0.6368	94208

IoU

arch: 0.2206

column: 0.2754

decoration: 0.4695

floor: 0.7533

door: 0.0

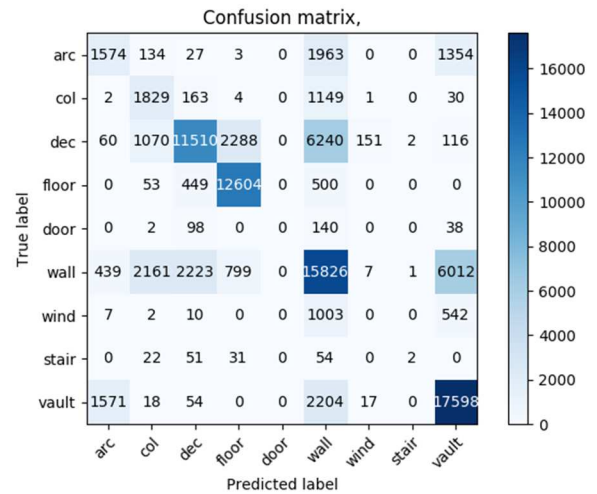
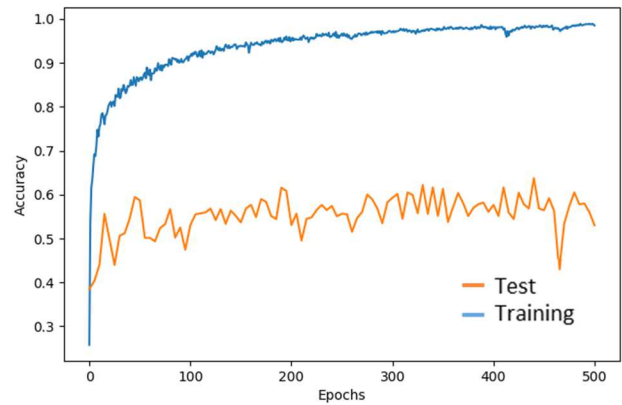
wall: 0.3886

window: 0.0

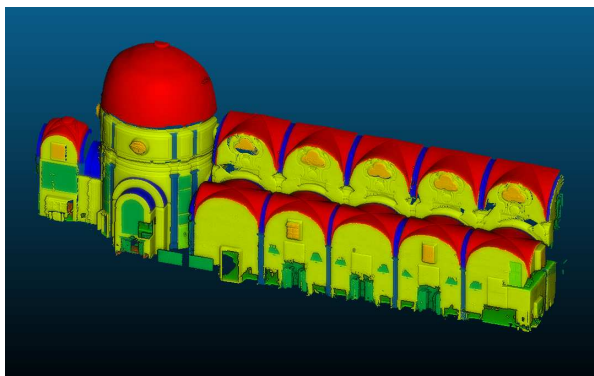
stair: 0.012

vault: 0.5954

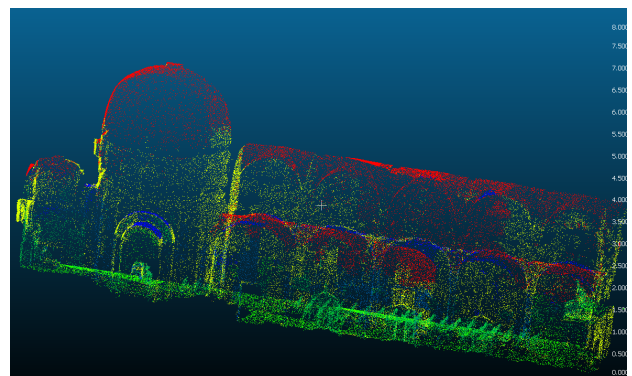
Average IoU: 0.3017



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_5**

Overall Accuracy: **0.6345**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z

Block size: 5x5 m

Stride: 5

Epochs: 500

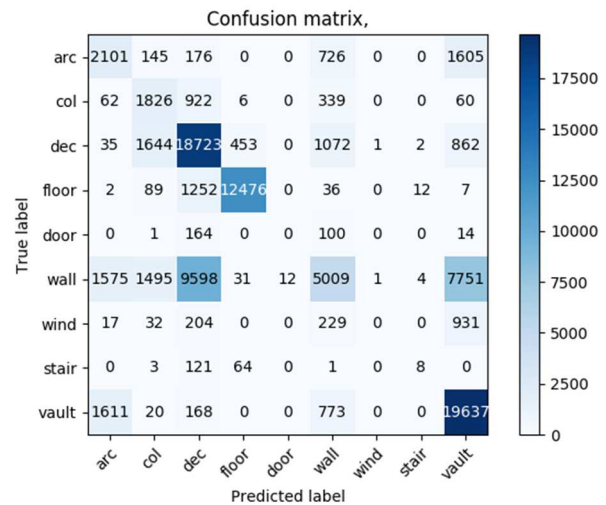
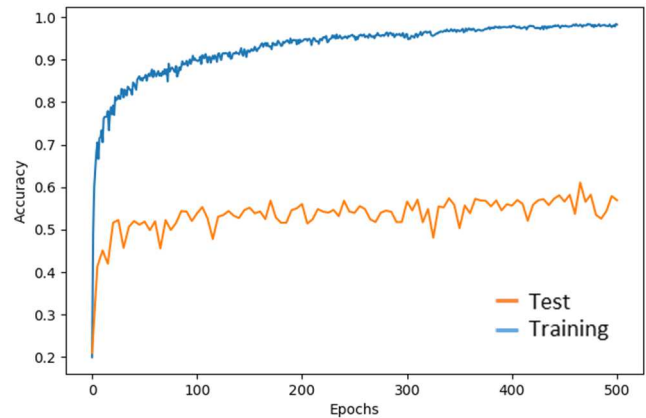
Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 2.790092
eval accuracy: 0.634553
report:

	precision	recall	f1-score	support
arc	0.3889	0.4420	0.4137	4753
col	0.3475	0.5680	0.4312	3215
dec	0.5976	0.8215	0.6919	22792
floor	0.9575	0.8992	0.9274	13874
door	0.0000	0.0000	0.0000	279
wall	0.6046	0.1966	0.2967	25476
wind	0.0000	0.0000	0.0000	1413
stair	0.3077	0.0406	0.0717	197
vault	0.6362	0.8842	0.7400	22209
micro avg	0.6346	0.6346	0.6346	94208
macro avg	0.4267	0.4280	0.3970	94208
weighted avg	0.6312	0.6346	0.5944	94208



IoU

arch: 0.2608

column: 0.2748

decoration: 0.5289

floor: 0.8647

door: 0.0

wall: 0.1742

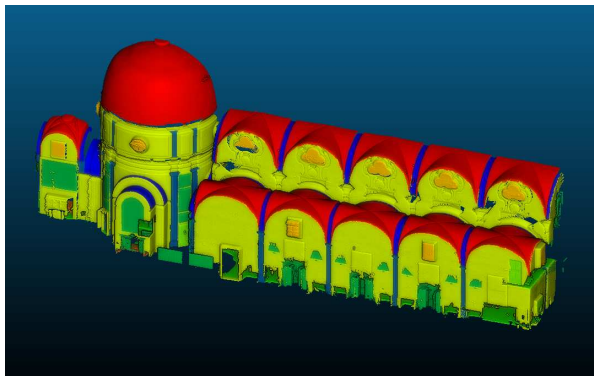
window: 0.0

stair: 0.0372

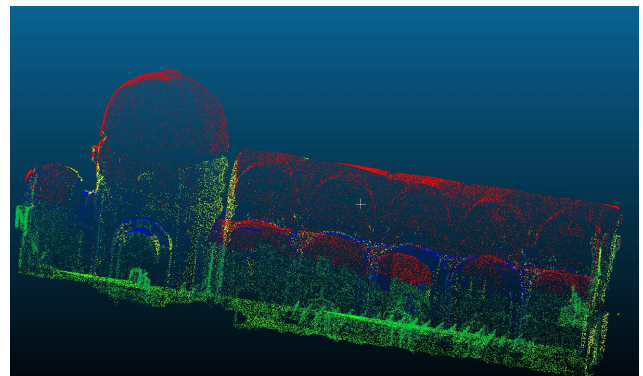
vault: 0.5872

Average IoU: 0.3031

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: TR_6

Overall Accuracy: **0.6356**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z H S V Nx Ny Nz

Block size: 5x5x5 m CUBE

Stride: 5

Epochs: 500

Scaler: -

Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

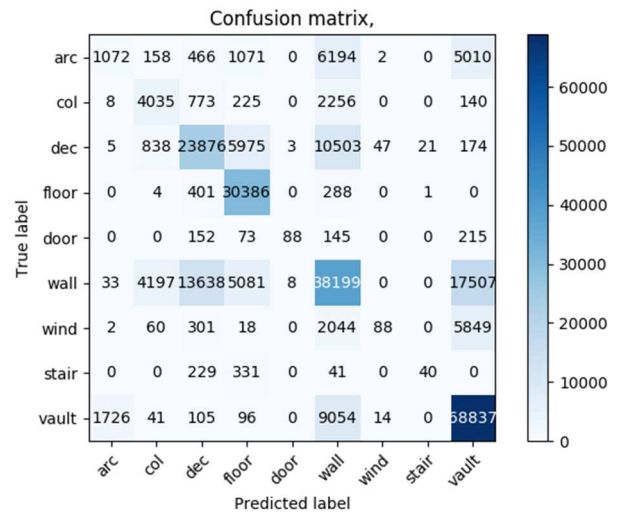
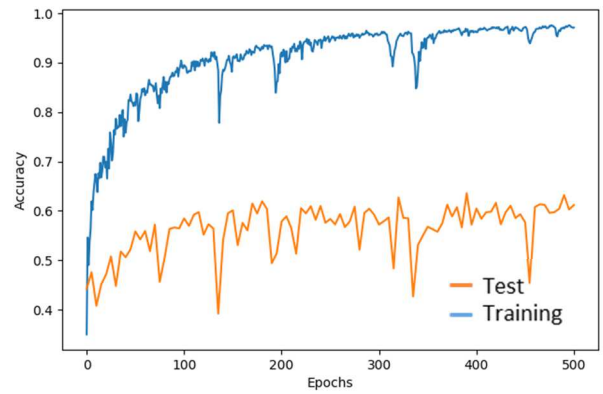
eval mean loss: 1.680796
eval accuracy: 0.635609
report:

	precision	recall	f1-score	support
arc	0.3767	0.0767	0.1275	13973
col	0.4323	0.5426	0.4812	7437
dec	0.5978	0.5761	0.5868	41442
floor	0.7025	0.9777	0.8175	31080
door	0.8889	0.1308	0.2280	673
wall	0.5558	0.4856	0.5183	78663
wind	0.5828	0.0105	0.0207	8362
stair	0.6452	0.0624	0.1138	641
vault	0.7043	0.8618	0.7752	79873
micro avg	0.6356	0.6356	0.6356	262144
macro avg	0.6096	0.4138	0.4077	262144
weighted avg	0.6140	0.6356	0.6034	262144

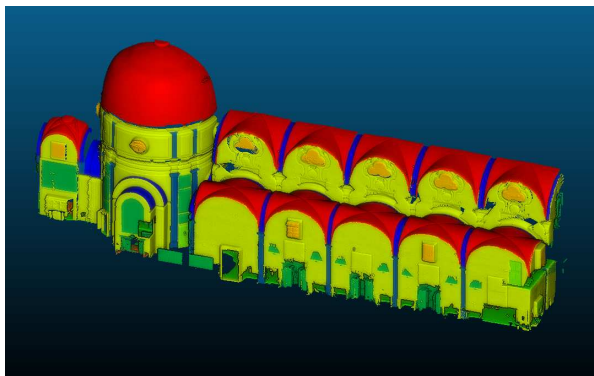
IoU

arch: 0.0680
column: 0.3168
decoration: 0.4151
floor: 0.6913
door: 0.1286
wall: 0.3498
window: 0.0104
stair: 0.0603
vault: 0.6328

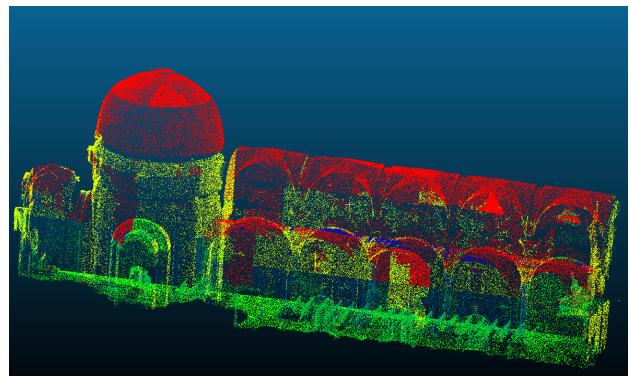
Average IoU: 0.2970



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: TR_7

Overall Accuracy: **0.6286**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k -NN features: x y z H S V Nx Ny Nz

Block size: 5x5x5 m CUBE

Stride: 5

Epochs: 500

Scaler: -

No Z normalisation | Focal loss | Skip connections

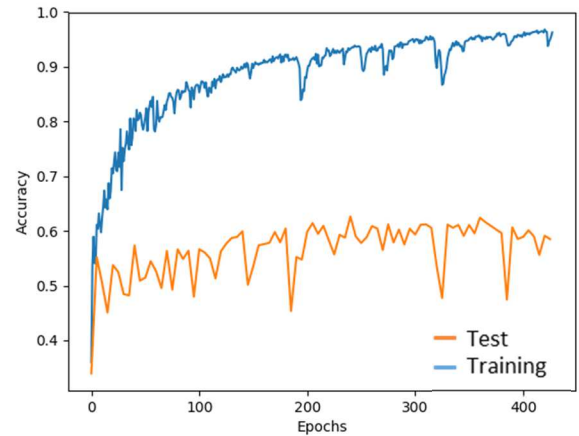
TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 2.026237

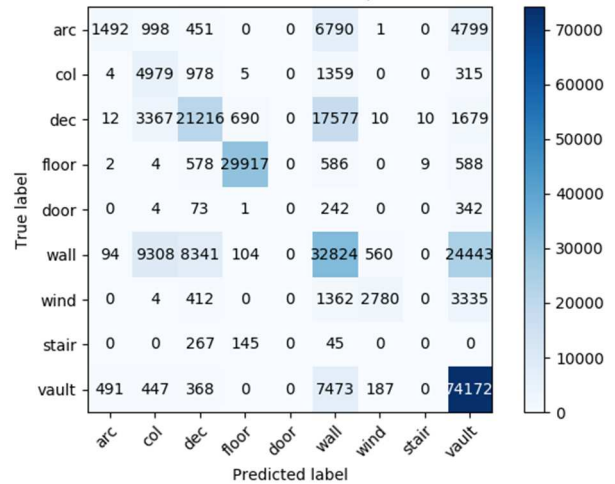
eval accuracy: 0.628681

report:

	precision	recall	f1-score	support
arc	0.7122	0.1027	0.1795	14531
col	0.2605	0.6517	0.3722	7640
dec	0.6491	0.4761	0.5493	44561
floor	0.9694	0.9442	0.9566	31684
door	0.0000	0.0000	0.0000	662
wall	0.4809	0.4338	0.4561	75674
wind	0.7858	0.3522	0.4864	7893
stair	0.0000	0.0000	0.0000	457
vault	0.6763	0.8922	0.7694	83138
micro avg	0.6287	0.6287	0.6287	266240
macro avg	0.5038	0.4281	0.4188	266240
weighted avg	0.6415	0.6287	0.6106	266240



Confusion matrix,



IoU

arch: 0.0985

column: 0.2286

decoration: 0.3786

floor: 0.9168

door: 0.0

wall: 0.2954

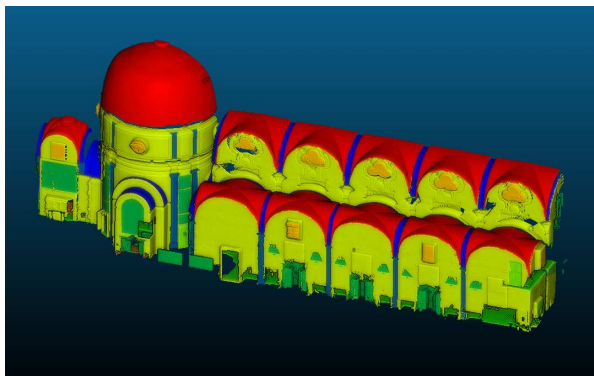
window: 0.3213

stair: 0.0

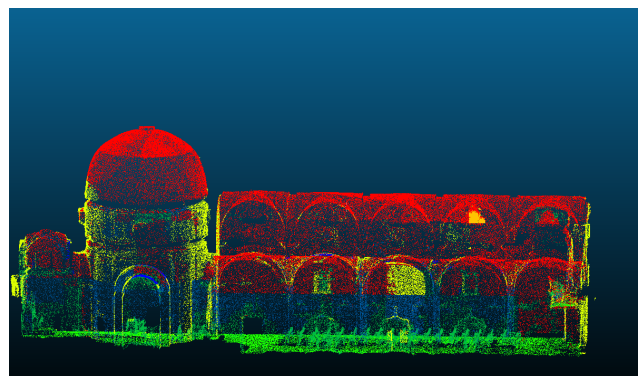
vault: 0.6251

Average IoU: 0.3183

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_8**

Overall Accuracy: **0.6301**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z H S V Nx Ny Nz

Block size: 2x2x2 m CUBE

Stride: 2

Epochs: 500

Scaler: -

Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

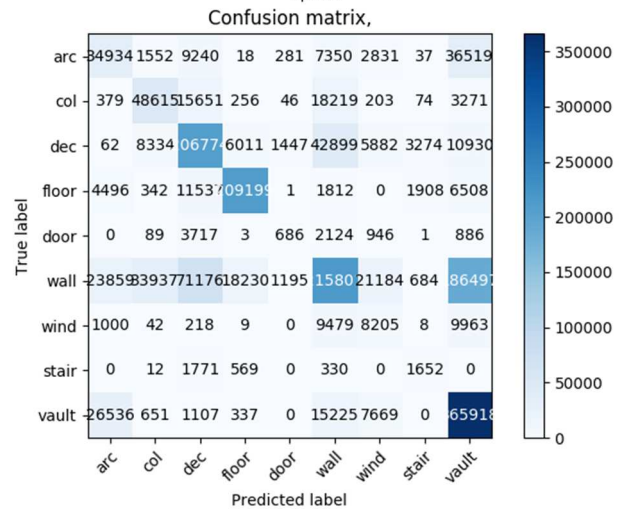
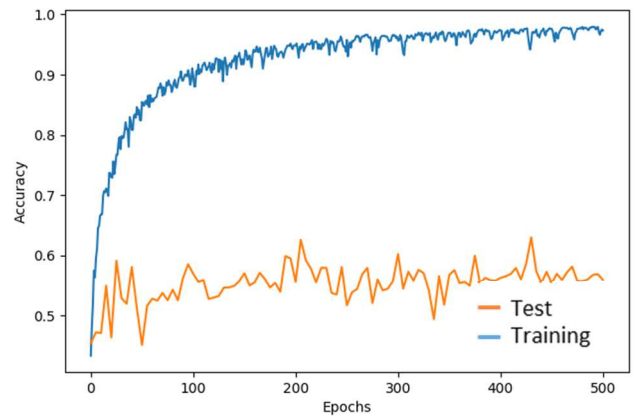
eval mean loss: 1.908843
eval accuracy: 0.630139
report:

	precision	recall	f1-score	support
arc	0.3828	0.3766	0.3797	92762
col	0.5195	0.5606	0.5393	86714
dec	0.6438	0.7240	0.6815	285613
floor	0.8916	0.8872	0.8894	235803
door	0.1876	0.0812	0.1133	8452
wall	0.6889	0.3769	0.4872	572563
wind	0.1749	0.2837	0.2164	28924
stair	0.2163	0.3812	0.2760	4334
vault	0.5897	0.8766	0.7051	417443
micro avg	0.6301	0.6301	0.6301	1732608
macro avg	0.4772	0.5053	0.4764	1732608
weighted avg	0.6481	0.6301	0.6165	1732608

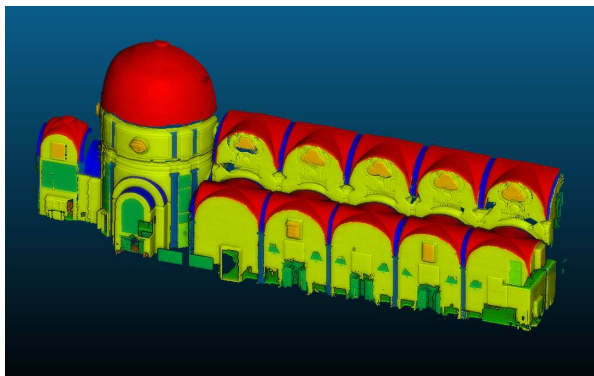
IoU

arch: 0.2343
column: 0.3692
decoration: 0.5168
floor: 0.8008
door: 0.0600
wall: 0.3220
window: 0.1213
stair: 0.1600
vault: 0.5445

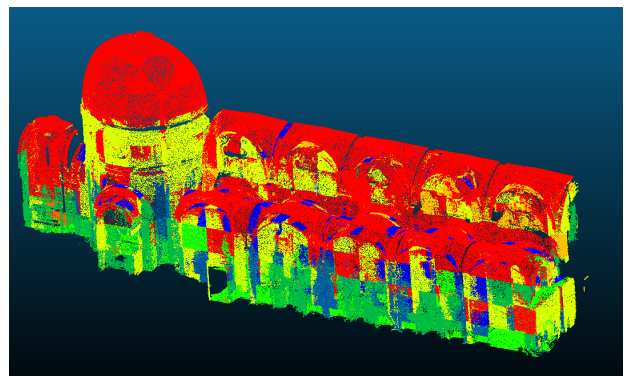
Average IoU: 0.3476



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: TR_9

Overall Accuracy: **0.6332**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z H S V Nx Ny Nz

Block size: 1x1x1 m CUBE

Stride: 1

Epochs: 500

Scaler: -

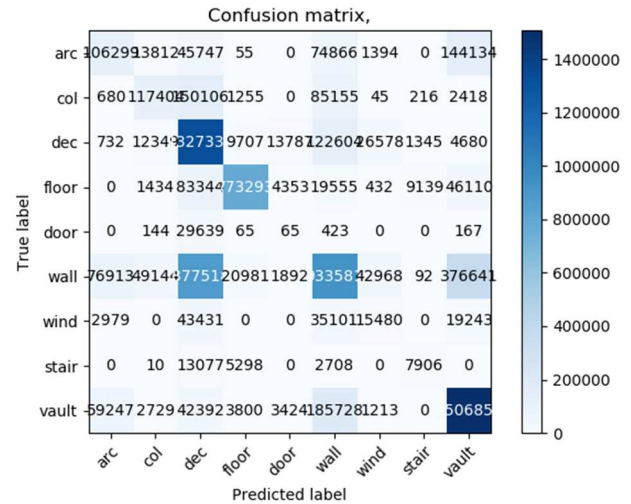
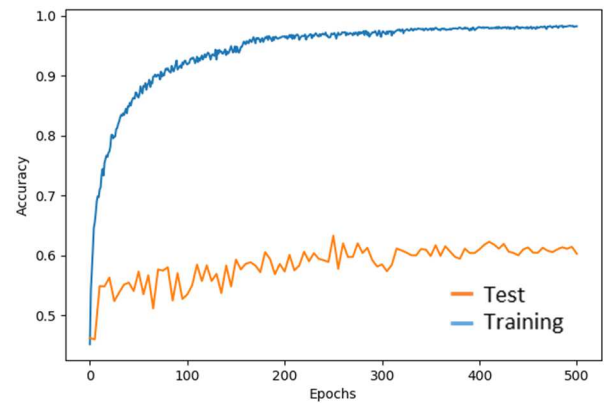
Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 2.162522
eval accuracy: 0.633260
report:

	precision	recall	f1-score	support
arc	0.4306	0.2752	0.3358	386307
col	0.5959	0.3286	0.4236	357279
dec	0.5081	0.8738	0.6425	1519113
floor	0.9495	0.8247	0.8827	937660
door	0.0028	0.0021	0.0024	30503
wall	0.6396	0.3923	0.4863	2379730
wind	0.1757	0.1332	0.1515	116234
stair	0.4228	0.2726	0.3315	28999
vault	0.7175	0.8346	0.7716	1805391
accuracy			0.6333	7561216
macro avg	0.4936	0.4375	0.4476	7561216
weighted avg	0.6469	0.6333	0.6166	7561216



IoU

arch: 0.2017

column: 0.2687

decoration: 0.4733

floor: 0.7900

door: 0.0012

wall: 0.3212

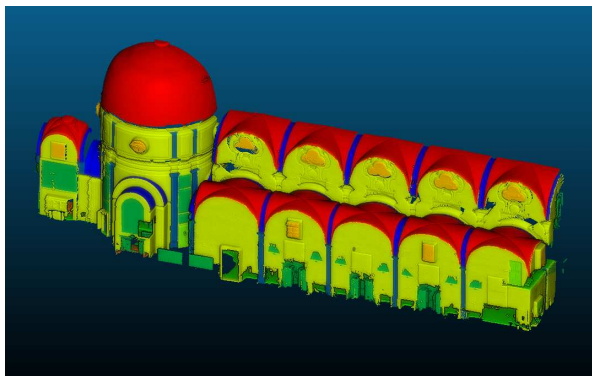
window: 0.0819

stair: 0.1986

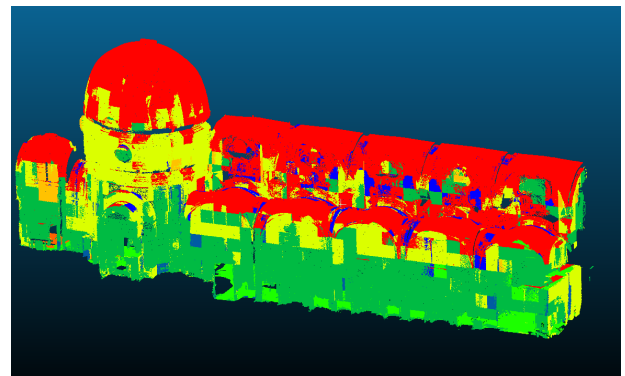
vault: 0.6281

Average IoU: 0.3294

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_10**

Overall Accuracy: **0.7948**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z R G B Nx Ny Nz

Epochs: 500

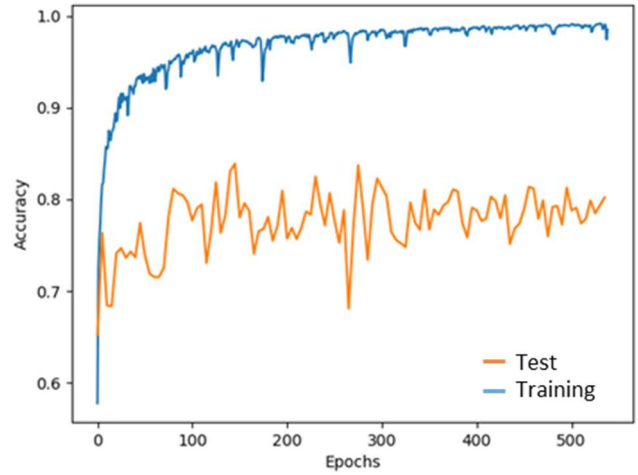
Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.174417
eval accuracy: 0.794840
report:

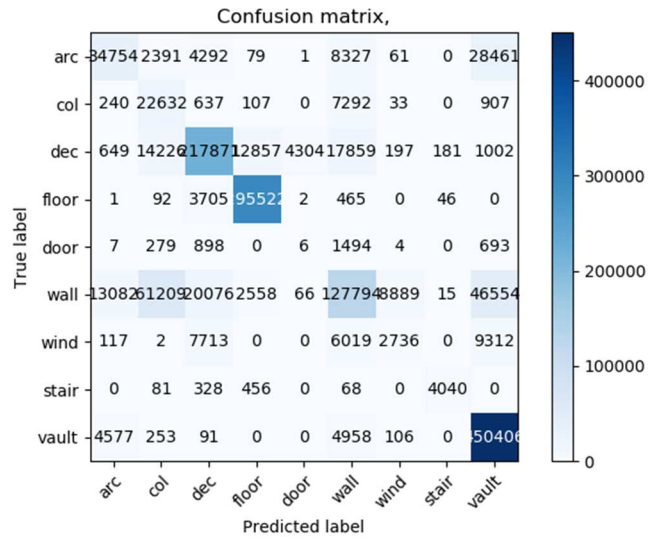
	precision	recall	f1-score	support
arc	0.6505	0.4435	0.5274	78366
col	0.2237	0.7106	0.3403	31848
dec	0.8524	0.8095	0.8304	269146
floor	0.9485	0.9856	0.9667	299833
door	0.0014	0.0018	0.0015	3381
wall	0.7333	0.4560	0.5623	280243
wind	0.2275	0.1056	0.1443	25899
stair	0.9435	0.8124	0.8730	4973
vault	0.8382	0.9783	0.9029	460391
accuracy			0.7948	1454080
macro avg	0.6021	0.5893	0.5721	1454080
weighted avg	0.8073	0.7948	0.7887	1454080



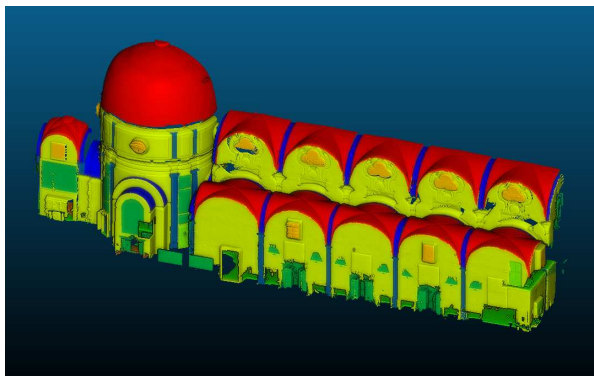
IoU

arch: 0.3581
column: 0.2050
decoration: 0.7099
floor: 0.9355
door: 0.0001
wall: 0.3911
window: 0.7746
stair: 0.8229
vault: 0.8229

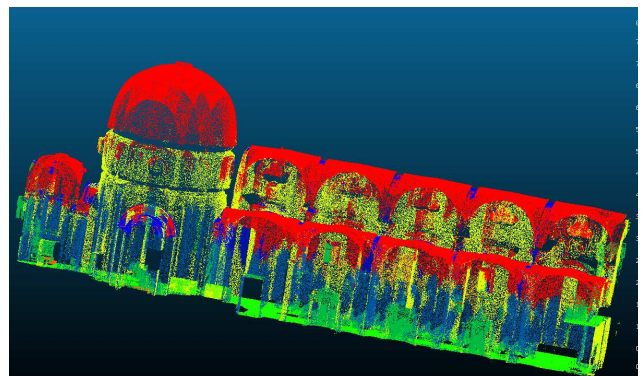
Average IoU: 0.4751



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: TR_11

Overall Accuracy: **0.7434**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z R G B Nx Ny Nz

Epochs: 60

N. of points: 8192

Batch: 2

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

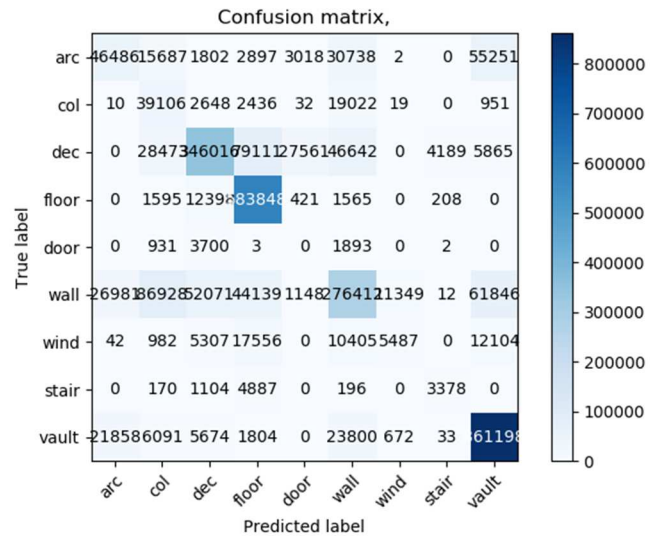
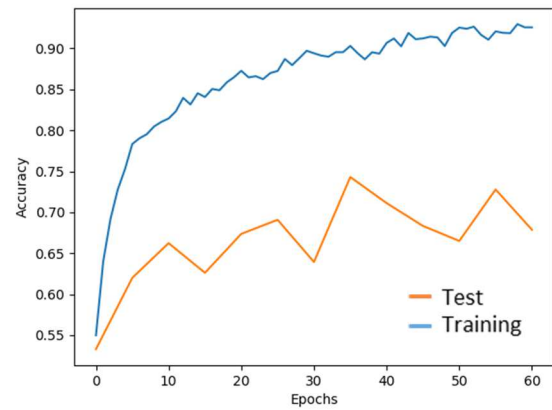
eval mean loss: 1.344832
eval accuracy: 0.743402
report:

	precision	recall	f1-score	support
arc	0.4874	0.2982	0.3700	155881
col	0.2173	0.6089	0.3203	64224
dec	0.8033	0.6433	0.7145	537857
floor	0.7925	0.9730	0.8736	600035
door	0.0000	0.0000	0.0000	6529
wall	0.6731	0.4928	0.5690	560886
wind	0.3130	0.1058	0.1581	51883
stair	0.4319	0.3470	0.3848	9735
vault	0.8636	0.9349	0.8979	921130
accuracy			0.7434	2908160
macro avg	0.5091	0.4893	0.4765	2908160
weighted avg	0.7534	0.7434	0.7375	2908160

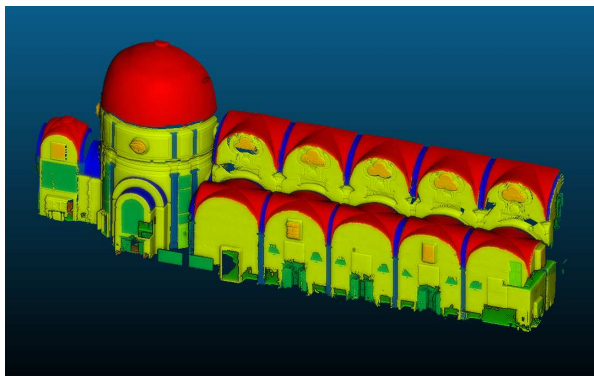
IoU

arch: 0.2270
column: 0.1906
decoration: 0.5557
floor: 0.7754
door: 0.0
wall: 0.3976
window: 0.0858
stair: 0.2382
vault: 0.8146

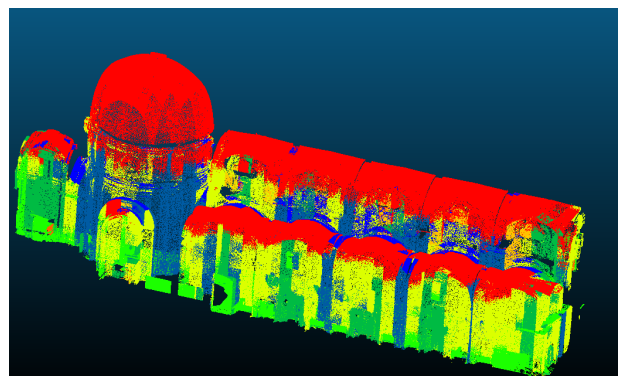
Average IoU: 0.3650



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_12**

Overall Accuracy: **0.8090**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k -NN features: x y z R G B Nx Ny Nz

Epochs: 500

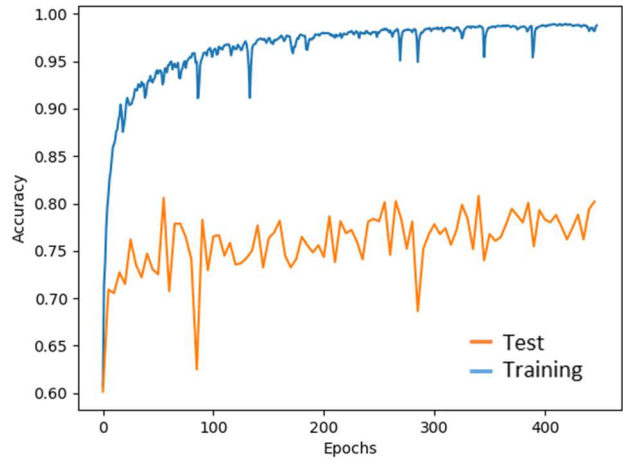
Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 0.972372
eval accuracy: 0.809088
report:

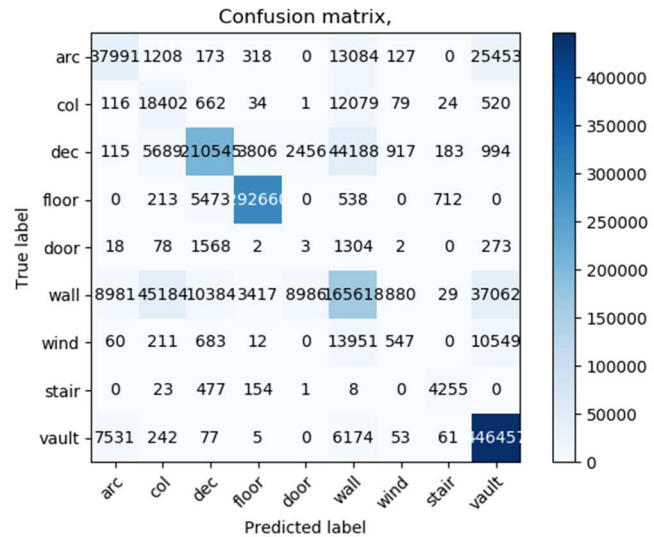
	precision	recall	f1-score	support
arc	0.6931	0.4849	0.5706	78354
col	0.2583	0.5766	0.3567	31917
dec	0.9152	0.7830	0.8440	268893
floor	0.9742	0.9768	0.9755	299596
door	0.0003	0.0009	0.0004	3248
wall	0.6446	0.5904	0.6163	280541
wind	0.2100	0.0210	0.0382	26013
stair	0.8083	0.8652	0.8358	4918
vault	0.8564	0.9693	0.9094	460600
accuracy			0.8091	1454080
macro avg	0.5956	0.5853	0.5719	1454080
weighted avg	0.8151	0.8091	0.8061	1454080



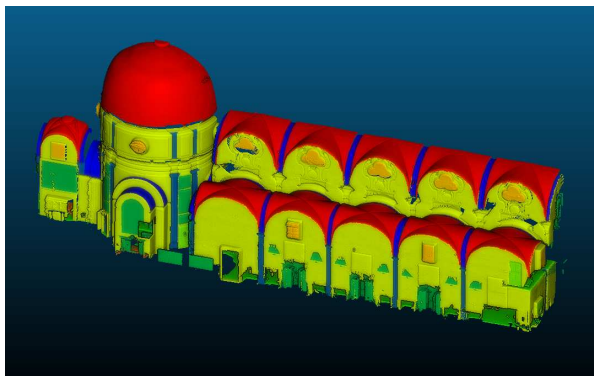
IoU

arch: 0.3991
column: 0.2170
decoration: 0.7300
floor: 0.9522
door: 0.0002
wall: 0.4453
window: 0.0194
stair: 0.7179
vault: 0.8337

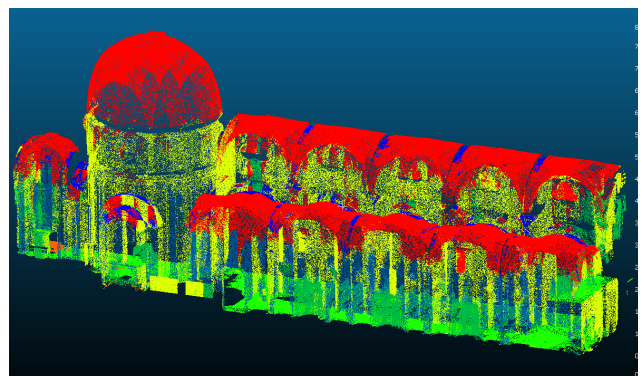
Average IoU: 0.4794



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault Door Arch Stair Window Decoration

TEST: **TR_13**

Overall Accuracy: **0.7344**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z R G B Nx Ny Nz

Epochs: 500

Scaler: -

No Z normalisation | Focal loss | Skip connections

- Best Training accuracy = 0.9895 – epoch = 490
- Best Validation accuracy = 0.8919 – epoch = 460

TEST: **TR_14**

Overall Accuracy: **0.7442**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z H S V Nx Ny Nz

Epochs: 500

Scaler: -

No Z normalisation | Focal loss | Skip connections

- Best Training accuracy = 0.9871 – epoch = 481
- Best Validation accuracy = 0.8892 – epoch = 485

TEST: **TR_15**

Overall Accuracy: **0.7148**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z L A B Nx Ny Nz

Epochs: 500

Scaler: -

No Z normalisation | Focal loss | Skip connections

- Best Training accuracy = 0.9867 – epoch = 499
- Best Validation accuracy = 0.8566 – epoch = 500

TEST: **TR_16**

Overall Accuracy: **0.6834**

Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8

k-NN features: x y z B Nx Ny Nz (only b* channel from L* a* b*)

Epochs: 500

Scaler: -

No Z normalisation | Focal loss | Skip connections

- Best Training accuracy = 0.9865 – epoch = 493
- Best Validation accuracy = 0.8675 – epoch = 155

TEST: TR_17

Overall Accuracy: **0.7301**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

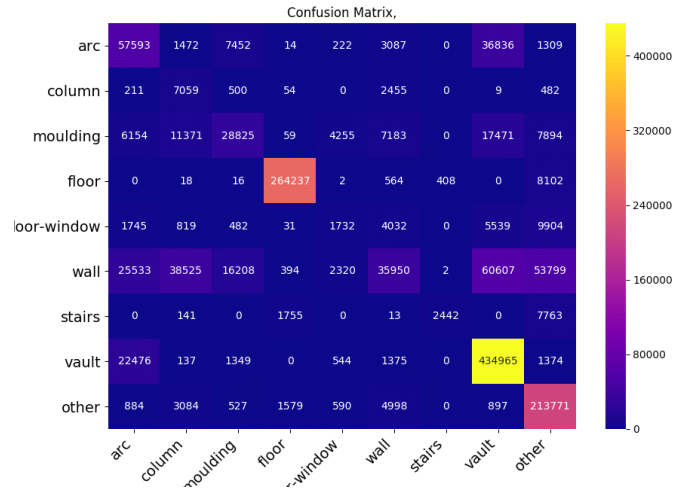
METRICS and CONFUSION MATRIX

eval mean loss: 3.627930
eval accuracy: 0.730032

Accuracy:
0.7300320870535715

report:

	precision	recall	f1-score	support
arc	0.5026	0.5333	0.5175	107985
column	0.1127	0.6554	0.1924	10770
moulding	0.5207	0.3464	0.4160	83212
floor	0.9855	0.9667	0.9760	273347
door-window	0.1792	0.0713	0.1020	24284
wall	0.6026	0.1541	0.2454	233338
stairs	0.8562	0.2016	0.3263	12114
vault	0.7819	0.9410	0.8541	462220
other	0.7023	0.9445	0.8056	226330
accuracy			0.7300	1433600
macro avg	0.5826	0.5349	0.4928	1433600
weighted avg	0.7281	0.7300	0.6977	1433600



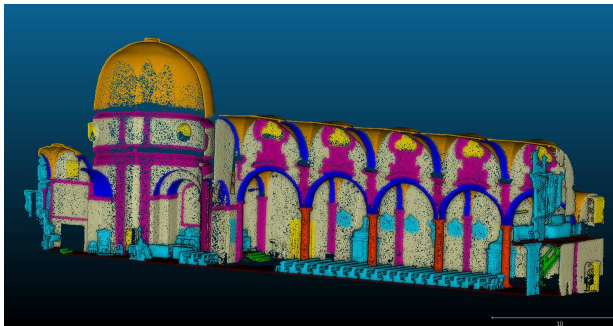
Mean Jaccard (Mean_IoU):
0.386628074403917

Jaccard:

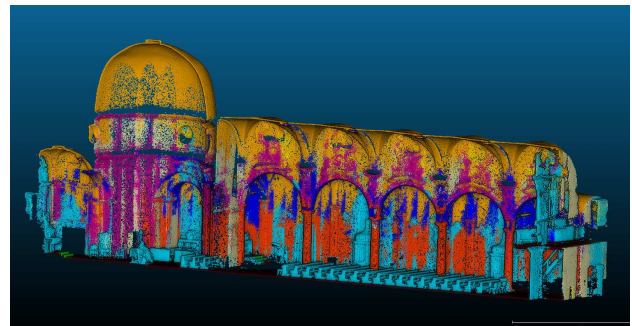
- arc: 0.3490738720391786
- column: 0.10641120340081704
- moulding: 0.26265194175641937
- floor: 0.9531224637759574
- door-window: 0.05376043703634727
- wall: 0.13985877959112217
- stairs: 0.19498562759501756
- vault: 0.7453403909325044
- other: 0.6744479535078891

all room eval accuracy: 0.730032

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_18

Overall Accuracy: **0.7313**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/window":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3.738076
eval accuracy: 0.731320

Accuracy:

0.7313197544642858

report:

	precision	recall	f1-score	support
arc	0.4448	0.5763	0.5021	108040
column	0.1633	0.6328	0.2596	10940
moulding	0.6177	0.2484	0.3543	83004
floor	0.9662	0.9837	0.9749	273029
door-window	0.4082	0.0771	0.1297	24172
wall	0.6483	0.1860	0.2891	233533
stairs	0.7121	0.1730	0.2784	12238
vault	0.8043	0.9199	0.8582	461563
other	0.6462	0.9602	0.7725	227081
accuracy			0.7313	1433600
macro avg	0.6012	0.5286	0.4910	1433600
weighted avg	0.7344	0.7313	0.6963	1433600

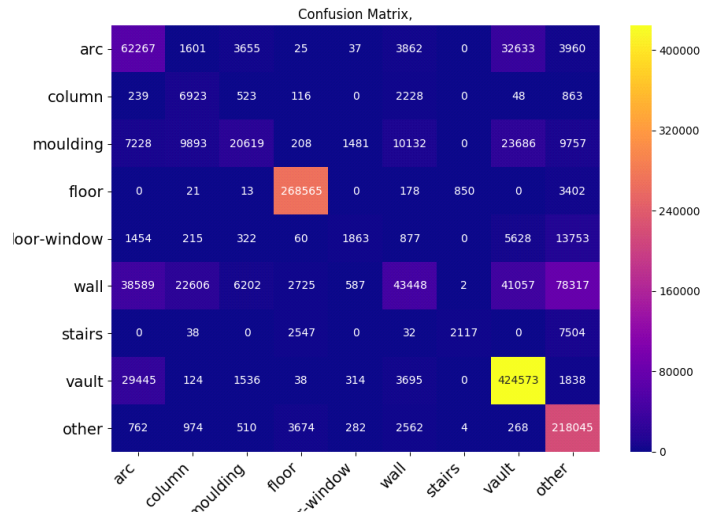
Mean Jaccard (Mean_IoU):

0.3812829818394667

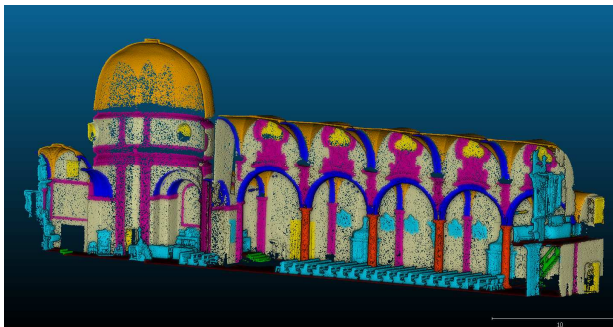
Jaccard:

- arc: 0.33520674860166777
- column: 0.1491640093079376
- moulding: 0.21530830679266955
- floor: 0.9509351254505669
- door-window: 0.06932608938339598
- wall: 0.16899326718501434
- stairs: 0.16167710401710708
- vault: 0.7516122807731866
- other: 0.629323905043654

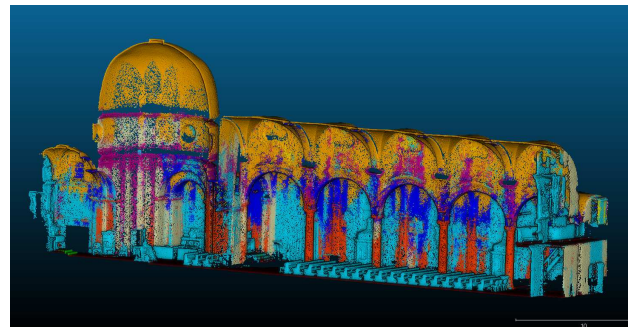
all room eval accuracy: 0.731320



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_19

Overall Accuracy: **0.7256**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 2.764056
eval accuracy: 0.725612

Accuracy:
0.7256124441964286

report:

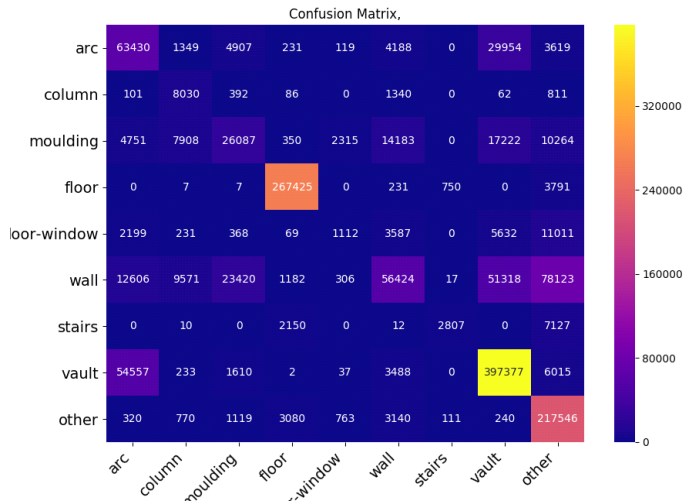
	precision	recall	f1-score	support
arc	0.4598	0.5884	0.5162	107797
column	0.2857	0.7420	0.4125	10822
moulding	0.4505	0.3140	0.3701	83080
floor	0.9740	0.9824	0.9782	272211
door-window	0.2390	0.0459	0.0771	24209
wall	0.6516	0.2422	0.3531	232967
stairs	0.7617	0.2319	0.3555	12106
vault	0.7919	0.8577	0.8235	463319
other	0.6430	0.9580	0.7695	227089
accuracy			0.7256	1433600
macro avg	0.5841	0.5514	0.5173	1433600
weighted avg	0.7219	0.7256	0.6988	1433600

Mean Jaccard (Mean_IoU):
0.39867416148129947

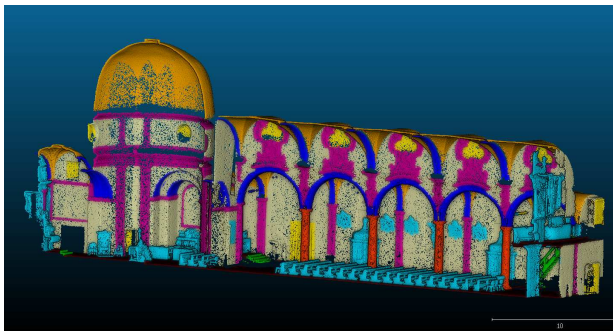
Jaccard:

- arc: 0.34788379375970074
- column: 0.25986214038380634
- moulding: 0.22703497732870334
- floor: 0.9572739215566954
- door-window: 0.040073516162744606
- wall: 0.2144290404961693
- stairs: 0.21618915588416512
- vault: 0.6999191541302728
- other: 0.625401753629438

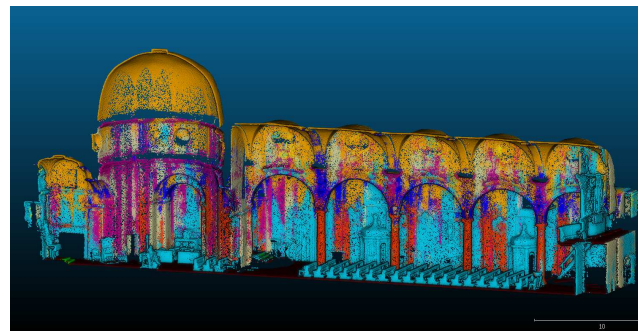
all room eval accuracy: 0.725612



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_20

Overall Accuracy: **0.7206**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3114.487684
eval accuracy: 0.720606

Accuracy:
0.7206061662946428

report:

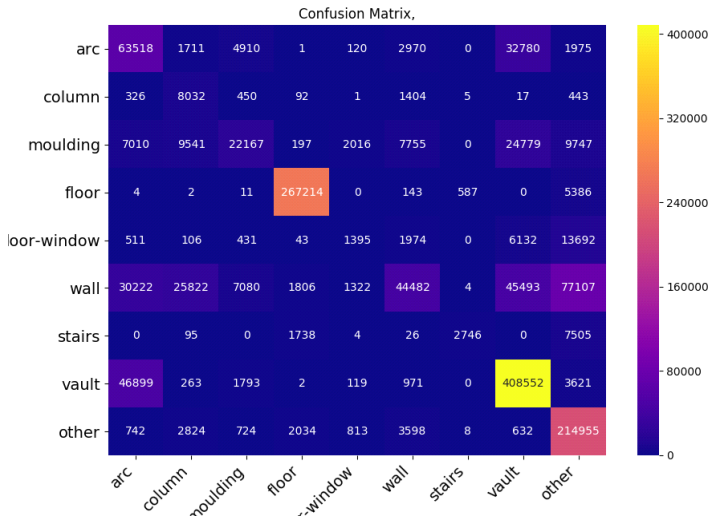
	precision	recall	f1-score	support
arc	0.4256	0.5882	0.4939	107985
column	0.1660	0.7458	0.2715	10770
moulding	0.5901	0.2664	0.3671	83212
floor	0.9784	0.9776	0.9780	273347
door-window	0.2409	0.0574	0.0928	24284
wall	0.7025	0.1906	0.2999	233338
stairs	0.8197	0.2267	0.3551	12114
vault	0.7881	0.8839	0.8333	462220
other	0.6427	0.9497	0.7667	226330
accuracy			0.7206	1433600
macro avg	0.5949	0.5429	0.4953	1433600
weighted avg	0.7350	0.7206	0.6901	1433600

Mean Jaccard (Mean_IoU):
0.382599311102157

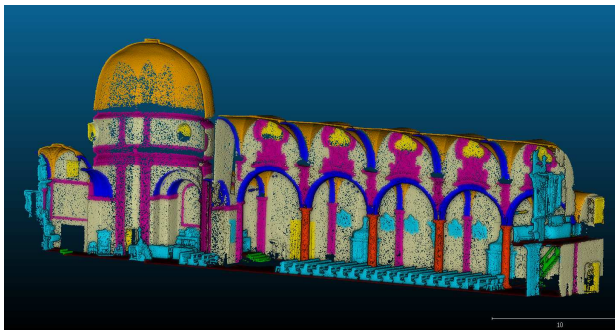
Jaccard:

- arc: 0.32792115602042343
- column: 0.15707748269253335
- moulding: 0.22479236596322927
- floor: 0.9568645706510063
- door-window: 0.04864186338435789
- wall: 0.17639057970727143
- stairs: 0.215914451957855
- vault: 0.7141855737143237
- other: 0.6216057558284125

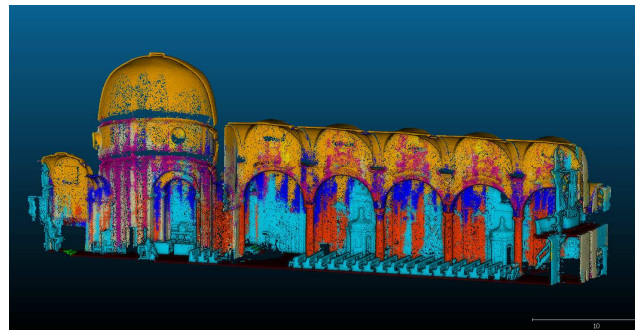
all room eval accuracy: 0.720606



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_21

Overall Accuracy: **0.7172**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3946.139809
eval accuracy: 0.717159

Accuracy:

0.7171589006696428

report:

	precision	recall	f1-score	support
arc	0.4743	0.6010	0.5302	108040
column	0.1248	0.5544	0.2038	10940
moulding	0.5898	0.3875	0.4677	83004
floor	0.9794	0.9823	0.9808	273029
door-window	0.2536	0.0479	0.0805	24172
wall	0.7057	0.1675	0.2708	233533
stairs	0.7398	0.1473	0.2457	12238
vault	0.8405	0.8580	0.8491	461563
other	0.5663	0.9630	0.7132	227081
accuracy			0.7172	1433600
macro avg	0.5860	0.5232	0.4824	1433600
weighted avg	0.7432	0.7172	0.6893	1433600

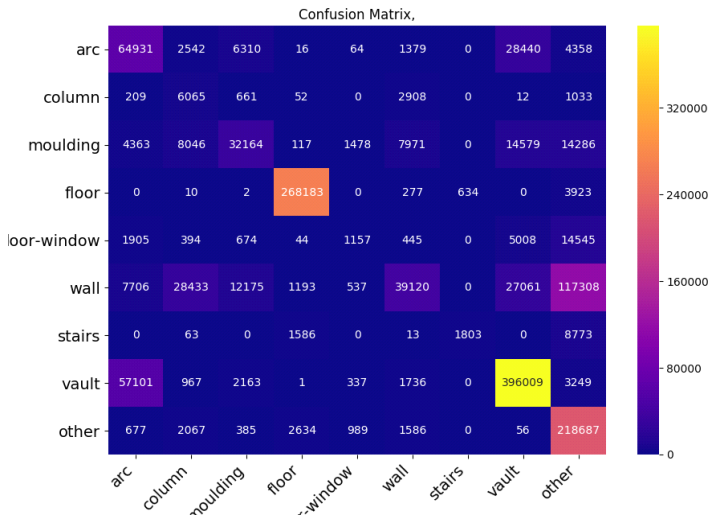
Mean Jaccard (Mean_IoU):

0.3747182361933269

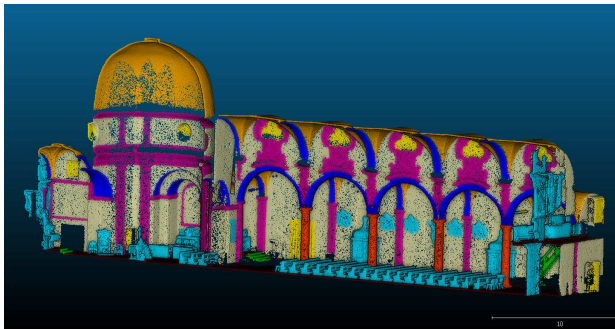
Jaccard:

- arc: 0.3607257737457014
- column: 0.11344506378362201
- moulding: 0.3052365858750736
- floor: 0.9623607682149624
- door-window: 0.04195525256554375
- wall: 0.1565751977202139
- stairs: 0.14007147296457426
- vault: 0.7378330187677351
- other: 0.5542609921025152

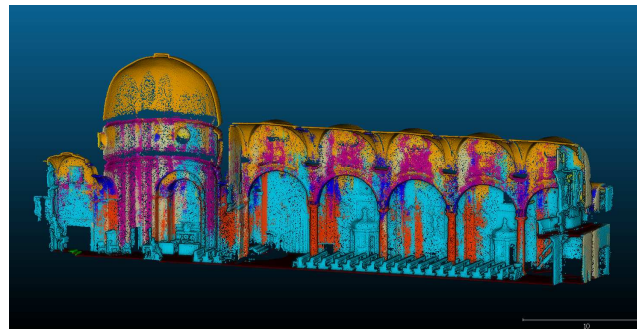
all room eval accuracy: 0.717159



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_22

Overall Accuracy: **0.7216**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k -NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3242.913401
eval accuracy: 0.721569

Accuracy:

0.7215694754464286

report:

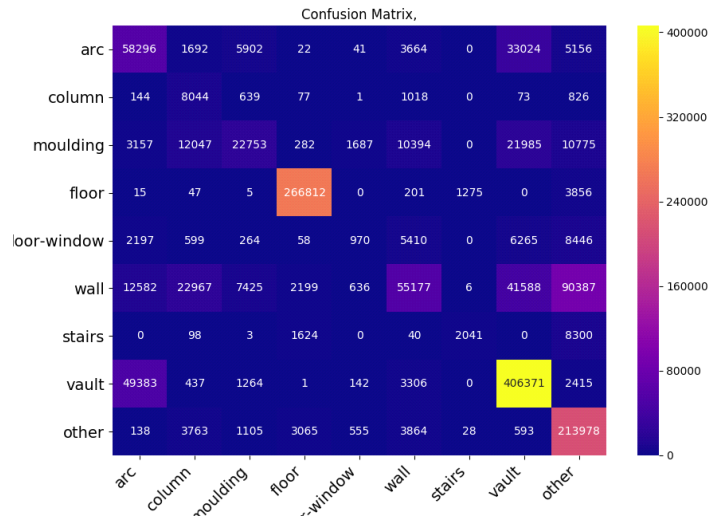
	precision	recall	f1-score	support
arc	0.4630	0.5408	0.4989	107797
column	0.1619	0.7433	0.2658	10822
moulding	0.5781	0.2739	0.3717	83080
floor	0.9733	0.9802	0.9767	272211
door-window	0.2406	0.0401	0.0687	24209
wall	0.6642	0.2368	0.3492	232967
stairs	0.6093	0.1686	0.2641	12106
vault	0.7970	0.8771	0.8351	463319
other	0.6218	0.9423	0.7492	227089
accuracy			0.7216	1433600
macro avg	0.5677	0.5337	0.4866	1433600
weighted avg	0.7275	0.7216	0.6952	1433600

Mean Jaccard (Mean_IoU):
0.37593740253955166

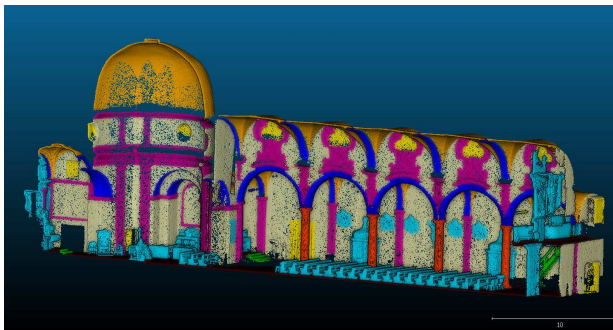
Jaccard:

- arc: 0.33233568777684663
- column: 0.15330080805000762
- moulding: 0.22824440498761123
- floor: 0.9544714690973353
- door-window: 0.03556891936489311
- wall: 0.21151634568204122
- stairs: 0.15214312336936264
- vault: 0.7168971521415832
- other: 0.5989587123862841

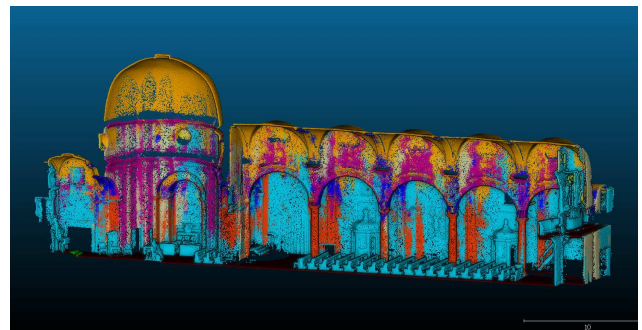
all room eval accuracy: 0.721569



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_23

Overall Accuracy: **0.7335**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k -NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3.380054
eval accuracy: 0.733567

Accuracy:
0.7335672433035715

report:

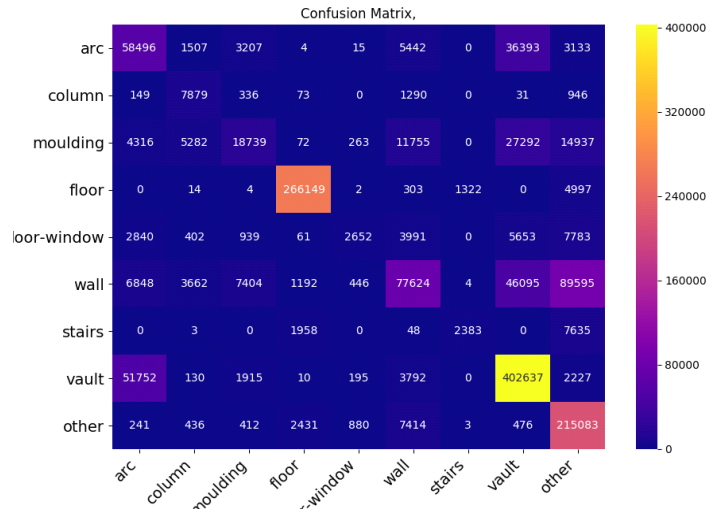
	precision	recall	f1-score	support
arc	0.4693	0.5406	0.5025	108197
column	0.4079	0.7361	0.5249	10704
moulding	0.5686	0.2267	0.3242	82656
floor	0.9787	0.9757	0.9772	272791
door-window	0.5956	0.1090	0.1843	24321
wall	0.6952	0.3333	0.4506	232870
stairs	0.6420	0.1981	0.3028	12027
vault	0.7764	0.8703	0.8207	462658
other	0.6210	0.9459	0.7498	227376
accuracy			0.7336	1433600
macro avg	0.6394	0.5484	0.5374	1433600
weighted avg	0.7350	0.7336	0.7091	1433600

Mean Jaccard (Mean_IoU):
0.41184057481294256

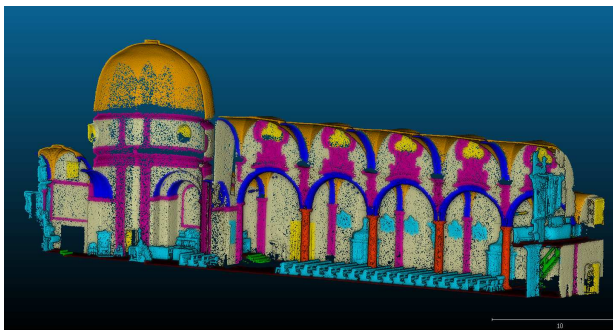
Jaccard:

- arc: 0.33552250448827886
- column: 0.3558717253839205
- moulding: 0.19343883228556977
- floor: 0.9553361187686653
- door-window: 0.10152361993721767
- wall: 0.29083007062437943
- stairs: 0.17842168313866427
- vault: 0.6958838433592927
- other: 0.5997367753304947

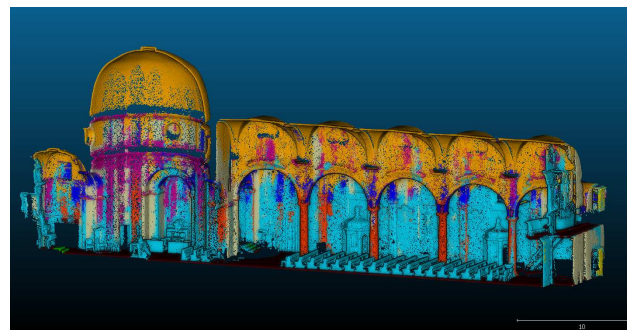
all room eval accuracy: 0.733567



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_24

Overall Accuracy: **0.7119**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3.832224
eval accuracy: 0.711964

Accuracy:

0.7119635881696429

report:

	precision	recall	f1-score	support
arc	0.4661	0.6011	0.5250	108631
column	0.2350	0.6722	0.3482	10727
moulding	0.5364	0.2240	0.3161	83198
floor	0.9801	0.9785	0.9793	272963
door-window	0.2814	0.0328	0.0587	24172
wall	0.6516	0.1626	0.2603	232659
stairs	0.6710	0.1463	0.2402	12003
vault	0.7832	0.8716	0.8251	462262
other	0.5803	0.9654	0.7248	226985
accuracy			0.7120	1433600
macro avg	0.5761	0.5172	0.4753	1433600
weighted avg	0.7154	0.7120	0.6732	1433600

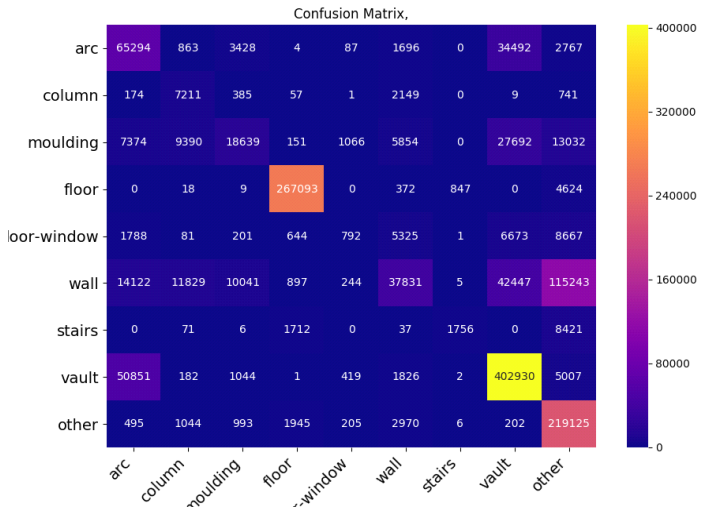
Mean Jaccard (Mean_IoU):

0.3667726374842374

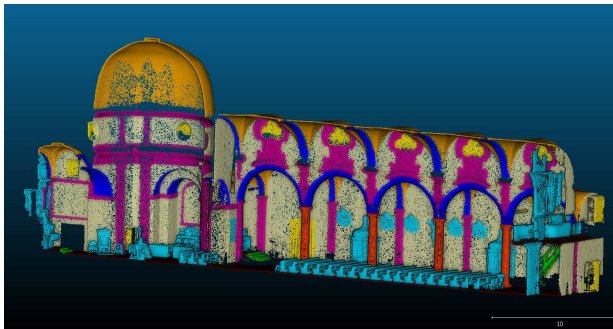
Jaccard:

- arc: 0.35595169951208877
- column: 0.21081713199824587
- moulding: 0.18769447661245658
- floor: 0.9594753820399894
- door-window: 0.030235931892799876
- wall: 0.14959586852677864
- stairs: 0.13650497512437812
- vault: 0.7022414631468323
- other: 0.5684368085045669

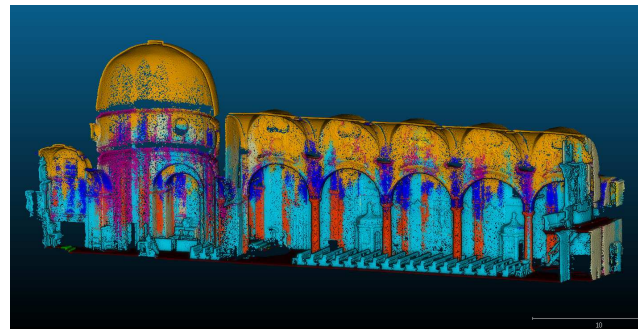
all room eval accuracy: 0.711964



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_25

Overall Accuracy: **0.7201**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k -NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3.336623
eval accuracy: 0.720095

Accuracy:
0.7200948660714286

report:

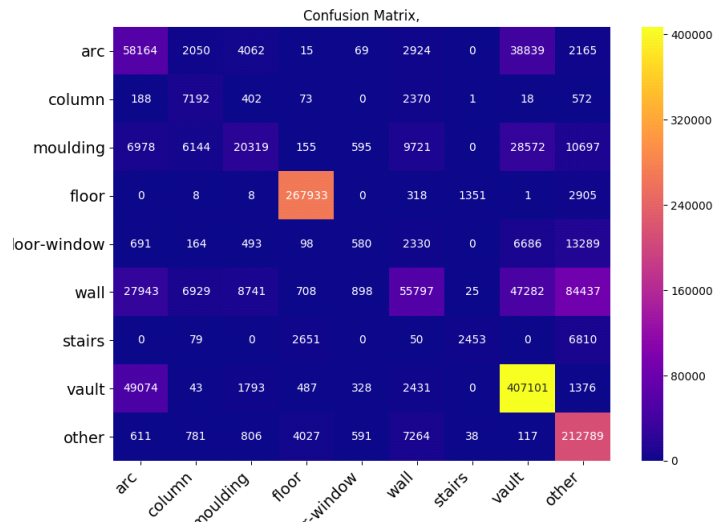
	precision	recall	f1-score	support
arc	0.4049	0.5371	0.4617	108288
column	0.3075	0.6649	0.4205	10816
moulding	0.5548	0.2443	0.3392	83181
floor	0.9703	0.9832	0.9767	272524
door-window	0.1895	0.0238	0.0423	24331
wall	0.6706	0.2397	0.3532	232760
stairs	0.6342	0.2037	0.3083	12043
vault	0.7701	0.8800	0.8214	462633
other	0.6351	0.9373	0.7572	227024
accuracy			0.7201	1433600
macro avg	0.5708	0.5238	0.4978	1433600
weighted avg	0.7161	0.7201	0.6890	1433600

Mean Jaccard (Mean_IoU):
0.3832820756154684

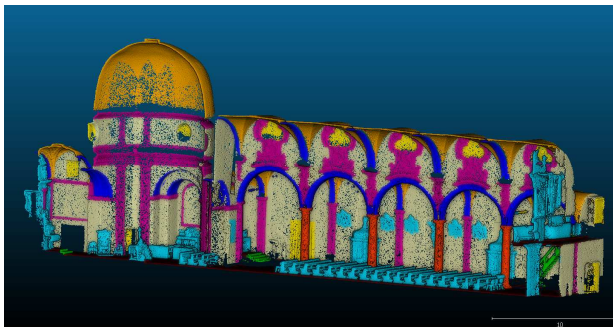
Jaccard:

- arc: 0.30016565775417625
- column: 0.26623232398015845
- moulding: 0.20423979253362282
- floor: 0.9543880771395393
- door-window: 0.02163210502759958
- wall: 0.21446526859567663
- stairs: 0.18227076831624311
- vault: 0.696914138197854
- other: 0.6092305489943455

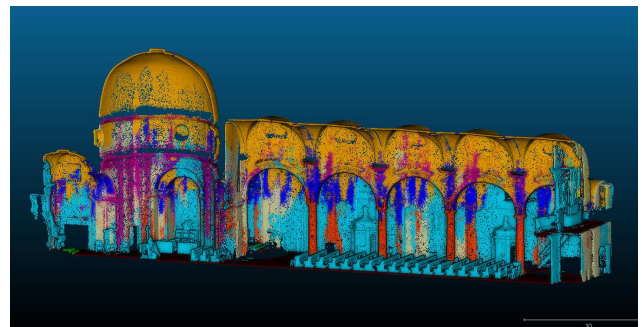
all room eval accuracy: 0.720095



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_26

Overall Accuracy: **0.7252**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3235.910257
eval accuracy: 0.725239

Accuracy:
0.7252385602678572

report:

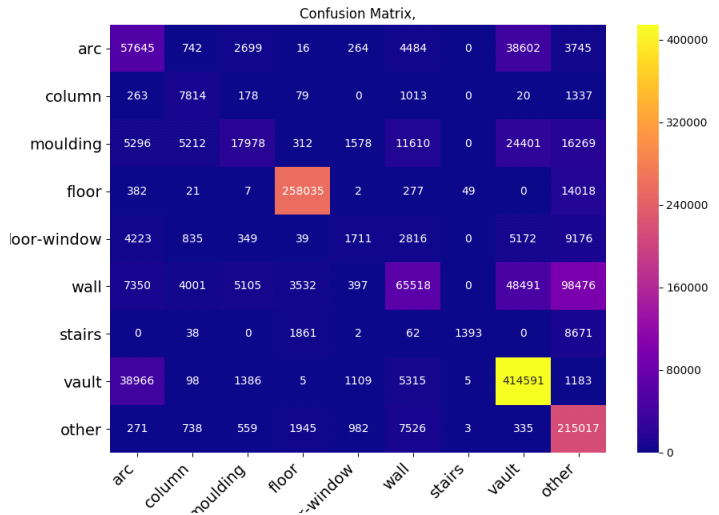
	precision	recall	f1-score	support
arc	0.5039	0.5328	0.5179	108197
column	0.4007	0.7300	0.5174	10704
moulding	0.6361	0.2175	0.3242	82656
floor	0.9707	0.9459	0.9581	272791
door-window	0.2830	0.0704	0.1127	24321
wall	0.6643	0.2814	0.3953	232870
stairs	0.9607	0.1158	0.2067	12027
vault	0.7799	0.8961	0.8340	462658
other	0.5845	0.9456	0.7224	227376
accuracy			0.7252	1433600
macro avg	0.6427	0.5262	0.5099	1433600
weighted avg	0.7276	0.7252	0.6955	1433600

Mean Jaccard (Mean_IoU):
0.39039559658006273

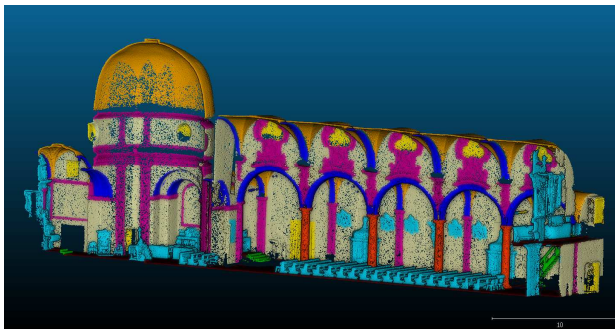
Jaccard:

- arc: 0.3494737735528773
- column: 0.34901067488498816
- moulding: 0.19343870710896394
- floor: 0.9196485850737758
- door-window: 0.05971034723433956
- wall: 0.24633327443011133
- stairs: 0.11527639854352863
- vault: 0.715207899544403
- other: 0.565460708847577

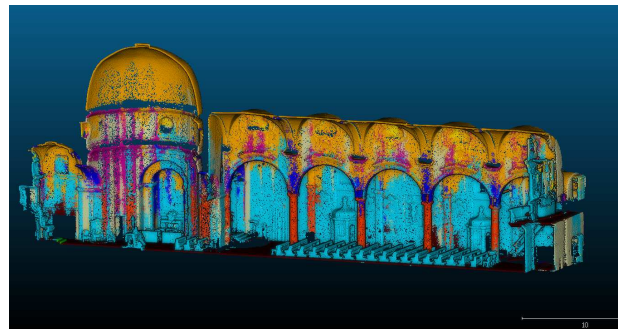
all room eval accuracy: 0.725239



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_27

Overall Accuracy: **0.6894**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 4517.872800
eval accuracy: 0.689376

Accuracy:

0.6893763950892857

report:

	precision	recall	f1-score	support
arc	0.3646	0.5810	0.4480	108631
column	0.3381	0.6949	0.4549	10727
moulding	0.6030	0.1483	0.2381	83198
floor	0.9720	0.9649	0.9685	272963
door-window	0.3626	0.0165	0.0317	24172
wall	0.6334	0.1378	0.2263	232659
stairs	0.9707	0.1571	0.2705	12003
vault	0.7999	0.8492	0.8238	462262
other	0.5343	0.9476	0.6833	226985
accuracy			0.6894	1433600
macro avg	0.6198	0.4997	0.4606	1433600
weighted avg	0.7098	0.6894	0.6489	1433600

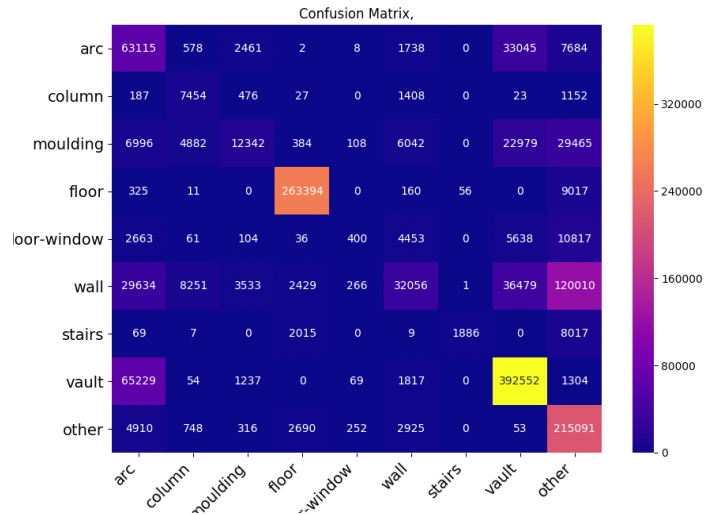
Mean Jaccard (Mean_IoU):

0.35294561923758033

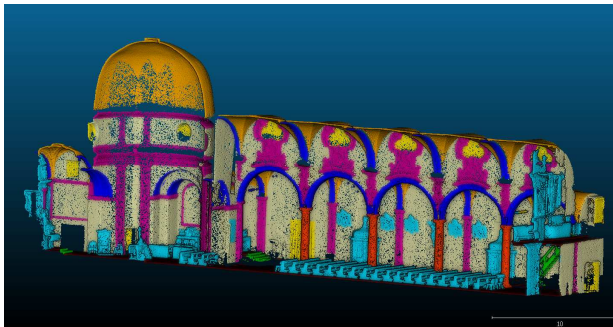
Jaccard:

- arc: 0.2886655933846801
- column: 0.29440341245704804
- moulding: 0.13514371749247195
- floor: 0.9388620760944729
- door-window: 0.016080402010050253
- wall: 0.12760587713117658
- stairs: 0.15638474295190713
- vault: 0.7003866335759235
- other: 0.5189781180404921

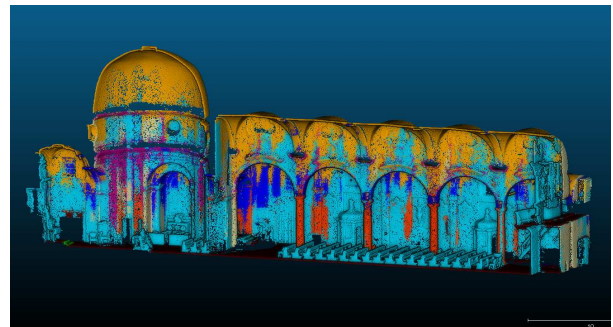
all room eval accuracy: 0.689376



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_28

Overall Accuracy: **0.7211**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k -NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3409.983795
eval accuracy: 0.721097

Accuracy:
0.7210972377232143

report:

	precision	recall	f1-score	support
arc	0.4495	0.4783	0.4635	108288
column	0.2411	0.6560	0.3526	10816
moulding	0.5806	0.2122	0.3108	83181
floor	0.9627	0.9824	0.9725	272524
door-window	0.0687	0.0039	0.0073	24331
wall	0.7098	0.2523	0.3722	232760
stairs	0.6857	0.1603	0.2599	12043
vault	0.7579	0.8930	0.8199	462633
other	0.6188	0.9498	0.7494	227024
accuracy			0.7211	1433600
macro avg	0.5639	0.5098	0.4787	1433600
weighted avg	0.7172	0.7211	0.6866	1433600

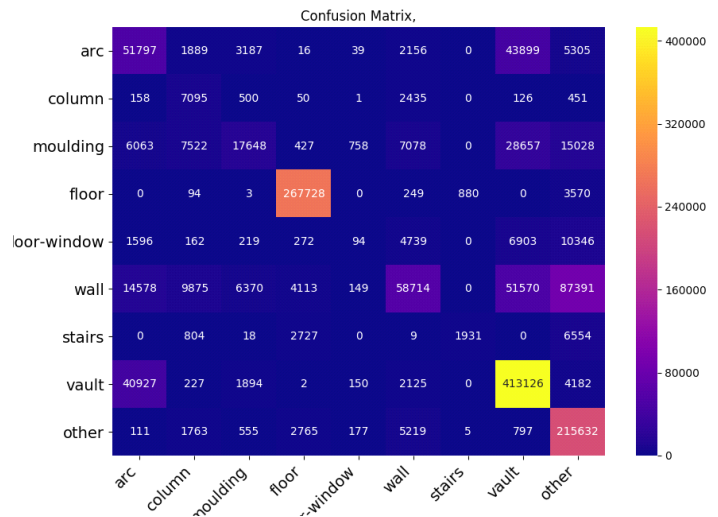
Mean Jaccard (Mean_IoU):

0.36908285551353887

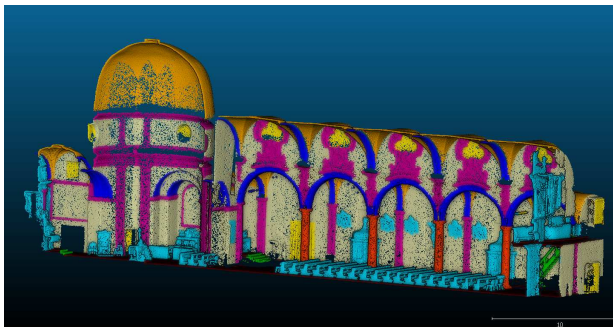
Jaccard:

- arc: 0.3016346282632875
- column: 0.21401423745173745
- moulding: 0.18397322964337465
- floor: 0.94638312312652
- door-window: 0.0036711579769576255
- wall: 0.2286637847100518
- stairs: 0.14936571782178218
- vault: 0.6948140299536651
- other: 0.5992257906744736

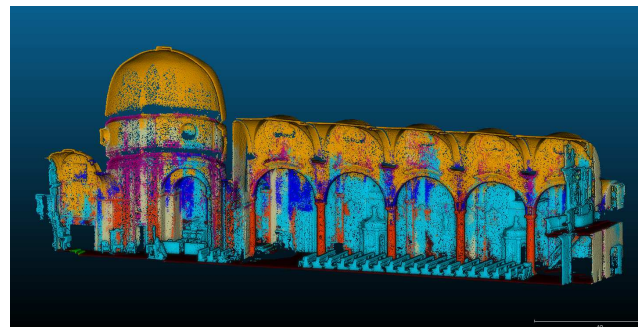
all room eval accuracy: 0.721097



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_29

Overall Accuracy: **0.8388**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.968708
eval accuracy: 0.838830

Accuracy:

0.8388297341086648

report:

	precision	recall	f1-score	support
arc	0.6800	0.7144	0.6968	113595
column	0.9072	0.7116	0.7976	10262
moulding	0.6682	0.5813	0.6217	82894
floor	0.9801	0.9814	0.9808	270221
door-window	0.5702	0.1949	0.2905	28538
wall	0.7101	0.8182	0.7603	233954
stairs	0.9151	0.2329	0.3714	12866
vault	0.9588	0.8637	0.9088	463976
other	0.7629	0.9174	0.8330	225486
accuracy			0.8388	1441792
macro avg	0.7947	0.6684	0.6956	1441792
weighted avg	0.8447	0.8388	0.8353	1441792

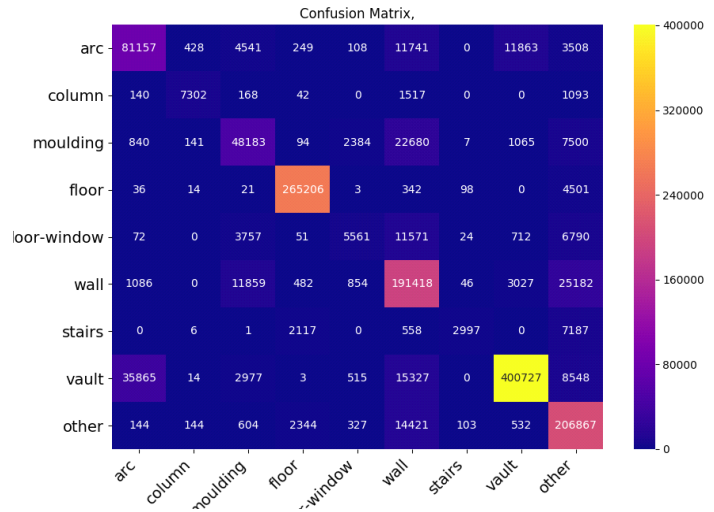
Mean Jaccard (Mean_IoU):

0.5743545516336812

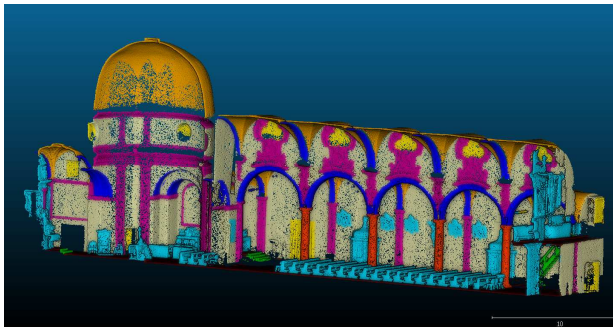
Jaccard:

- arc: 0.5347085875423315
- column: 0.6632755018621128
- moulding: 0.45105877066521877
- floor: 0.9622754469290973
- door-window: 0.16991047694705003
- wall: 0.6133010371310207
- stairs: 0.22801278149726112
- vault: 0.8328092689769834
- other: 0.7138390931520557

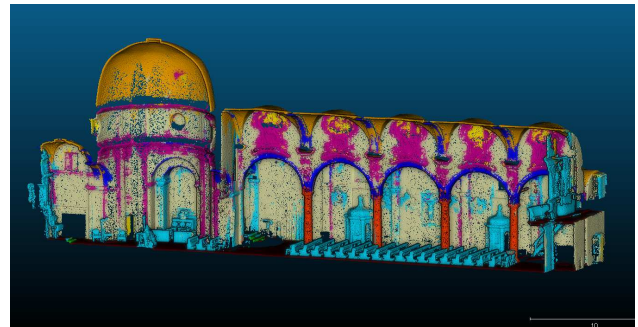
all room eval accuracy: 0.838830



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_30

Overall Accuracy: **0.8723**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.353572
eval accuracy: 0.872313

Accuracy:

0.8723130659623579

report:

	precision	recall	f1-score	support
arc	0.7380	0.7493	0.7436	113351
column	0.9154	0.8757	0.8951	10559
moulding	0.7269	0.6207	0.6696	82712
floor	0.9847	0.9845	0.9846	270232
door-window	0.4078	0.1531	0.2226	28715
wall	0.7413	0.8620	0.7971	233664
stairs	0.9660	0.3320	0.4941	12851
vault	0.9544	0.9207	0.9373	463323
other	0.8657	0.9251	0.8944	226385
accuracy			0.8723	1441792
macro avg	0.8111	0.7137	0.7376	1441792
weighted avg	0.8705	0.8723	0.8676	1441792

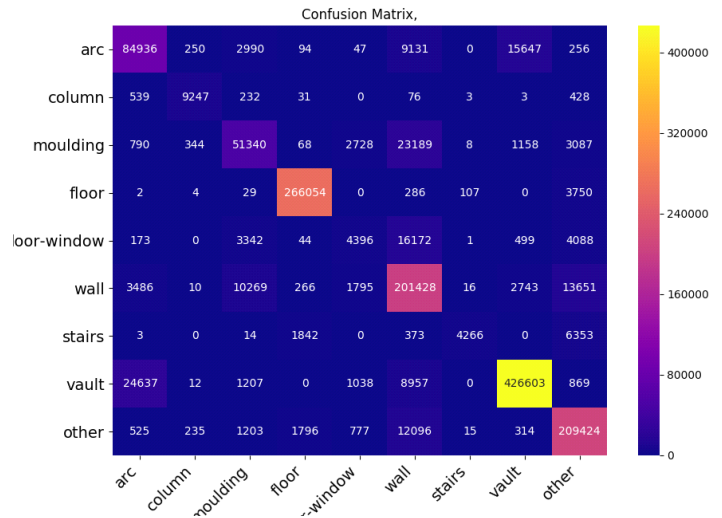
Mean Jaccard (Mean_IoU):

0.6313445716434716

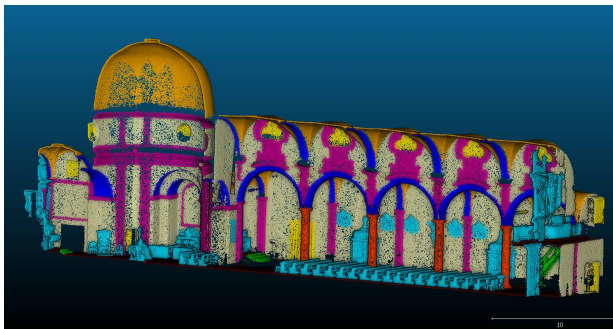
Jaccard:

- arc: 0.5918637548255822
- column: 0.8101454354301735
- moulding: 0.5033432028078982
- floor: 0.969679961220674
- door-window: 0.12524216524216525
- wall: 0.6627141841918248
- stairs: 0.3281286054918852
- vault: 0.8819815293774693
- other: 0.8090023062035717

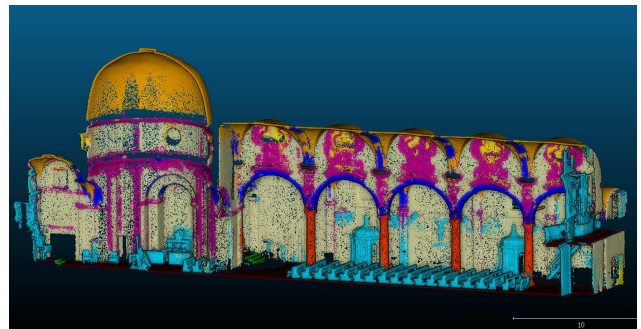
all room eval accuracy: 0.872313



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_31

Overall Accuracy: **0.8679**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

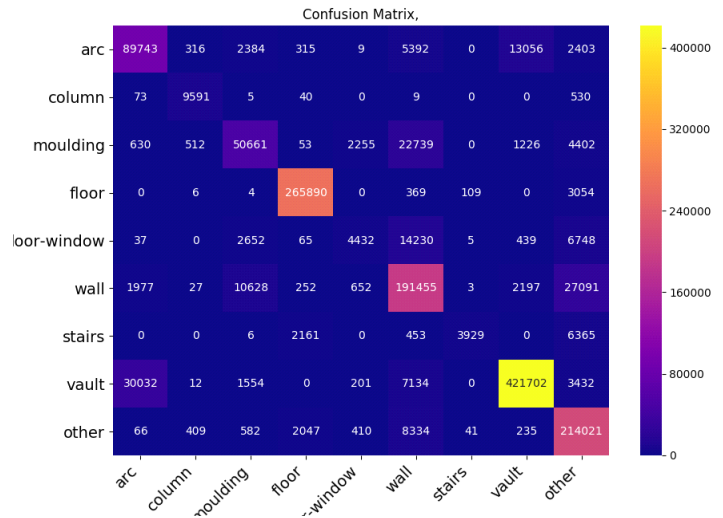
eval mean loss: 1.557556
eval accuracy: 0.867964

Accuracy:
0.8679643110795454

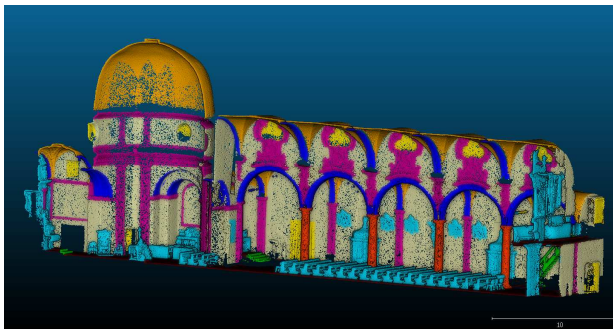
report:	precision	recall	f1-score	support
arc	0.7322	0.7899	0.7600	113618
column	0.8821	0.9359	0.9082	10248
moulding	0.7398	0.6142	0.6712	82478
floor	0.9818	0.9869	0.9843	269432
door-window	0.5569	0.1549	0.2424	28608
wall	0.7655	0.8172	0.7905	234282
stairs	0.9613	0.3042	0.4622	12914
vault	0.9609	0.9087	0.9341	464067
other	0.7984	0.9464	0.8661	226145
accuracy			0.8680	1441792
macro avg	0.8199	0.7176	0.7354	1441792
weighted avg	0.8683	0.8680	0.8626	1441792

Mean Jaccard (Mean_IoU):
0.6279100069829049

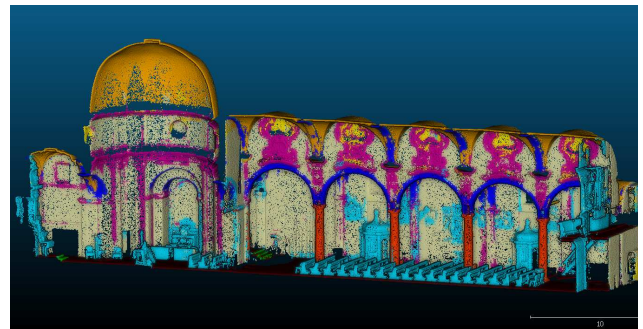
Jaccard:
- arc: 0.6128604890974029
- column: 0.8318300086730269
- moulding: 0.5051299691902725
- floor: 0.9691104914985512
- door-window: 0.1379181577718998
- wall: 0.6535594076643158
- stairs: 0.30056609547123625
- vault: 0.87631852375213
- other: 0.7638969197273084
all room eval accuracy: 0.867964



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_32

Overall Accuracy: **0.8412**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1861.334332
eval accuracy: 0.841246

Accuracy:
0.8412461714311079

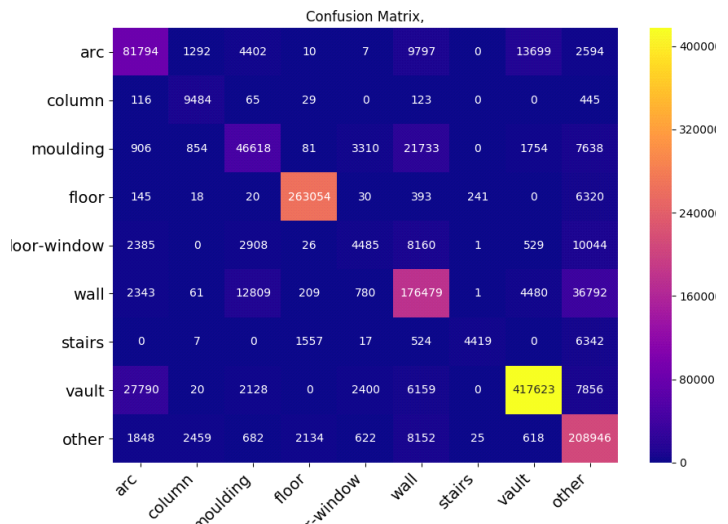
report:

	precision	recall	f1-score	support
arc	0.6971	0.7200	0.7084	113595
column	0.6681	0.9242	0.7756	10262
moulding	0.6695	0.5624	0.6113	82894
floor	0.9849	0.9735	0.9791	270221
door-window	0.3849	0.1572	0.2232	28538
wall	0.7623	0.7543	0.7583	233954
stairs	0.9428	0.3435	0.5035	12866
vault	0.9519	0.9001	0.9253	463976
other	0.7281	0.9266	0.8155	225486
accuracy			0.8412	1441792
macro avg	0.7544	0.6958	0.7000	1441792
weighted avg	0.8427	0.8412	0.8372	1441792

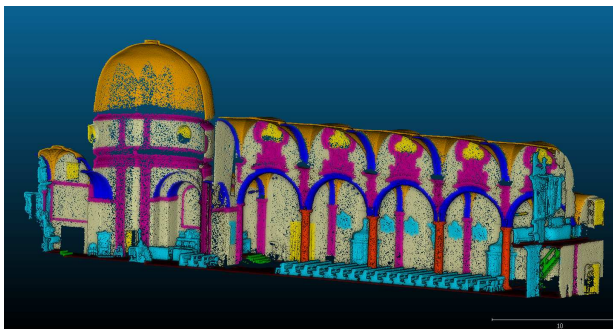
Mean Jaccard (Mean_IoU):
0.5781456011036625

Jaccard:

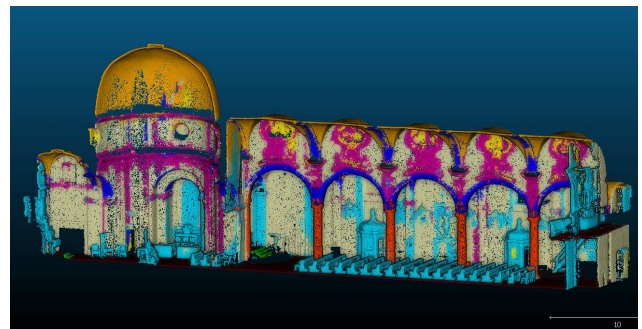
- arc: 0.5484818411029451
 - column: 0.6334067989046951
 - moulding: 0.44017449106771916
 - floor: 0.9591164813849278
 - door-window: 0.12561617745910822
 - wall: 0.6106645443692797
 - stairs: 0.336455002284148
 - vault: 0.8609789385143158
 - other: 0.6884161348458241
- all room eval accuracy: 0.841246



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_33

Overall Accuracy: **0.8618**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1529.408141
eval accuracy: 0.861898

Accuracy:

0.8618975552645597

report:

	precision	recall	f1-score	support
arc	0.6788	0.7906	0.7305	113351
column	0.8449	0.9118	0.8771	10559
moulding	0.7313	0.5987	0.6584	82712
floor	0.9799	0.9888	0.9844	270232
door-window	0.3947	0.1210	0.1852	28715
wall	0.7475	0.8533	0.7969	233664
stairs	0.9703	0.3258	0.4878	12851
vault	0.9681	0.8858	0.9251	463323
other	0.8232	0.9243	0.8708	226385
accuracy			0.8619	1441792
macro avg	0.7932	0.7111	0.7240	1441792
weighted avg	0.8632	0.8619	0.8573	1441792

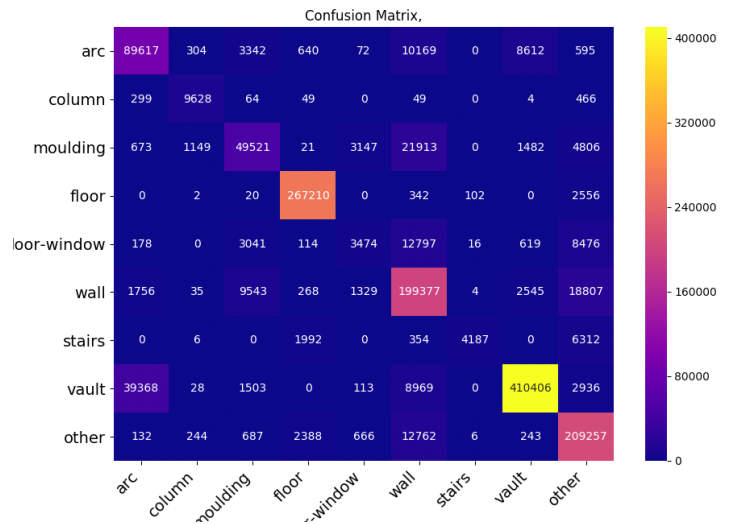
Mean Jaccard (Mean_IoU):

0.6150255945236626

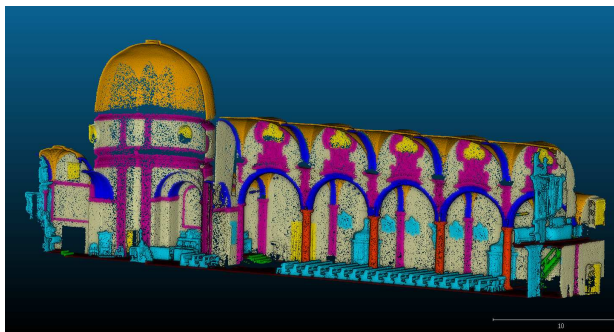
Jaccard:

- arc: 0.5753641890894149
- column: 0.7810497282388253
- moulding: 0.4907345013477089
- floor: 0.9691915967849578
- door-window: 0.10205040831913519
- wall: 0.6623402509476146
- stairs: 0.32259804299252637
- vault: 0.860700294445796
- other: 0.7712013385469837

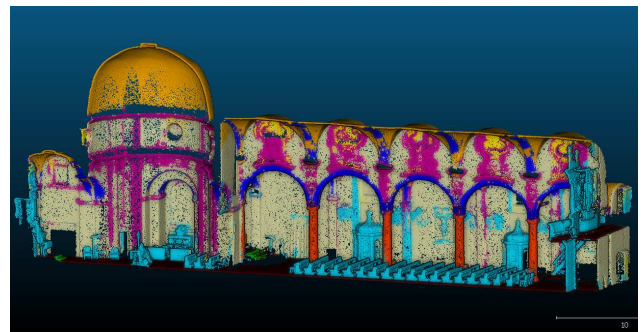
all room eval accuracy: 0.861898



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_34

Overall Accuracy: **0.8639**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1433.472266
eval accuracy: 0.863990

Accuracy:
0.8639900901100852

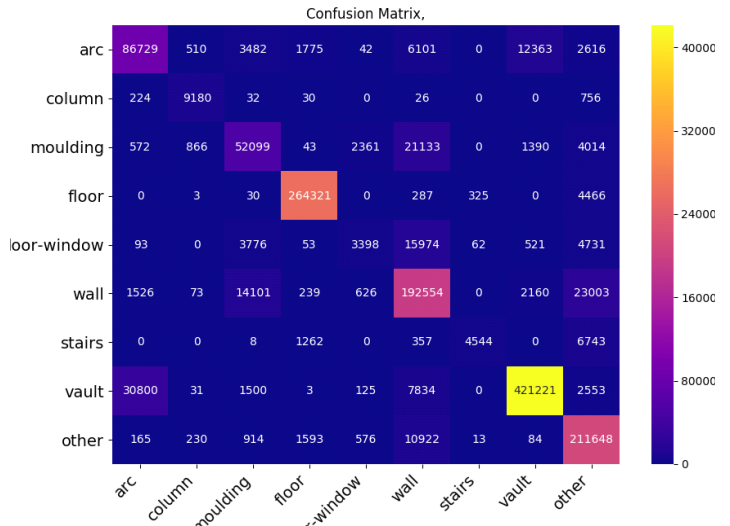
report:

	precision	recall	f1-score	support
arc	0.7221	0.7633	0.7421	113618
column	0.8427	0.8958	0.8685	10248
moulding	0.6860	0.6317	0.6577	82478
floor	0.9814	0.9810	0.9812	269432
door-window	0.4767	0.1188	0.1902	28608
wall	0.7546	0.8219	0.7868	234282
stairs	0.9191	0.3519	0.5089	12914
vault	0.9623	0.9077	0.9342	464067
other	0.8124	0.9359	0.8698	226145
accuracy			0.8640	1441792
macro avg	0.7953	0.7120	0.7266	1441792
weighted avg	0.8630	0.8640	0.8589	1441792

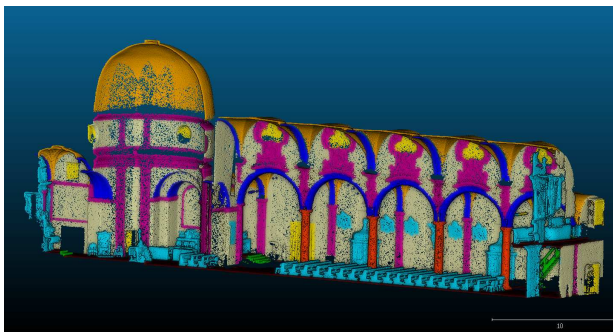
Mean Jaccard (Mean_IoU):
0.6168433636100619

Jaccard:

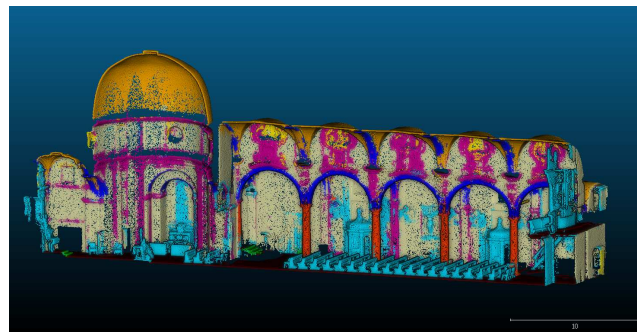
- arc: 0.5900012245064559
 - column: 0.7674943566591422
 - moulding: 0.49001608337017144
 - floor: 0.9631636482891812
 - door-window: 0.10507761766343002
 - wall: 0.6485133842568268
 - stairs: 0.3412948775724801
 - vault: 0.8764755454290084
 - other: 0.7695535347438616
- all room eval accuracy: 0.863990



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_35

Overall Accuracy: **0.7807**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 2.475676
eval accuracy: 0.780746

Accuracy:
0.7807457663796165

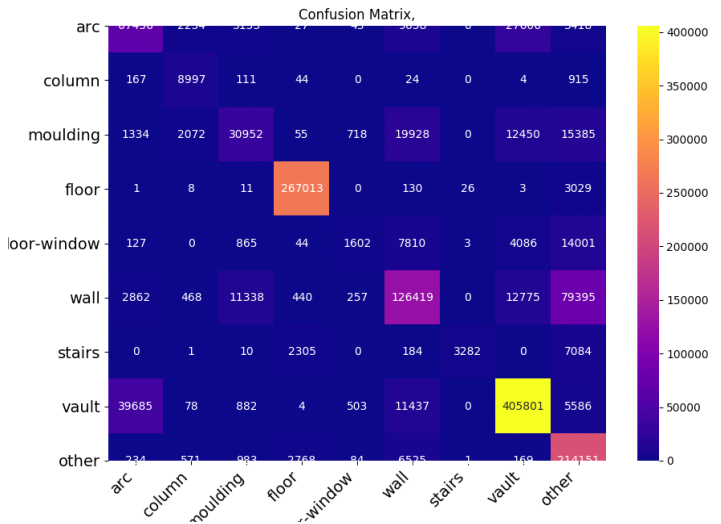
report:

	precision	recall	f1-score	support
arc	0.6030	0.5938	0.5984	113595
column	0.6235	0.8767	0.7288	10262
moulding	0.6408	0.3734	0.4718	82894
floor	0.9791	0.9881	0.9836	270221
door-window	0.4995	0.0561	0.1009	28538
wall	0.6942	0.5404	0.6077	233954
stairs	0.9909	0.2551	0.4057	12866
vault	0.8767	0.8746	0.8756	463976
other	0.6244	0.9497	0.7535	225486
accuracy			0.7807	1441792
macro avg	0.7258	0.6120	0.6140	1441792
weighted avg	0.7834	0.7807	0.7677	1441792

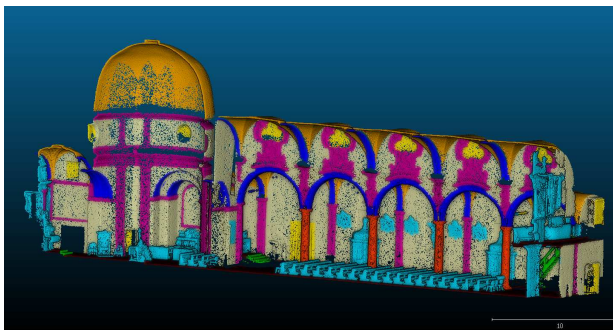
Mean Jaccard (Mean_IoU):
0.489337537357964

Jaccard:

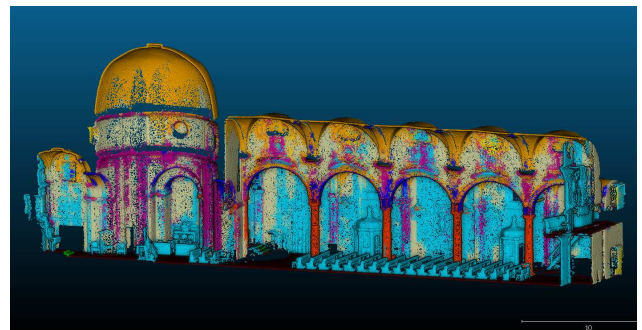
- arc: 0.42692319863295464
 - column: 0.5732764113674016
 - moulding: 0.30875736929783437
 - floor: 0.9677609927946997
 - door-window: 0.05314666755133862
 - wall: 0.43645434144657347
 - stairs: 0.25449751861042186
 - vault: 0.7787855351210684
 - other: 0.604435801399383
- all room eval accuracy: 0.780746



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_36

Overall Accuracy: **0.7941**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 2.057964
eval accuracy: 0.813375

Accuracy:
0.8133746060458097

report:

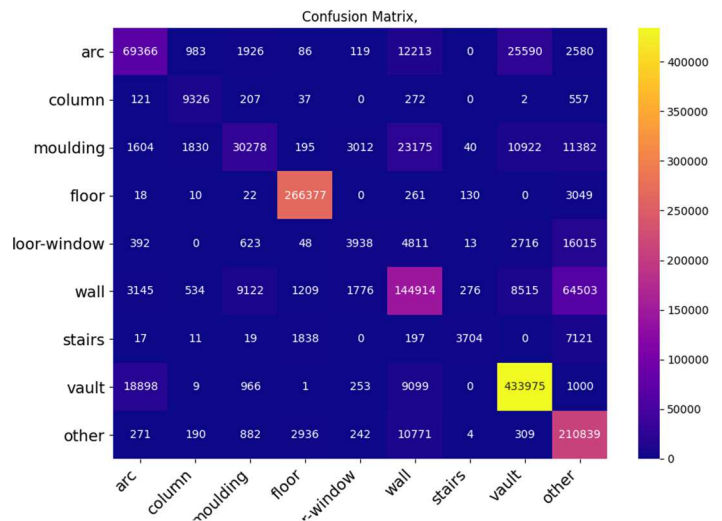
	precision	recall	f1-score	support
arc	0.7393	0.6146	0.6712	112863
column	0.7233	0.8863	0.7966	10522
moulding	0.6874	0.3673	0.4788	82438
floor	0.9767	0.9871	0.9819	269867
door-window	0.4216	0.1379	0.2078	28556
wall	0.7044	0.6193	0.6591	233994
stairs	0.8889	0.2870	0.4339	12907
vault	0.9003	0.9349	0.9173	464201
other	0.6650	0.9311	0.7759	226444
accuracy			0.8134	1441792
macro avg	0.7452	0.6406	0.6580	1441792
weighted avg	0.8102	0.8134	0.8017	1441792

Mean Jaccard (Mean_IoU):
0.5346362535277489

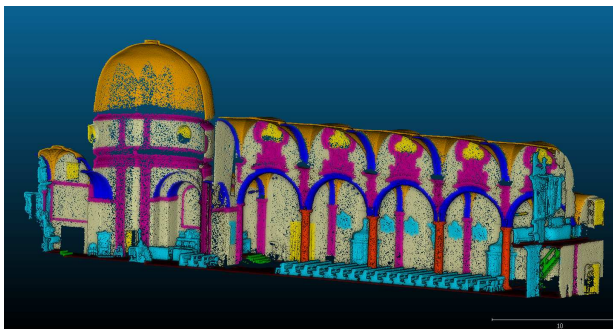
Jaccard:

- arc: 0.5051081708888873
- column: 0.6619348427851516
- moulding: 0.3147237669559794
- floor: 0.9643758349413686
- door-window: 0.1159667824960245
- wall: 0.49157883667522634
- stairs: 0.2770381451009723
- vault: 0.8471854837922519
- other: 0.6338144181138791

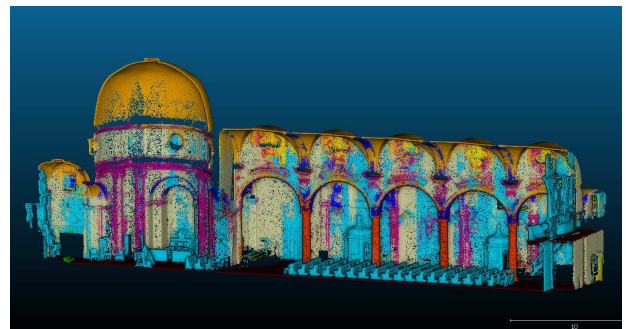
all room eval accuracy: 0.813375



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_37

Overall Accuracy: **0.7941**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

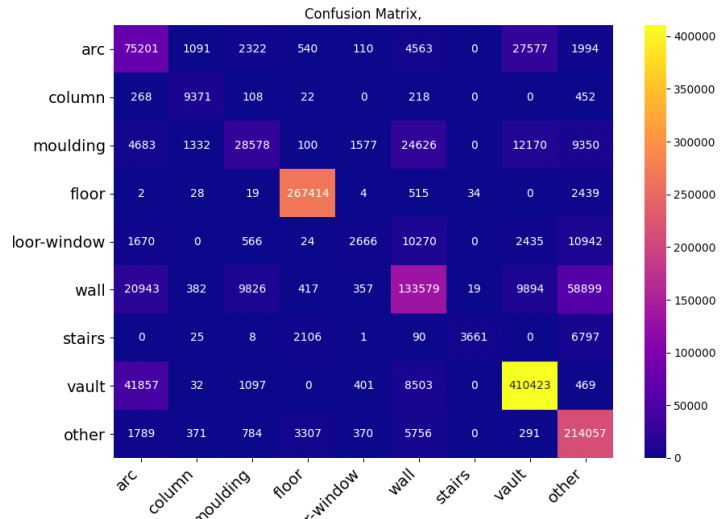
eval mean loss: 2.135717
eval accuracy: 0.794116

Accuracy:
0.7941159335049716

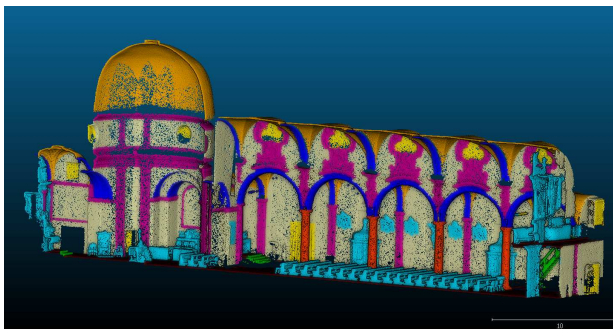
report:	precision	recall	f1-score	support
arc	0.5136	0.6632	0.5789	113398
column	0.7418	0.8977	0.8124	10439
moulding	0.6599	0.3468	0.4546	82416
floor	0.9762	0.9888	0.9824	270455
door-window	0.4860	0.0933	0.1566	28573
wall	0.7101	0.5701	0.6324	234316
stairs	0.9857	0.2885	0.4464	12688
vault	0.8868	0.8869	0.8869	462782
other	0.7009	0.9441	0.8045	226725
accuracy			0.7941	1441792
macro avg	0.7401	0.6310	0.6395	1441792
weighted avg	0.7952	0.7941	0.7827	1441792

Mean Jaccard (Mean_IoU):
0.5172710823560014

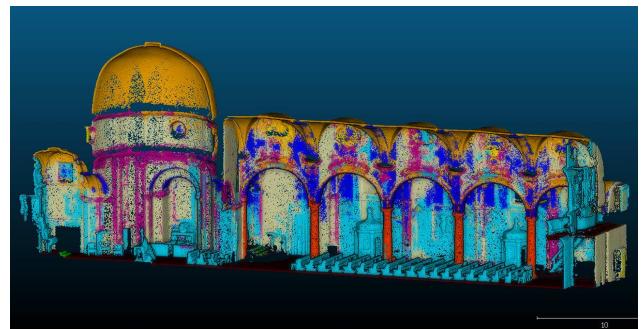
Jaccard:
- arc: 0.4073506310600726
- column: 0.684014598540146
- moulding: 0.29417577666604905
- floor: 0.9654945824653123
- door-window: 0.08492339056477559
- wall: 0.46243989240350764
- stairs: 0.2873400831959815
- vault: 0.7967073603947595
- other: 0.6729934259134082
all room eval accuracy: 0.794116



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_38

Overall Accuracy: **0.7646**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 2209.115974
eval accuracy: 0.764569

Accuracy:
0.7645686756480824

report:

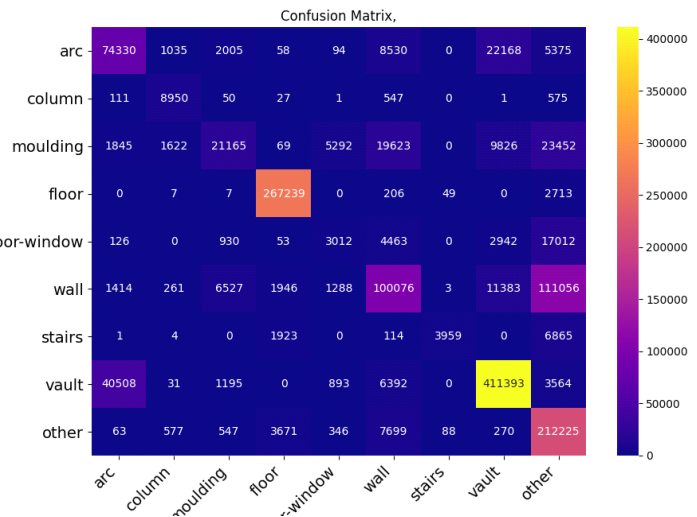
	precision	recall	f1-score	support
arc	0.6278	0.6543	0.6408	113595
column	0.7167	0.8721	0.7868	10262
moulding	0.6527	0.2553	0.3671	82894
floor	0.9718	0.9890	0.9803	270221
door-window	0.2757	0.1055	0.1526	28538
wall	0.6778	0.4278	0.5245	233954
stairs	0.9658	0.3077	0.4667	12866
vault	0.8983	0.8867	0.8924	463976
other	0.5543	0.9412	0.6977	225486
accuracy			0.7646	1441792
macro avg	0.7046	0.6044	0.6121	1441792
weighted avg	0.7741	0.7646	0.7495	1441792

Mean Jaccard (Mean_IoU):
0.48780963183015225

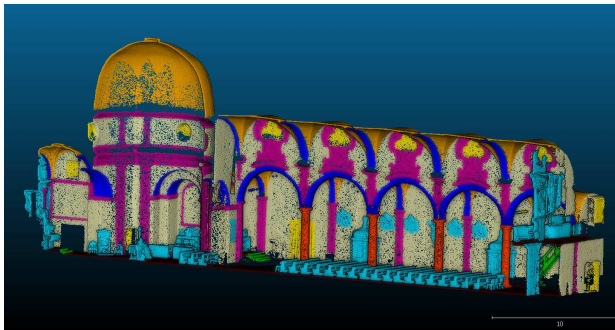
Jaccard:

- arc: 0.4714485960561451
- column: 0.6485977244727879
- moulding: 0.22478891190058944
- floor: 0.9614020318885627
- door-window: 0.08262921101722813
- wall: 0.35547441107101246
- stairs: 0.30439797016761494
- vault: 0.8057587070036
- other: 0.5357891228938293

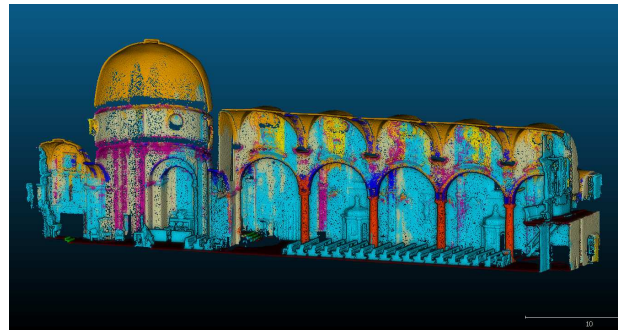
all room eval accuracy: 0.764569



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_39

Overall Accuracy: **0.8290**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1933.318965
eval accuracy: 0.829036

Accuracy:
0.8290356722745028

report:

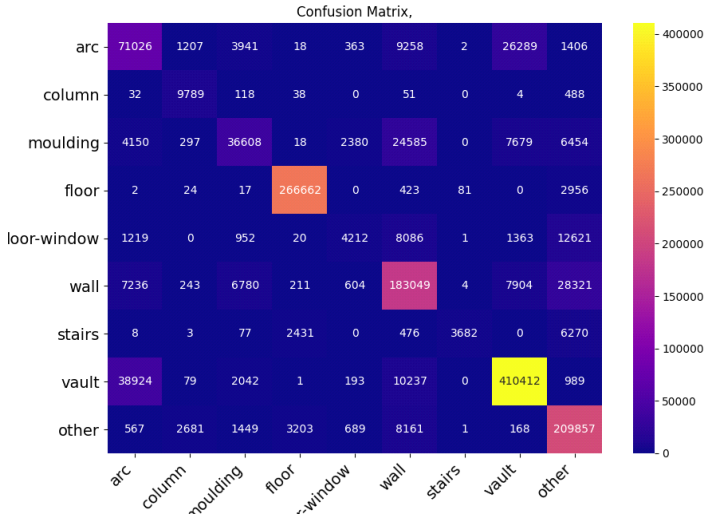
	precision	recall	f1-score	support
arc	0.5767	0.6257	0.6002	113510
column	0.6834	0.9305	0.7881	10520
moulding	0.7042	0.4455	0.5458	82171
floor	0.9782	0.9870	0.9826	270165
door-window	0.4990	0.1479	0.2282	28474
wall	0.7492	0.7811	0.7648	234352
stairs	0.9764	0.2844	0.4405	12947
vault	0.9044	0.8867	0.8954	462877
other	0.7791	0.9254	0.8460	226776
accuracy			0.8290	1441792
macro avg	0.7612	0.6682	0.6768	1441792
weighted avg	0.8271	0.8290	0.8215	1441792

Mean Jaccard (Mean_IoU):
0.5549145743314207

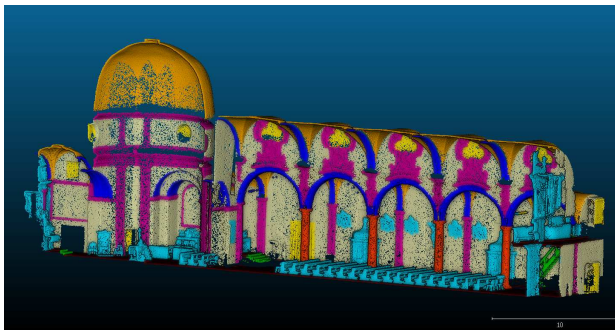
Jaccard:

- arc: 0.42877668308702793
- column: 0.6502590673575129
- moulding: 0.3752857596850749
- floor: 0.9657992430415965
- door-window: 0.12879552334648198
- wall: 0.6191848566953851
- stairs: 0.2824486038662166
- vault: 0.8106359276611546
- other: 0.7330455042423353

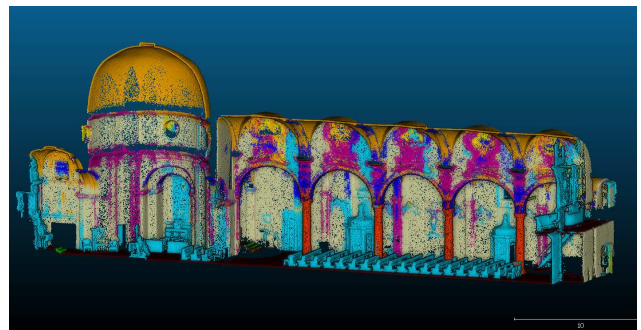
all room eval accuracy: 0.829036



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_40

Overall Accuracy: **0.8116**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1585.391593
eval accuracy: 0.811665

Accuracy:

0.8116649280894886

report:

	precision	recall	f1-score	support
arc	0.6145	0.6029	0.6086	113212
column	0.7529	0.9247	0.8300	10305
moulding	0.6827	0.4590	0.5490	82297
floor	0.9845	0.9842	0.9843	270278
door-window	0.3763	0.1716	0.2357	28823
wall	0.7176	0.6406	0.6769	234662
stairs	0.9731	0.2609	0.4114	12884
vault	0.9090	0.8992	0.9041	463275
other	0.6928	0.9444	0.7993	226056
accuracy			0.8117	1441792
macro avg	0.7448	0.6542	0.6666	1441792
weighted avg	0.8109	0.8117	0.8039	1441792

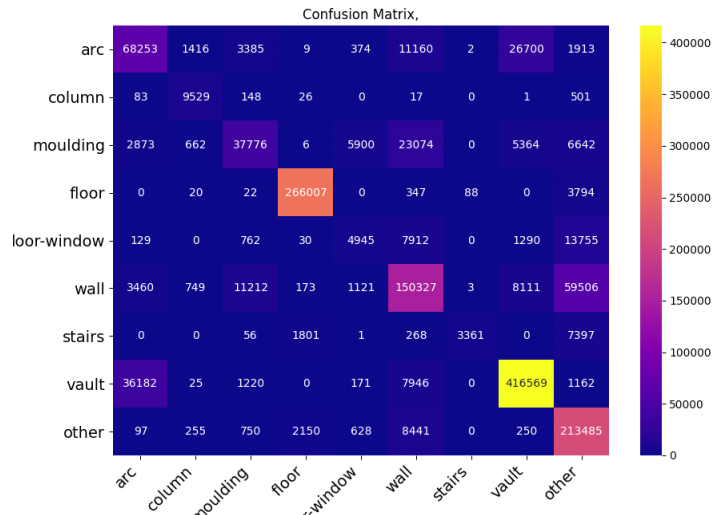
Mean Jaccard (Mean_IoU):

0.5432278783897246

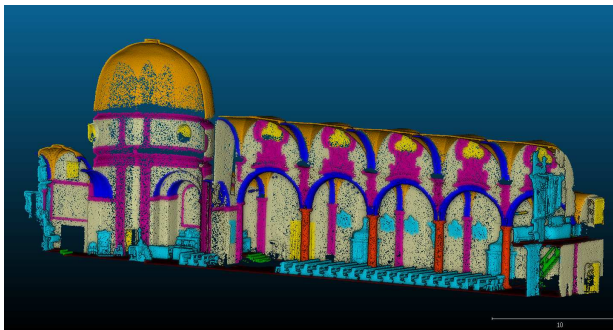
Jaccard:

- arc: 0.43741828808736444
- column: 0.7094252531268612
- moulding: 0.3783199134719385
- floor: 0.9691554360538195
- door-window: 0.13358366200226918
- wall: 0.5116173802952078
- stairs: 0.2589966864452493
- vault: 0.8249038101669138
- other: 0.6656304758578974

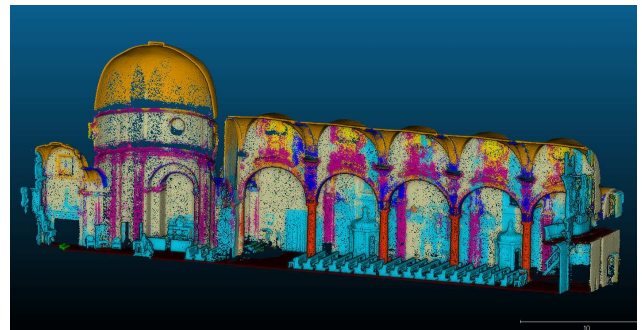
all room eval accuracy: 0.811665



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_41

Overall Accuracy: **0.3498**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":9

k-NN features: x y z R G B Nx Ny Nz Ev1 Ev2 Ev3

Scaler: -

No Z normalisation | Focal loss | Skip connections

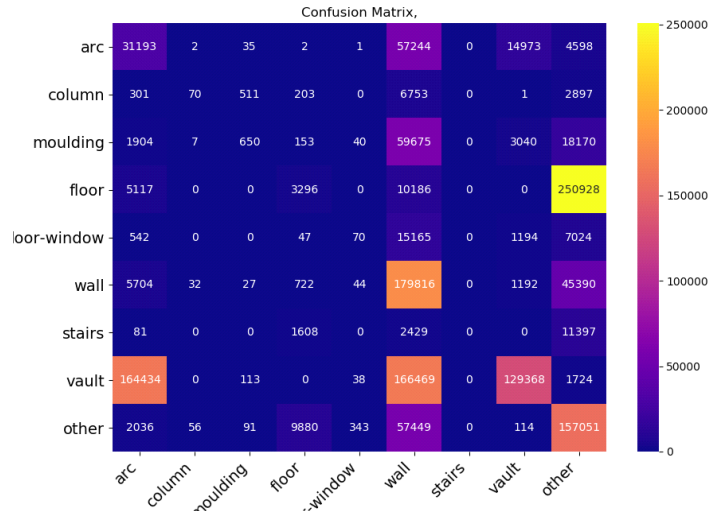
METRICS and CONFUSION MATRIX

eval mean loss: 5.874920
eval accuracy: 0.349828
report:

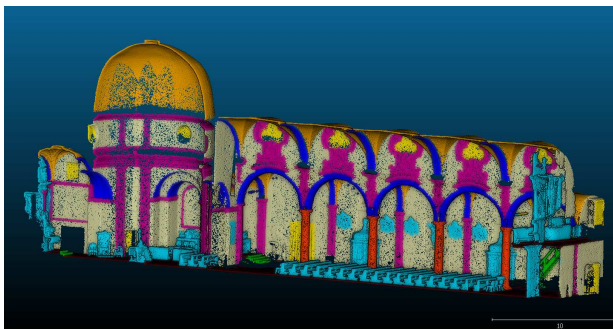
	precision	recall	f1-score	support
0	0.1476	0.2887	0.1953	108048
1	0.4192	0.0065	0.0128	10736
2	0.4555	0.0078	0.0153	83639
3	0.2072	0.0122	0.0231	269527
4	0.1306	0.0029	0.0057	24042
5	0.3239	0.7720	0.4563	232927
6	0.0000	0.0000	0.0000	15515
7	0.8631	0.2799	0.4228	462146
9	0.3146	0.6918	0.4325	227020
accuracy			0.3498	1433600
macro avg	0.3180	0.2291	0.1738	1433600
weighted avg	0.4627	0.3498	0.2991	1433600

IoU:

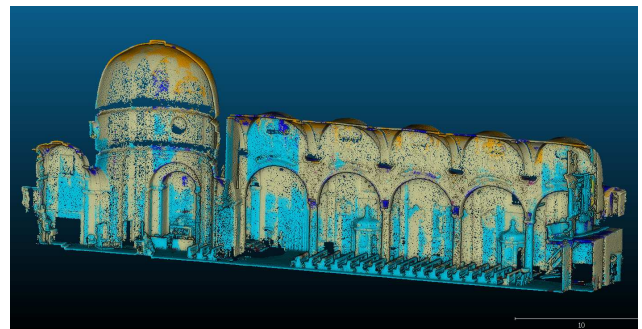
0.10824625998119146
0.00646173728422413
0.007699962092494314
0.011682060806260677
0.0028562102170719764
0.2956056005536769
0.0
0.2680313263995359
0
0.27594052864984153
avg IoU:
0.0976523685984297



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_42

Overall Accuracy: **0.7730**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz Ev1 Ev2 Ev3 Ev1_1 Ev2_1 Ev3_1

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.924226
eval accuracy: 0.773048

Accuracy:
0.7730475725446428

report:

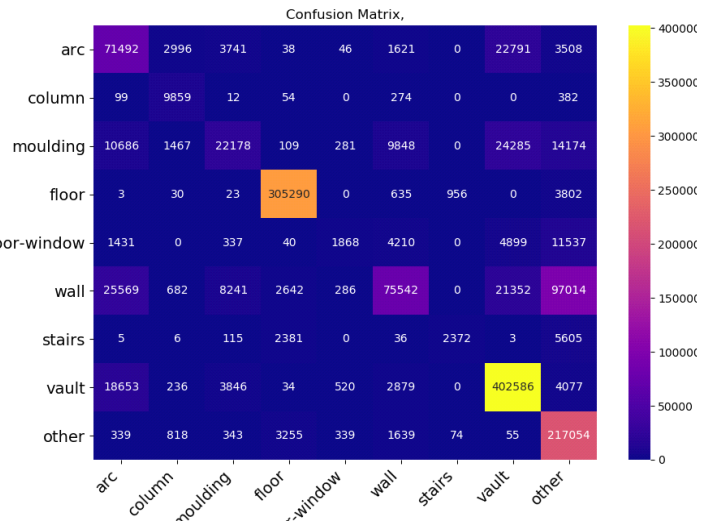
	precision	recall	f1-score	support
arc	0.5573	0.6730	0.6097	106233
column	0.6126	0.9231	0.7365	10680
moulding	0.5711	0.2671	0.3640	83028
floor	0.9727	0.9825	0.9776	310739
door-window	0.5593	0.0768	0.1351	24322
wall	0.7813	0.3266	0.4606	231328
stairs	0.6972	0.2254	0.3407	10523
vault	0.8458	0.9301	0.8860	432831
other	0.6077	0.9694	0.7471	223916
accuracy			0.7730	1433600
macro avg	0.6895	0.5971	0.5841	1433600
weighted avg	0.7808	0.7730	0.7469	1433600

Mean Jaccard (Mean_IoU):
0.4631713965127685

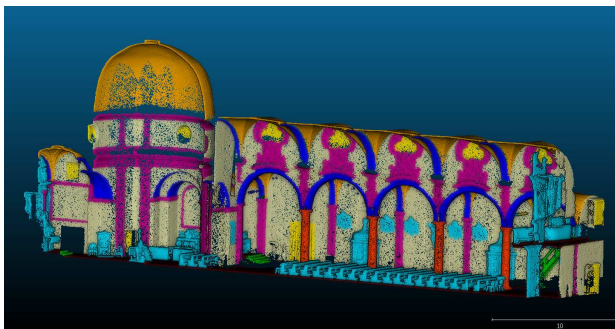
Jaccard:

- arc: 0.43855279785054413
- column: 0.5828554537392847
- moulding: 0.22247858274983448
- floor: 0.95614672462824
- door-window: 0.07241994262231527
- wall: 0.29921178753911354
- stairs: 0.20531463689085086
- vault: 0.7952850166727247
- other: 0.5962776259220087

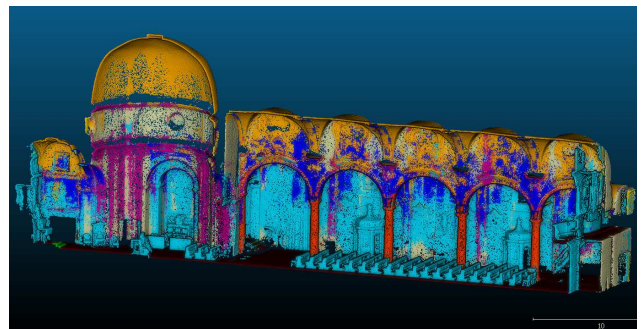
all room eval accuracy: 0.773048



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_43

Overall Accuracy: **0.8275**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8
k-NN features: x y z R G B Nx Ny Nz Ev1 Ev2 Ev3 Ev1_1 Ev2_1 Ev3_1

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.838411
eval accuracy: 0.827522

Accuracy:

0.8275216238839286

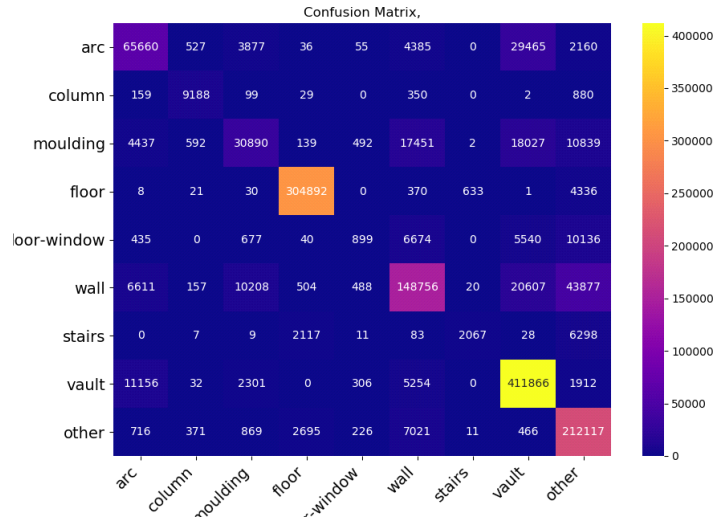
report:

	precision	recall	f1-score	support
arc	0.7362	0.6185	0.6722	106165
column	0.8433	0.8581	0.8507	10707
moulding	0.6309	0.3728	0.4686	82869
floor	0.9821	0.9826	0.9823	310291
door-window	0.3629	0.0368	0.0669	24401
wall	0.7815	0.6433	0.7057	231228
stairs	0.7563	0.1946	0.3096	10620
vault	0.8475	0.9516	0.8965	432827
other	0.7250	0.9449	0.8205	224492
accuracy			0.8275	1433600
macro avg	0.7407	0.6226	0.6415	1433600
weighted avg	0.8171	0.8275	0.8123	1433600

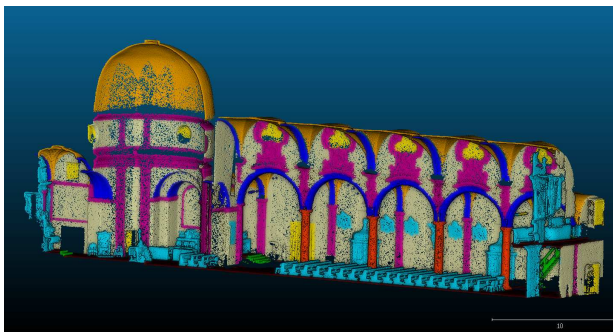
Mean Jaccard (Mean IoU):
0.5320905119841556

Jaccard:

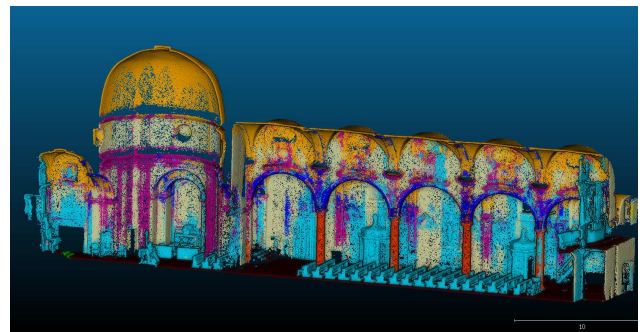
- arc: 0.5062959278879148
 - column: 0.7401321089092959
 - moulding: 0.30602641199140074
 - floor: 0.9653032600814941
 - door-window: 0.03460487316678856
 - wall: 0.5452612749985338
 - stairs: 0.1831472620946305
 - vault: 0.812418263265761
 - other: 0.6956252254615813
- all room eval accuracy: 0.827522



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_44

Overall Accuracy: **0.8712**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Block size: 2x2 m

Stride: 1

N. of points: 8192

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.865272
eval accuracy: 0.871221

Accuracy:

0.8712213689630682

report:

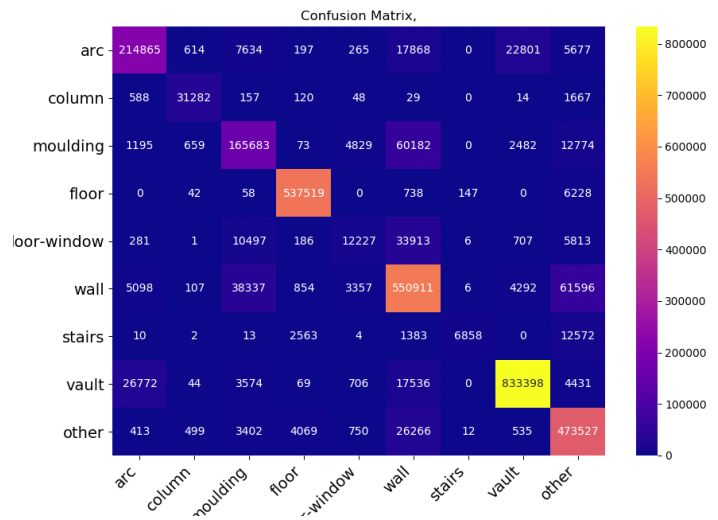
	precision	recall	f1-score	support
arc	0.8621	0.7960	0.8278	269921
column	0.9408	0.9226	0.9316	33905
moulding	0.7224	0.6684	0.6943	247877
floor	0.9851	0.9868	0.9859	544732
door-window	0.5511	0.1922	0.2850	63631
wall	0.7772	0.8290	0.8023	664558
stairs	0.9757	0.2930	0.4507	23405
vault	0.9643	0.9401	0.9520	886530
other	0.8104	0.9294	0.8659	509473
accuracy			0.8712	3244032
macro avg	0.8432	0.7286	0.7551	3244032
weighted avg	0.8701	0.8712	0.8666	3244032

Mean Jaccard (Mean_IoU):
0.6534468946843615

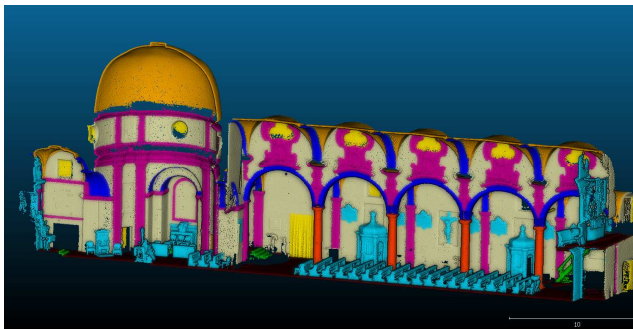
Jaccard:

- arc: 0.7061470102997917
- column: 0.8720207398321858
- moulding: 0.53180398588986
- floor: 0.9722462888636063
- door-window: 0.16615029215926078
- wall: 0.6698225960001118
- stairs: 0.29088903970139124
- vault: 0.9084733272942713
- other: 0.7634687721187751

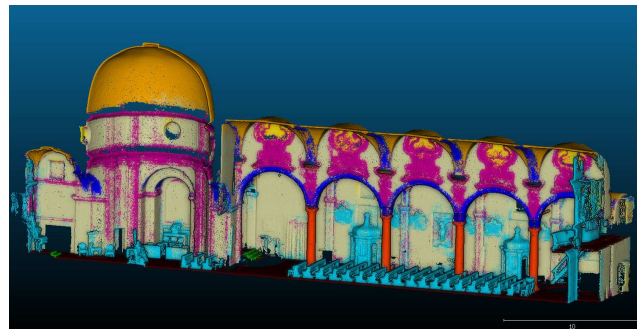
all room eval accuracy: 0.871221



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_45

Overall Accuracy: **0.7755**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Block size: 2x2 m

Stride: 1

N. of points: 8192

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 3.718476
eval accuracy: 0.775503

Accuracy:

0.775503447561553

report:

	precision	recall	f1-score	support
arc	0.6384	0.6978	0.6668	270887
column	0.9266	0.9259	0.9262	33677
moulding	0.6824	0.3461	0.4592	247501
floor	0.9722	0.9854	0.9788	544144
door-window	0.6006	0.1039	0.1771	63801
wall	0.7779	0.5415	0.6385	664797
stairs	0.9702	0.1836	0.3087	23390
vault	0.8480	0.9149	0.8802	886551
other	0.6127	0.9655	0.7496	509284
accuracy			0.7755	3244032
macro avg	0.7810	0.6294	0.6428	3244032
weighted avg	0.7842	0.7755	0.7593	3244032

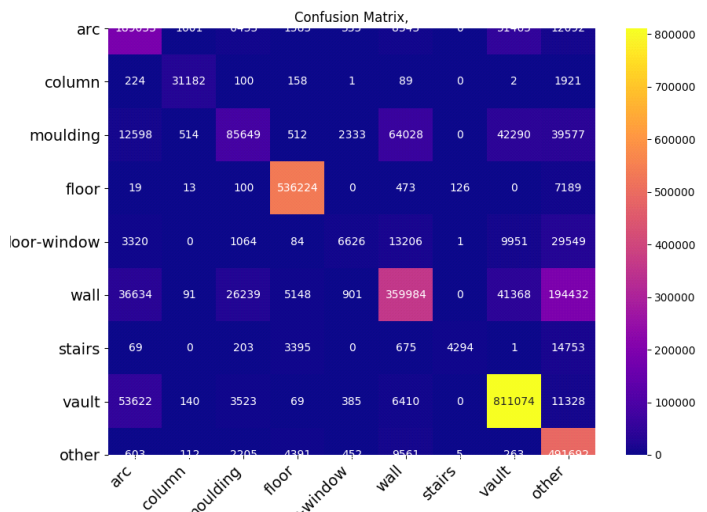
Mean Jaccard (Mean_IoU):

0.5281588603813154

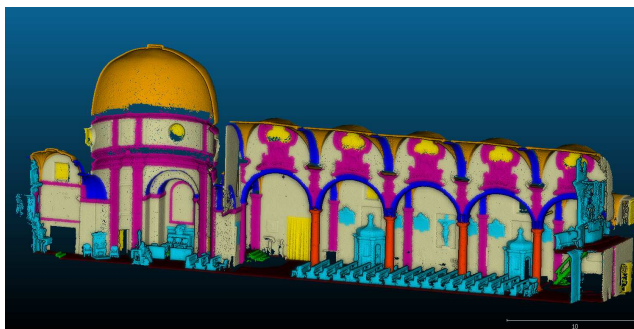
Jaccard:

- arc: 0.5001190551781065
- column: 0.8626203386079451
- moulding: 0.2980464073940035
- floor: 0.9584225521282034
- door-window: 0.09714403002580342
- wall: 0.4689844212084181
- stairs: 0.1825525040387722
- vault: 0.7860074368319909
- other: 0.5995329980185947

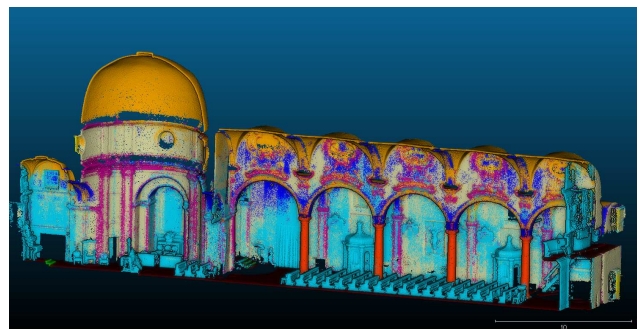
all room eval accuracy: 0.775503



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: TR_46

Overall Accuracy: **0.8791**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "other":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

Random points added in the *floor* class

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.308561
eval accuracy: 0.879194

Accuracy:
0.8791940862482245

report:

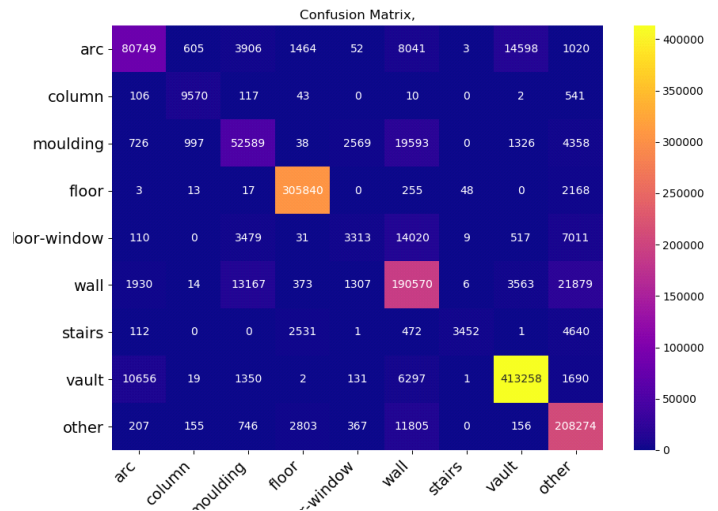
	precision	recall	f1-score	support
arc	0.8536	0.7312	0.7877	110438
column	0.8415	0.9212	0.8795	10389
moulding	0.6977	0.6398	0.6675	82196
floor	0.9767	0.9919	0.9842	308344
door-window	0.4280	0.1163	0.1829	28490
wall	0.7591	0.8186	0.7877	232809
stairs	0.9810	0.3080	0.4688	11209
vault	0.9535	0.9535	0.9535	433404
other	0.8279	0.9277	0.8749	224513
accuracy			0.8792	1441792
macro avg	0.8132	0.7120	0.7319	1441792
weighted avg	0.8743	0.8792	0.8725	1441792

Mean Jaccard (Mean_IoU):
0.6277654201973766

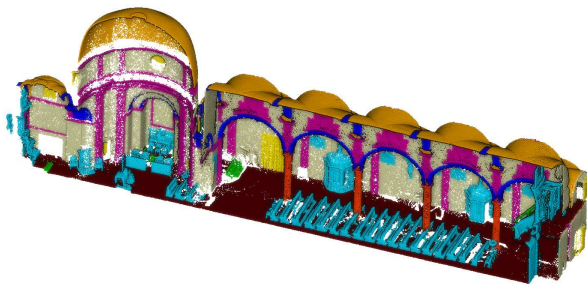
Jaccard:

- arc: 0.649692649330587
- column: 0.7849409448818898
- moulding: 0.5009525805406847
- floor: 0.9689857395866667
- door-window: 0.10064708205486526
- wall: 0.6497398585758024
- stairs: 0.30613692798864844
- vault: 0.9111288960616624
- other: 0.7776641027555821

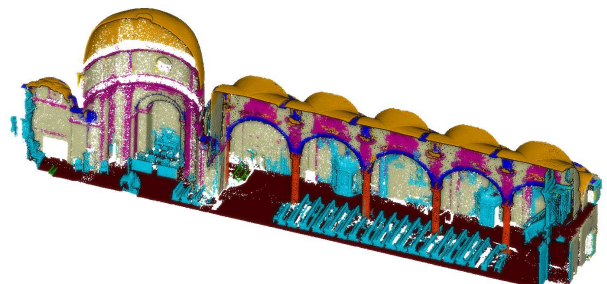
all room eval accuracy: 0.879194



VISUAL INSPECTION



Ground truth



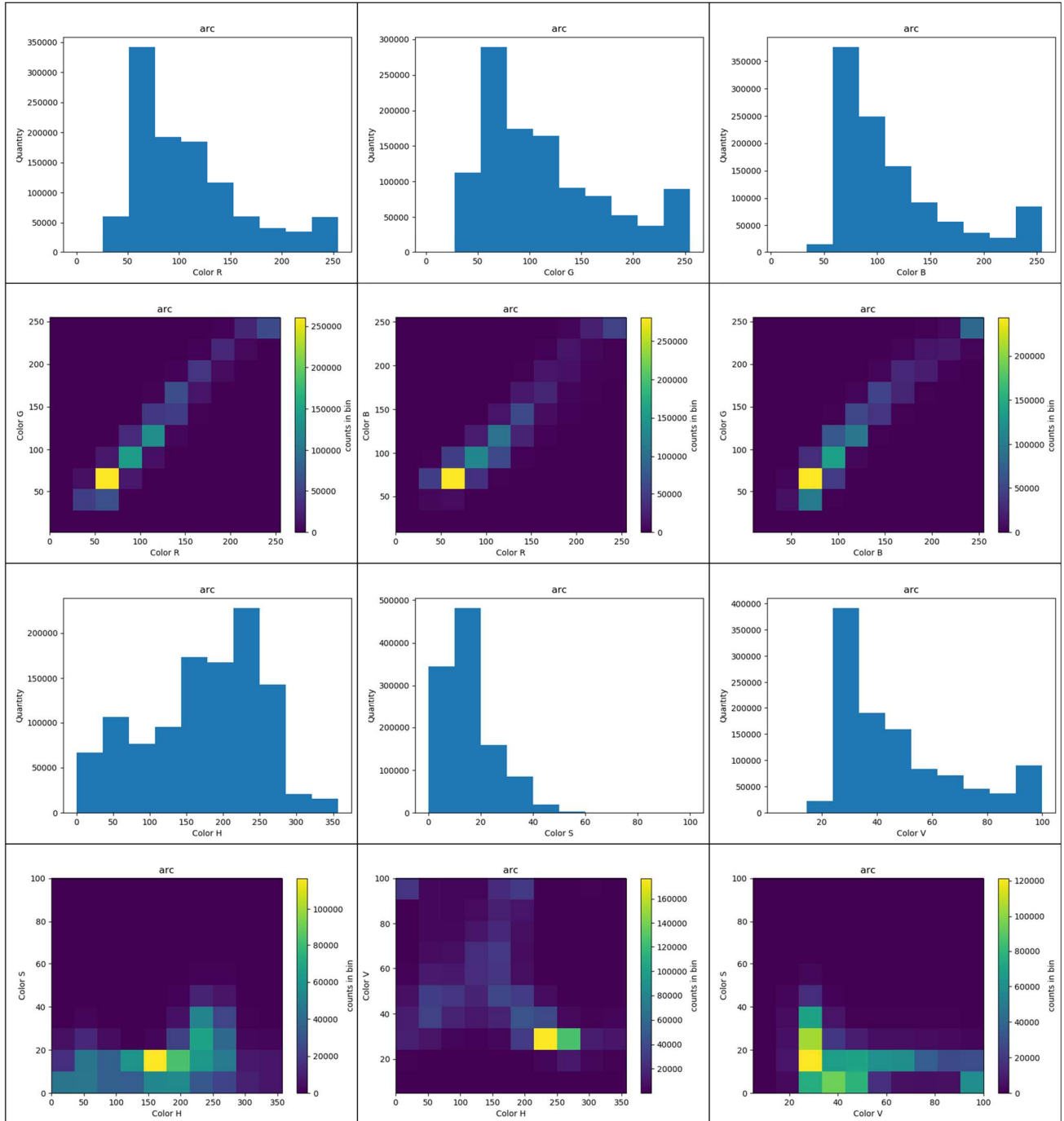
Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

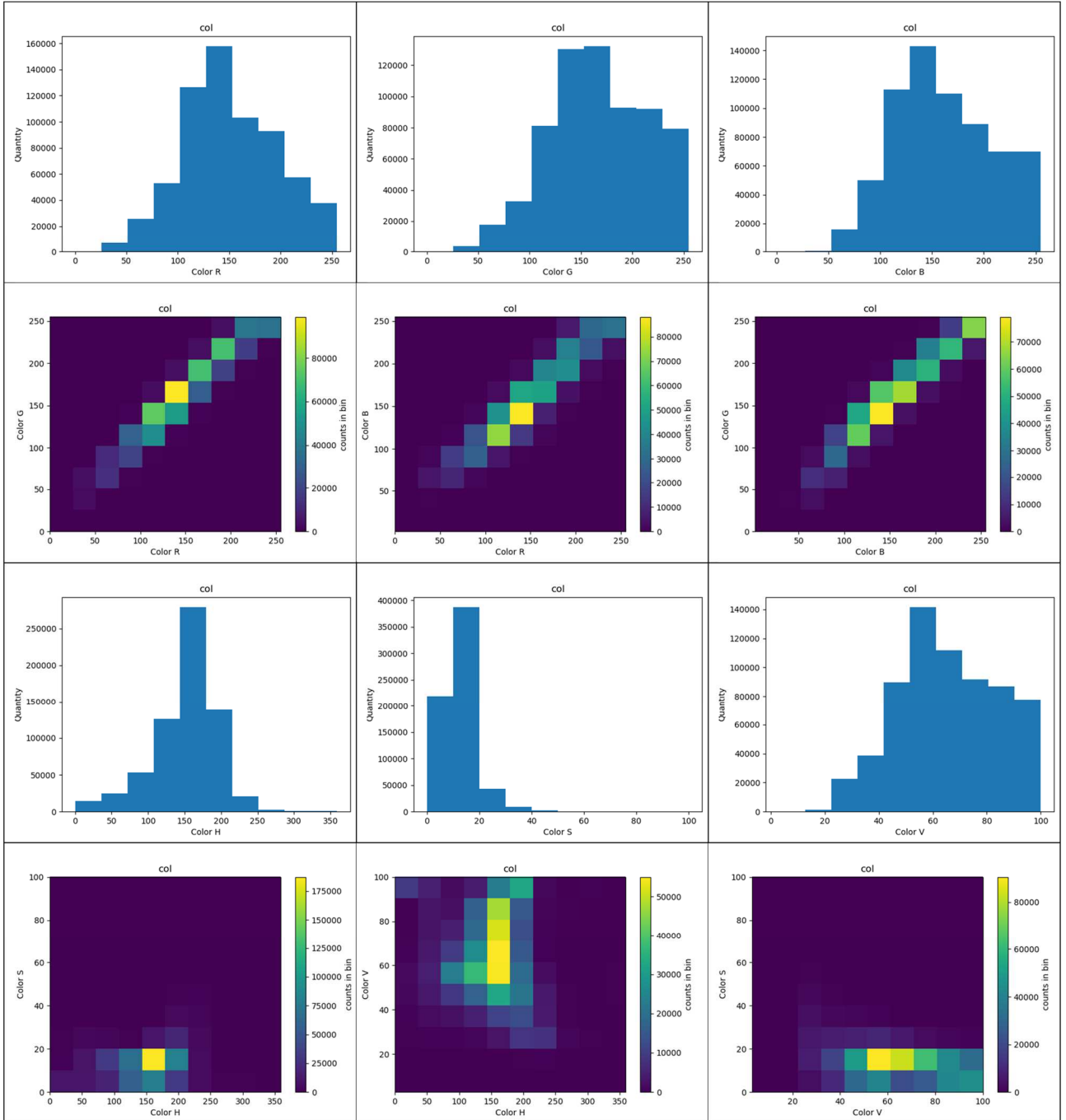
Evaluation of the radiometric component (RGB vs. HSV)

These tests were performed with the “old” classes on the Trompone church scene.

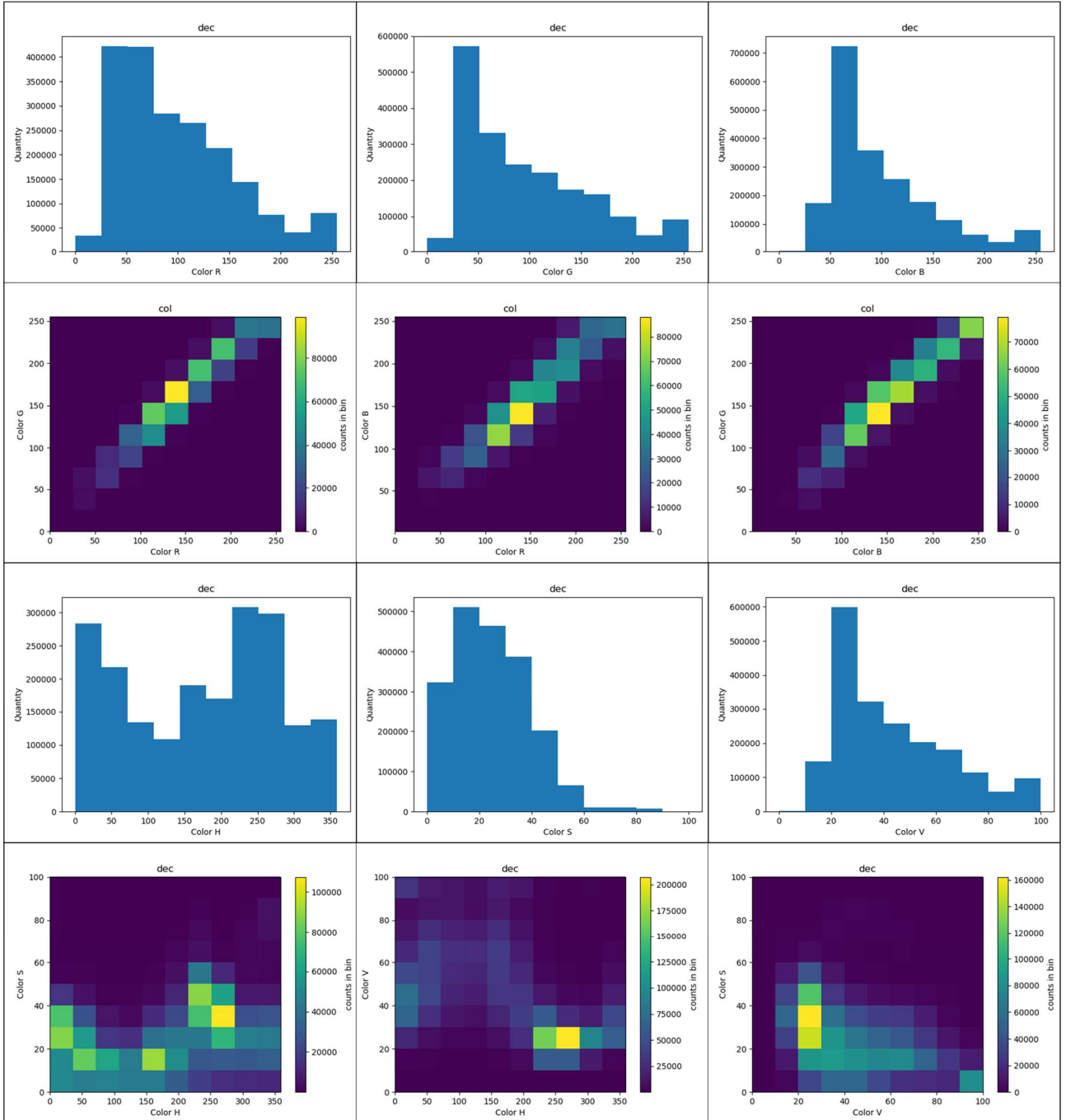
ARCH



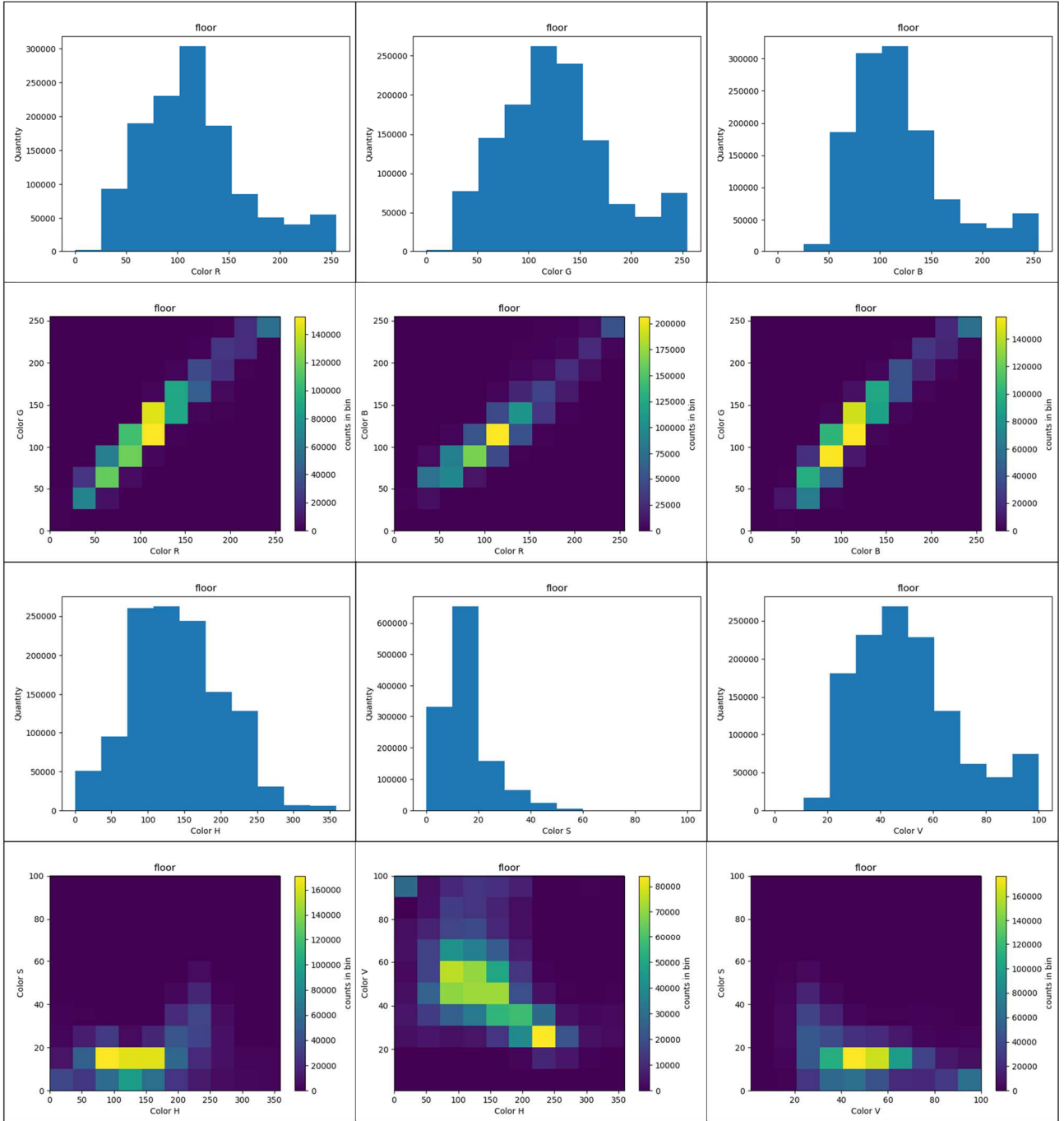
COLUMN



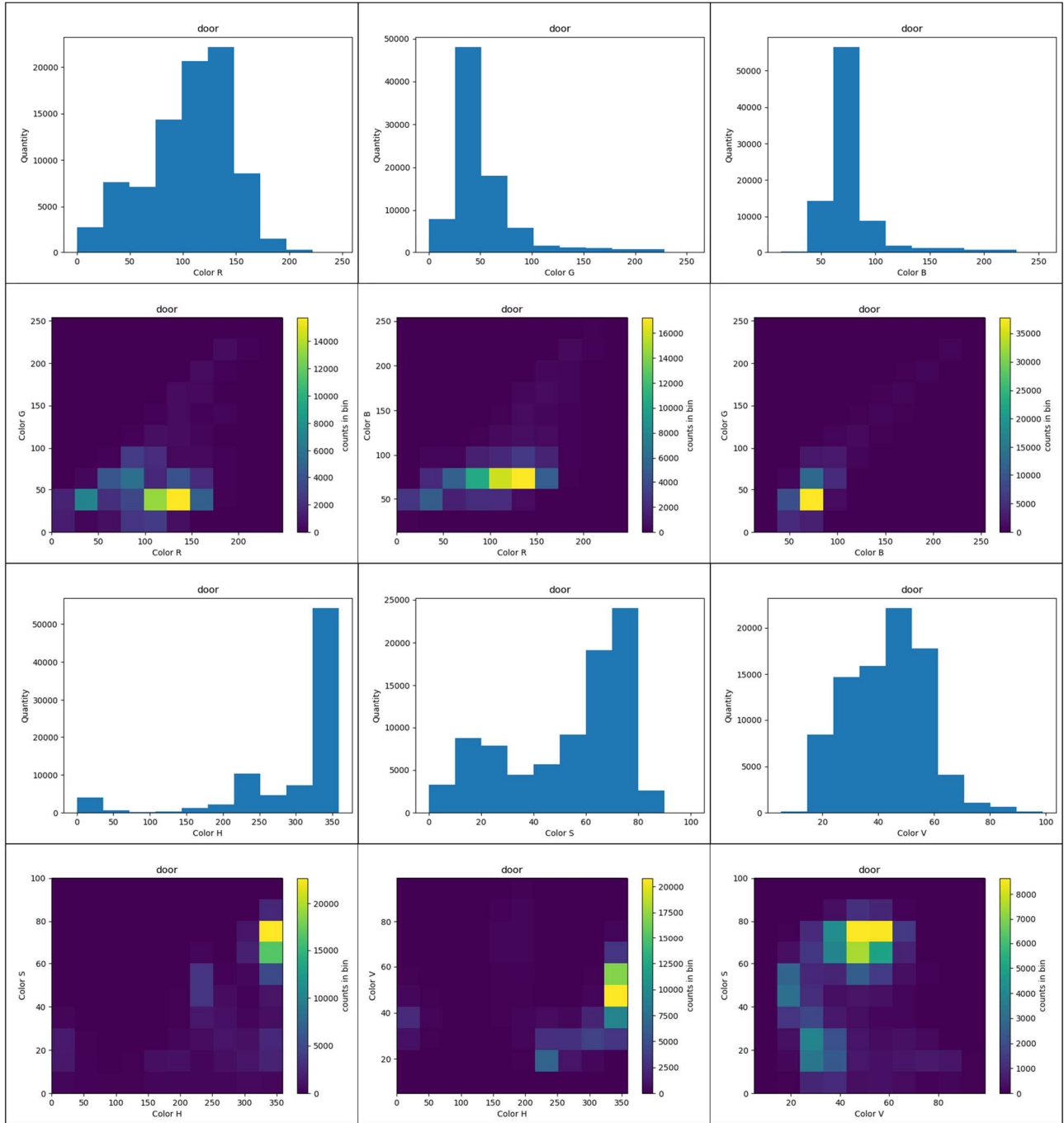
DECORATION



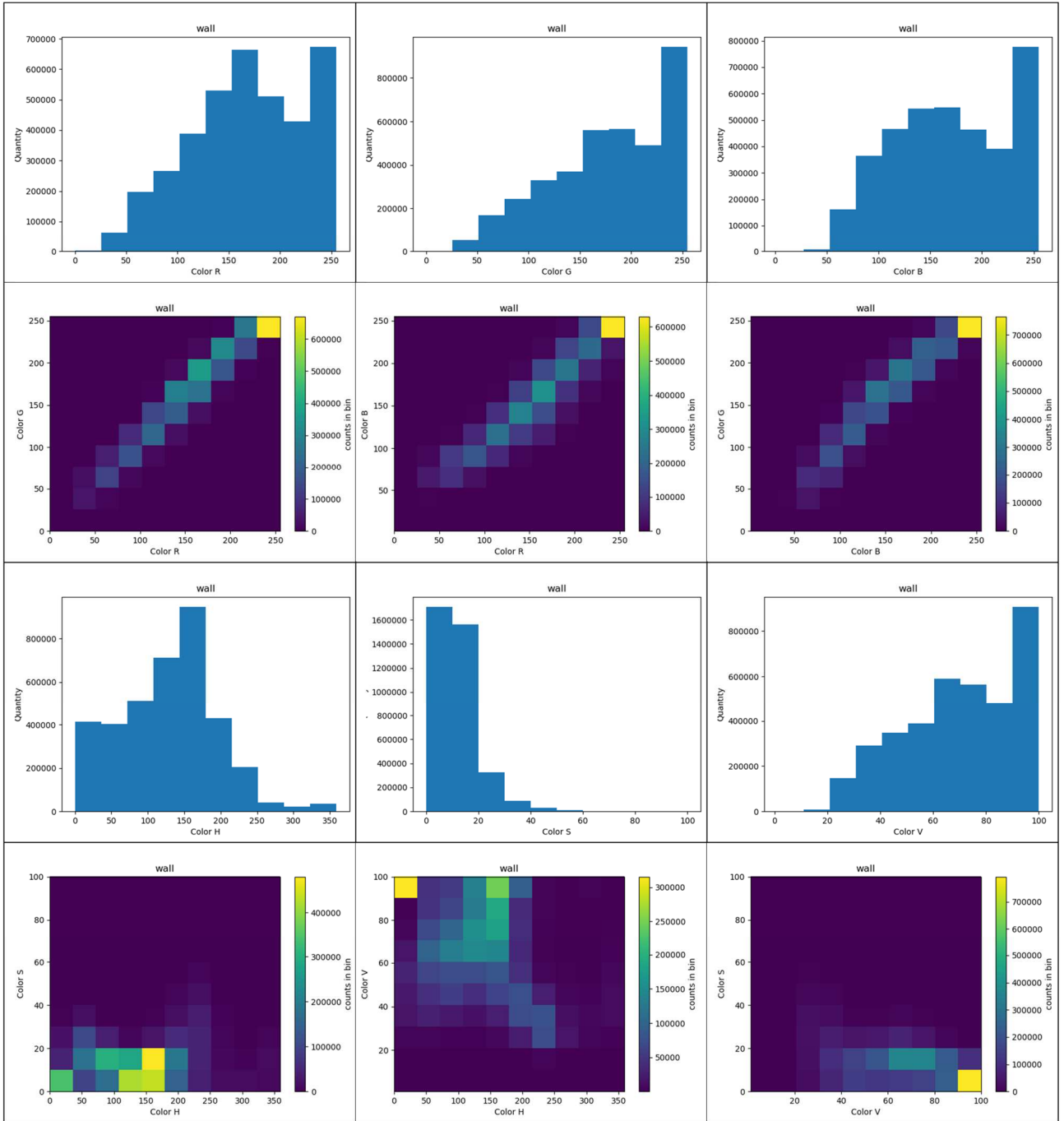
FLOOR



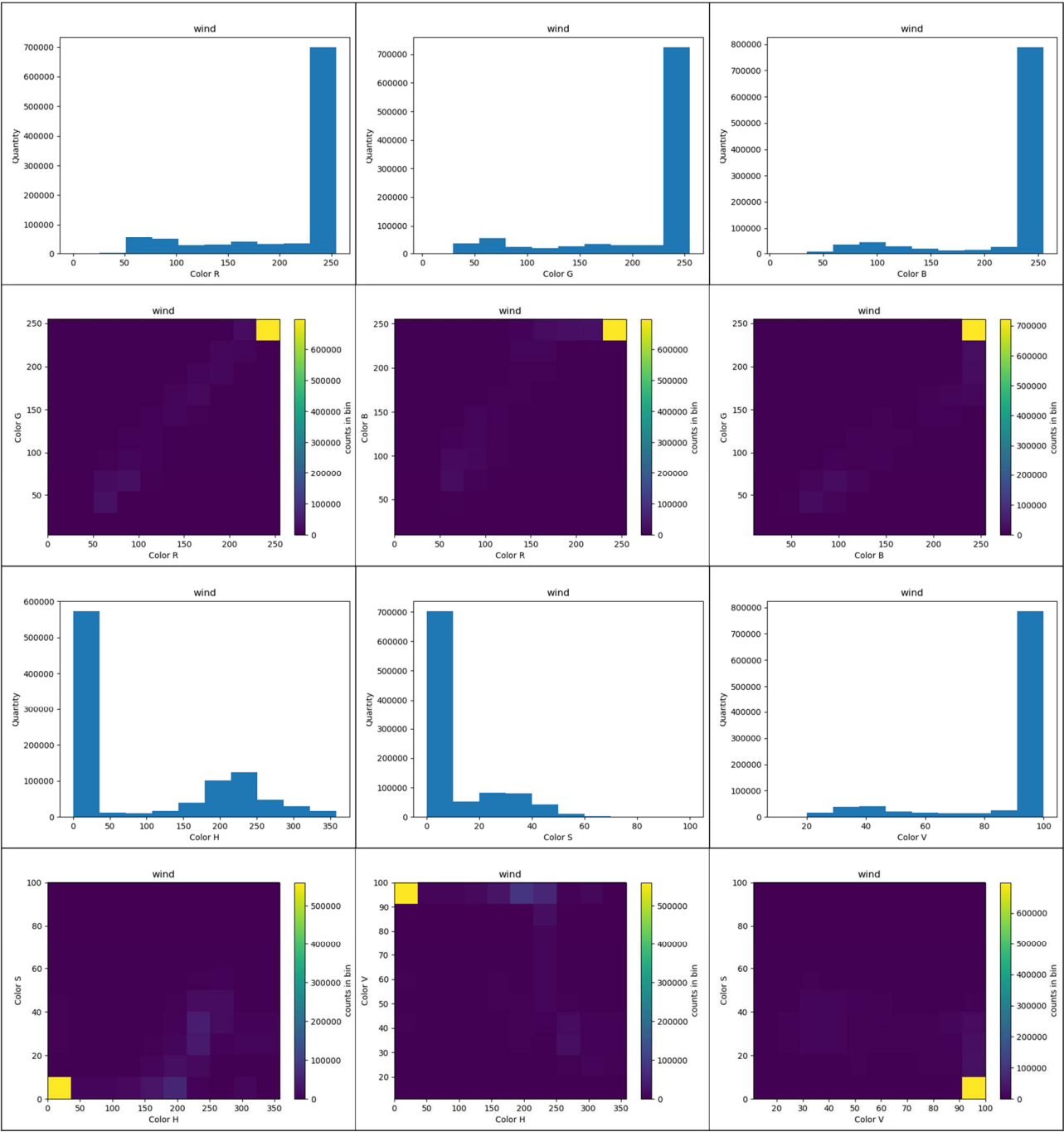
DOOR



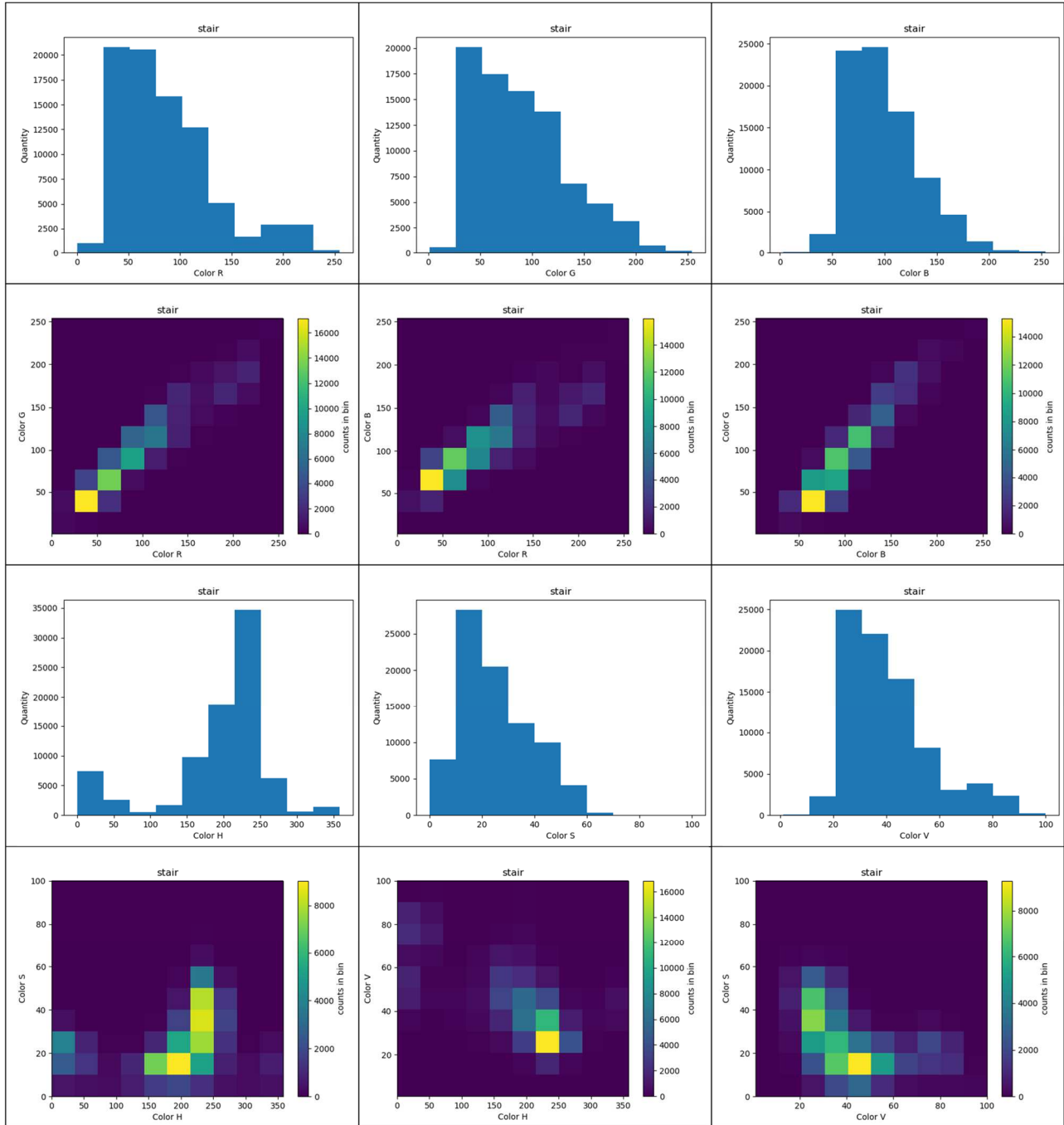
WALL



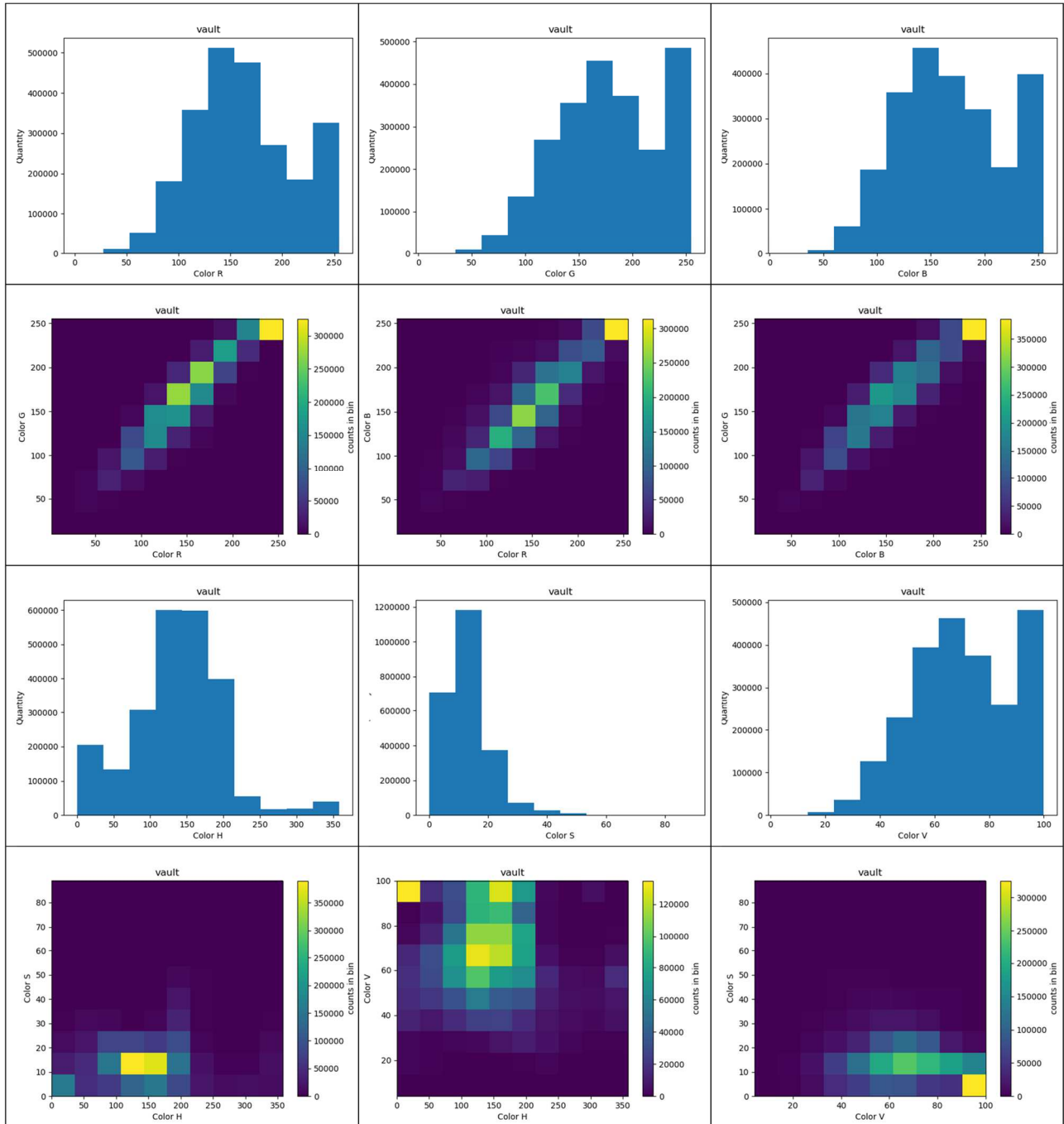
WINDOW



STAIR



VAULT



Preliminary tests on the Sacred Mount of Ghiffa scene (SMG)

TEST: SMG_1

Overall Accuracy: **0.6814**

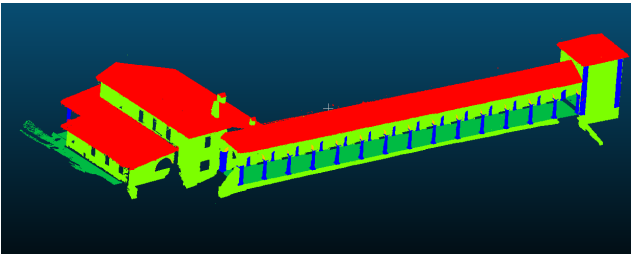
Classes: "column":0 - "floor":1 - "wall":2 - "vault/arch":3 - "roof":4
k-NN features: x y z R G B Nx Ny Nz
Scaler: -
No Z normalisation | Focal loss | Skip connections

METRICS

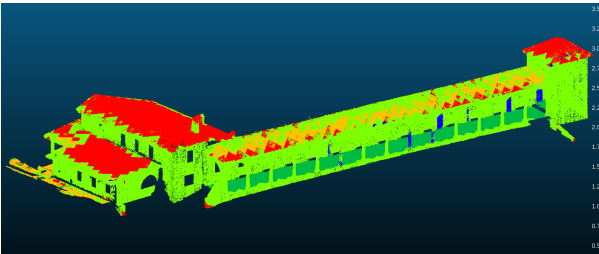
Accuracy
column: 0.1104
floor: 0.9587
wall: 0.4795
vault/arch: 0.3376
roof: 0.9656
Overall accuracy: 0.6814

IoU
column: 0.0431
floor: 0.4626
wall: 0.4583
vault/arch: 0.2514
roof: 0.6564
Average IoU: 0.3743

VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Column Vault/Arch Roof

TEST: SMG_2

Overall Accuracy: **0.7278**

Classes: (old) "door":0 - "stair":1 - "floor":2 - "wall":3 - "roof":4 - "arch":5 - "vault":6 - "decoration":7 - "column":8 - "window":9

k-NN features: x y z H S V Nx Ny Nz

Block size: 5x5x5 m CUBE

Stride: 5

Scaler: -

Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.762089

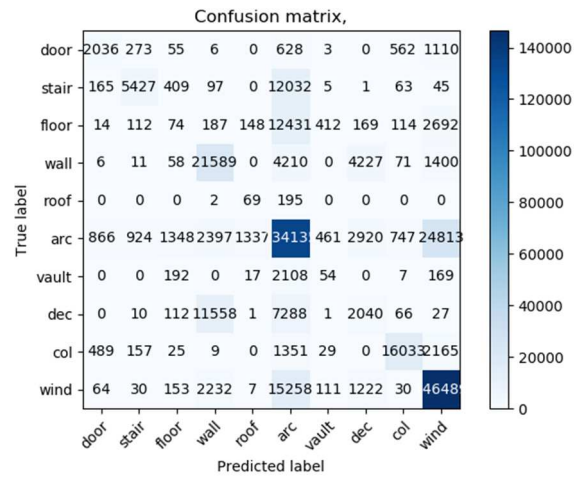
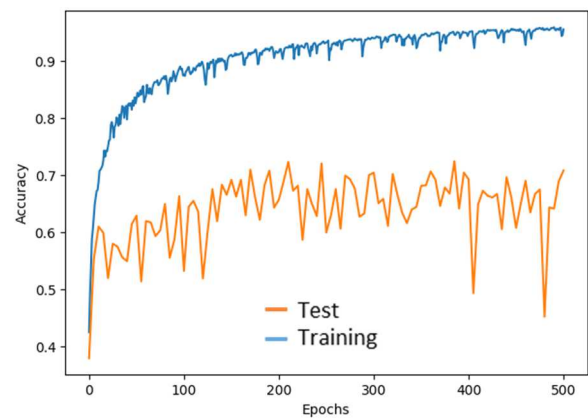
eval accuracy: 0.727863

report:

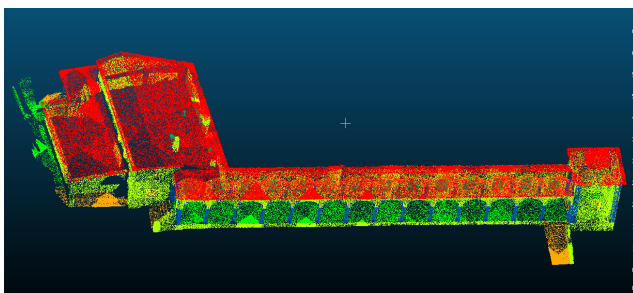
	precision	recall	f1-score	support
door	0.5593	0.4357	0.4898	4673
stair	0.7815	0.2975	0.4309	18244
floor	0.0305	0.0045	0.0079	16353
wall	0.5670	0.6838	0.6199	31572
roof	0.0437	0.2594	0.0748	266
arc	0.7073	0.7893	0.7461	169948
vault	0.0502	0.0212	0.0298	2547
dec	0.1928	0.0967	0.1288	21103
col	0.9062	0.7914	0.8449	20258
wind	0.8188	0.8846	0.8504	165596
micro avg	0.7279	0.7279	0.7279	450560
macro avg	0.4657	0.4264	0.4223	450560
weighted avg	0.6961	0.7279	0.7045	450560

IoU:

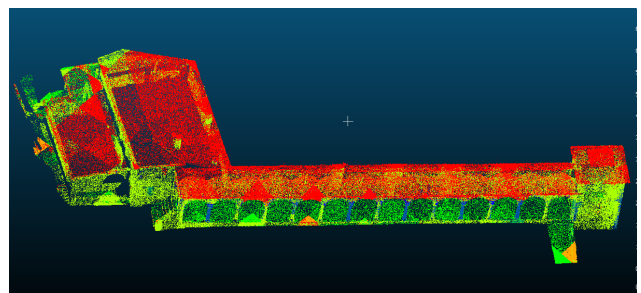
0.32435877011311137
0.2746318506148474
0.0039561614541566426
0.4492093216812318
0.03885135135135135
0.5949682633322836
0.015130288596245448
0.068821267120977
0.7314992243817866
0.7397799178858381
avg IoU:
0.3241206416531829



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Vault Door Arch Stair Window Decoration

TEST: SMG_3

Overall Accuracy: **0.7701**

Classes: (old) "door":0 - "stair":1 - "floor":2 - "wall":3 - "roof":4 - "arch":5 - "vault":6 - "decoration":7 - "column":8 - "window":9

k -NN features: x y z H S V Nx Ny Nz

Block size: 2x2x2 m CUBE

Stride: 2

Scaler: -

Subsampling method: OCTREE

No Z normalisation | Focal loss | Skip connections

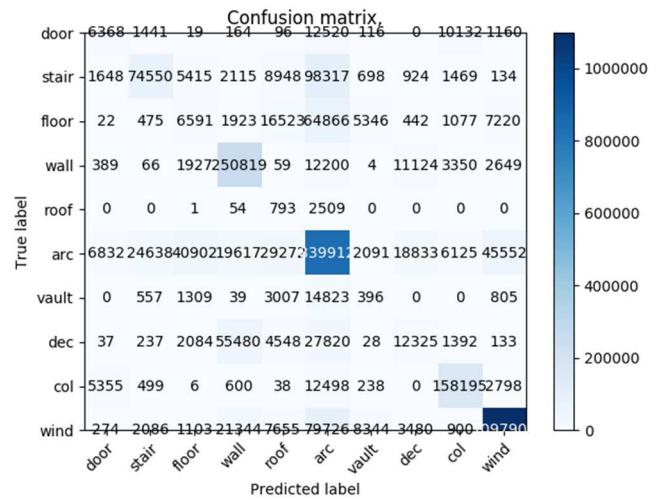
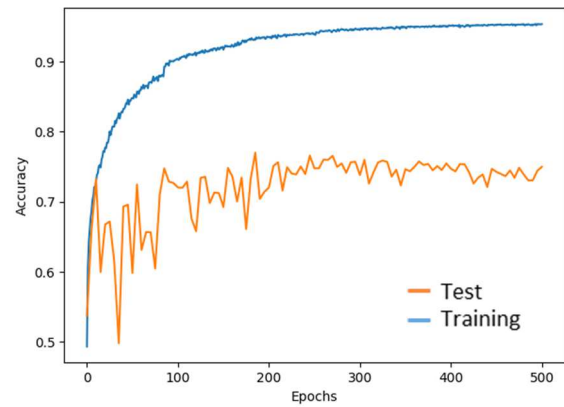
TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.239613
eval accuracy: 0.770128
report:

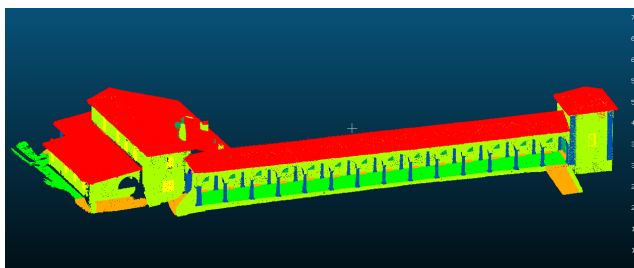
	precision	recall	f1-score	support
door	0.3043	0.1989	0.2406	32016
stair	0.7131	0.3838	0.4991	194218
floor	0.1110	0.0631	0.0805	104485
wall	0.7122	0.8876	0.7903	282587
roof	0.0112	0.2362	0.0213	3357
arc	0.7208	0.8125	0.7639	1033774
vault	0.0229	0.0189	0.0207	20936
dec	0.2615	0.1184	0.1630	104084
col	0.8662	0.8778	0.8719	180227
wind	0.9478	0.8978	0.9222	1222812
accuracy			0.7701	3178496
macro avg	0.4671	0.4495	0.4373	3178496
weighted avg	0.7705	0.7701	0.7640	3178496

IoU:

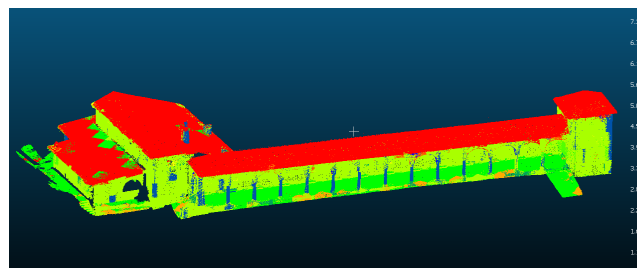
0.13673158267665814
0.33249039992507257
0.04191388290058569
0.653305480526043
0.010788675292164946
0.6180126897185025
0.010475913335626042
0.08874120688041358
0.7729195981863665
0.8555533822762754
avg IoU:
0.35209328117177086



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Vault Door Arch Stair Window Decoration

Tests on the Pilato's building from the Sacred Mount of Varallo (SMV)

TEST: SMV_1

Overall Accuracy: 0.8250

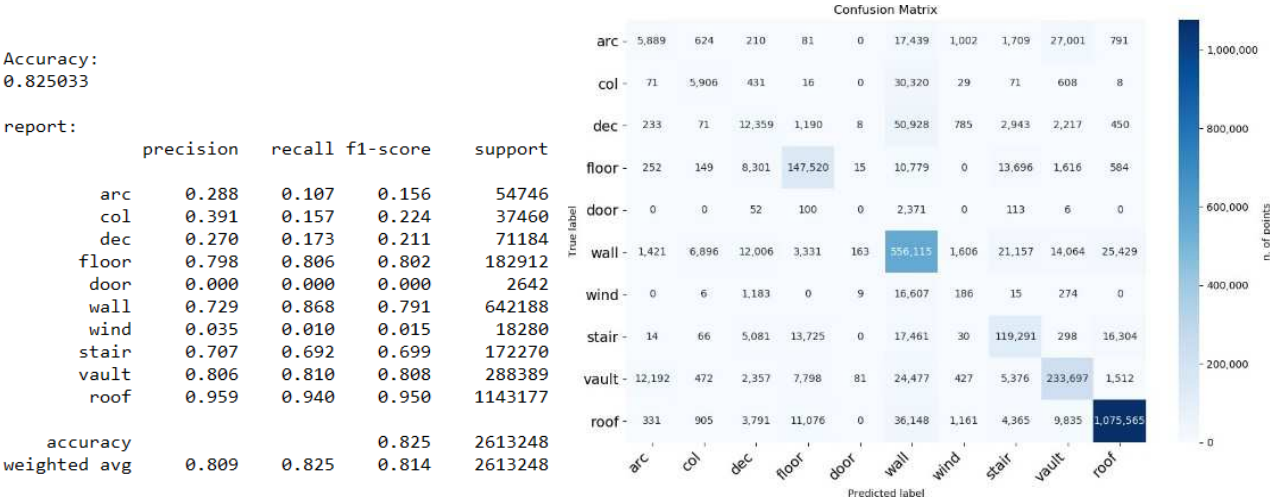
Classes: (old) "arc":0 - "col":1 - "dec":2 - "floor":3 - "door":4 - "wall":5 - "wind":6 - "stair":7 - "vault":8 - "roof":9
k-NN features: x y z H S V Nx Ny Nz

Scaler: -

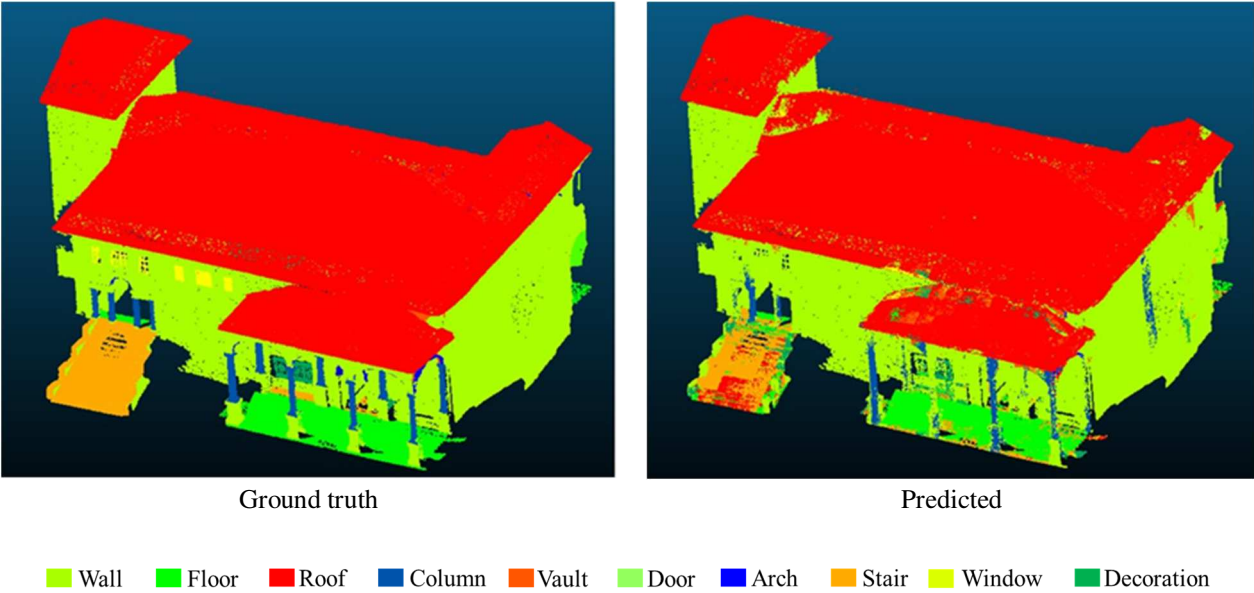
Subsampling: OCTREE

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX



VISUAL INSPECTION



TEST: SMV_2

Overall Accuracy: **0.5607**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 2.358285

eval accuracy: 0.560790

Accuracy:

0.5607898658261381

report:

	precision	recall	f1-score	support
arc	0.1406	0.0877	0.1081	45938
column	0.0134	0.0004	0.0007	27979
moldings	0.1270	0.4843	0.2013	148286
floor	0.6641	0.8050	0.7278	199615
doorwindow	0.2319	0.2501	0.2406	40954
wall	0.7496	0.8797	0.8095	579623
stairs	0.6302	0.0983	0.1700	157987
vault	0.5267	0.8757	0.6578	328080
roof	0.8445	0.3735	0.5179	1080690
accuracy			0.5608	2609152
macro avg	0.4365	0.4283	0.3815	2609152
weighted avg	0.6850	0.5608	0.5602	2609152

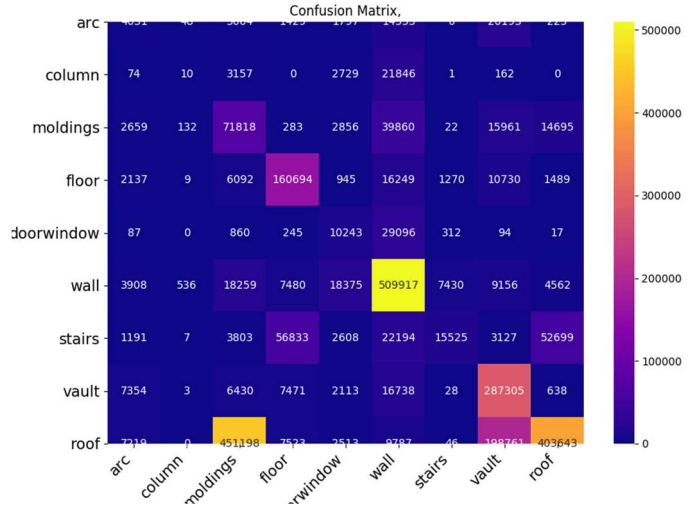
Mean Jaccard (Mean_IoU):

0.2767384891555248

Jaccard:

- arc: 0.05712301784120056
- column: 0.0003482621717629031
- moldings: 0.11190979650922712
- floor: 0.572111122583034
- doorwindow: 0.13677393510482042
- wall: 0.6799382888901334
- stairs: 0.09291066213434193
- vault: 0.4900607917252296
- roof: 0.3494705254399734

all room eval accuracy: 0.560790



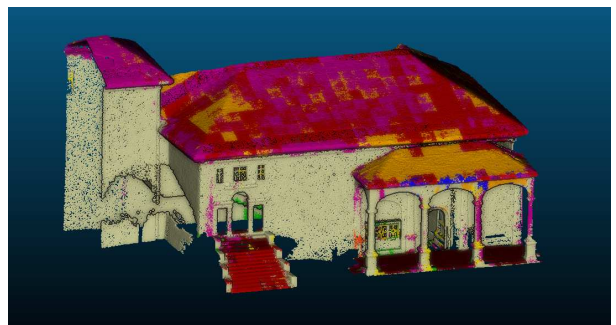
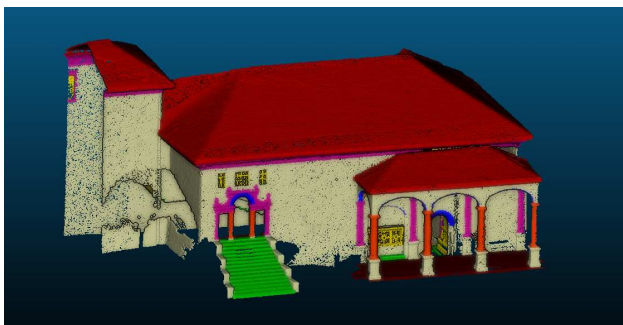
VISUAL INSPECTION



Ground truth



Predicted



Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: SMV_3

Overall Accuracy: **0.8212**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8 - "other":9

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

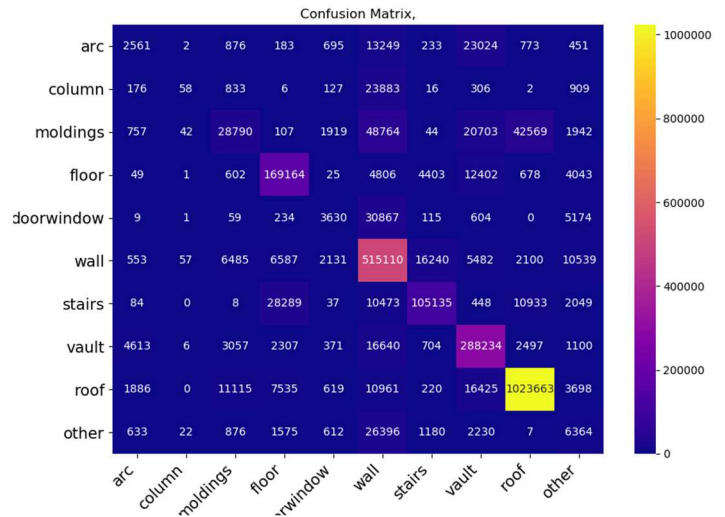
METRICS and CONFUSION MATRIX

eval mean loss: 1.083438
eval accuracy: 0.821228
report:

	precision	recall	f1-score	support
0	0.2262	0.0609	0.0960	42047
1	0.3069	0.0022	0.0044	26316
2	0.5463	0.1977	0.2903	145637
3	0.7832	0.8623	0.8209	196173
4	0.3571	0.0892	0.1427	40693
5	0.7347	0.9112	0.8135	565284
6	0.8195	0.6677	0.7359	157456
7	0.7793	0.9021	0.8362	319529
8	0.9450	0.9513	0.9481	1076122
9	0.1755	0.1595	0.1671	39895
accuracy			0.8212	2609152
macro avg	0.5674	0.4804	0.4855	2609152
weighted avg	0.7982	0.8212	0.7984	2609152

IoU:

0.0504064400574724
0.002193065376035089
0.1698044211668672
0.6961596075655566
0.07685955662834276
0.6856039280043337
0.5821074020962178
0.7185138837301478
0.9013649079274902
0.09117478510028654
avg IoU:
0.39741879976527505



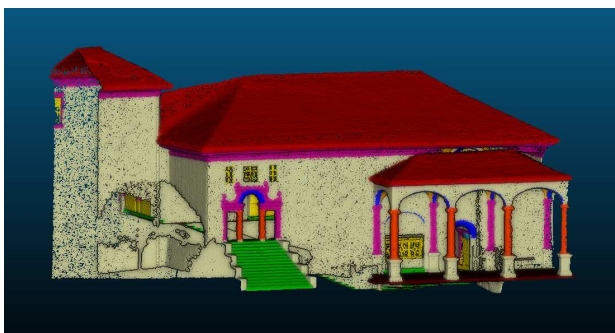
VISUAL INSPECTION



Ground truth



Predicted



Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: SMV_4

Overall Accuracy: **0.8294**

With normal vectors erroneously oriented on a portion of the roof: **0.8223**

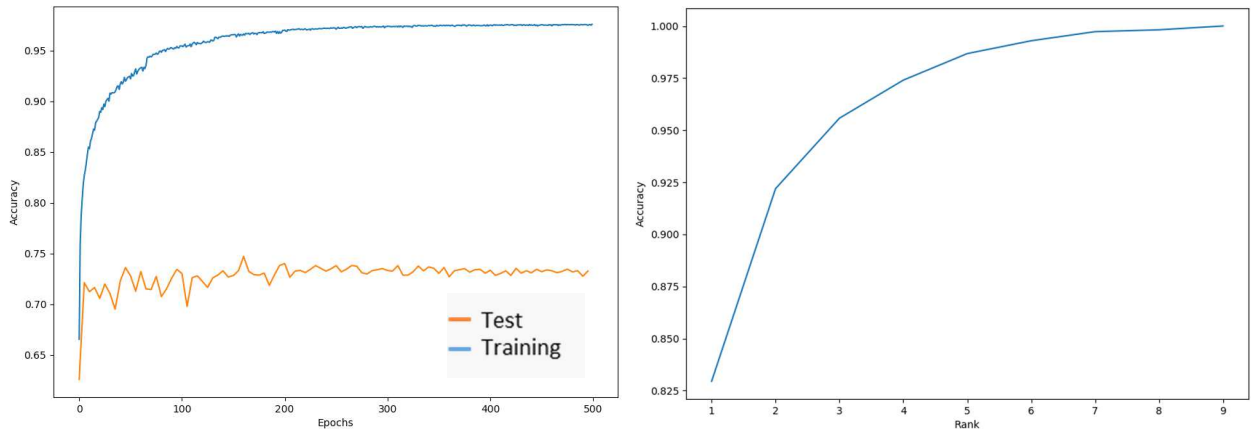
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

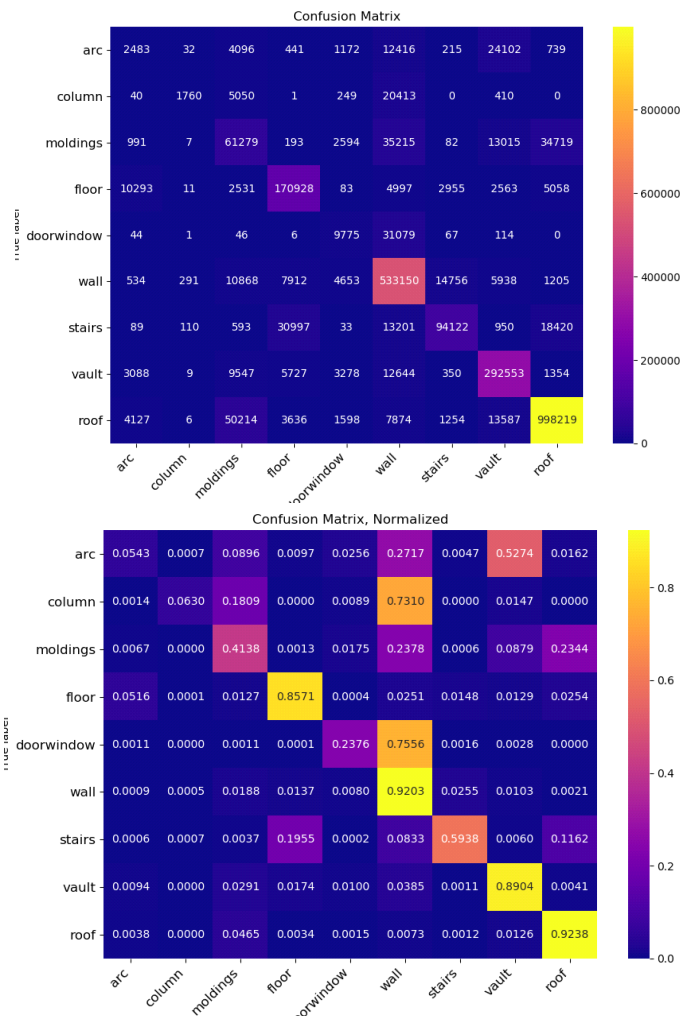
eval mean loss: 1.008368
eval accuracy: 0.829491

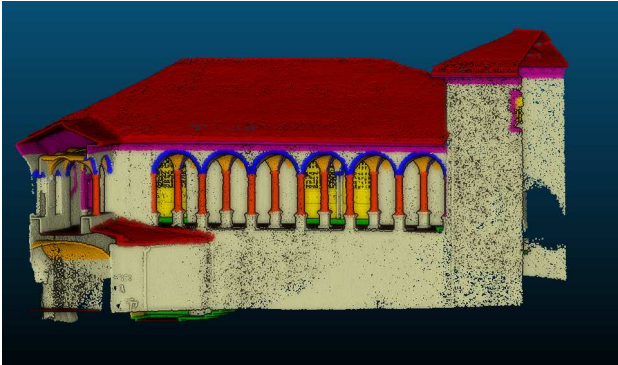
Accuracy:
0.8294913443141679

report:	precision	recall	f1-score	support
arc	0.1145	0.0543	0.0737	45696
column	0.7903	0.0630	0.1167	27923
moldings	0.4249	0.4138	0.4193	148095
floor	0.7775	0.8571	0.8154	199419
doorwindow	0.4171	0.2376	0.3028	41132
wall	0.7946	0.9203	0.8528	579307
stairs	0.8271	0.5938	0.6913	158515
vault	0.8282	0.8904	0.8582	328550
roof	0.9420	0.9238	0.9328	1080515
accuracy			0.8295	2609152
macro avg	0.6573	0.5505	0.5626	2609152
weighted avg	0.8216	0.8295	0.8192	2609152

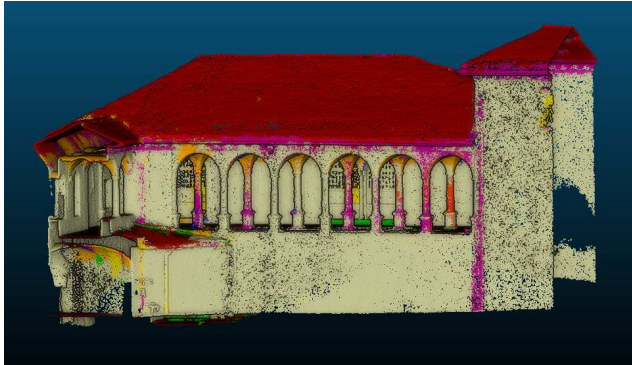
Mean Jaccard (Mean_IoU):
0.45883697021725417

Jaccard:
- arc: 0.038257680811069
- column: 0.06199365973934484
- moldings: 0.2652311288088643
- floor: 0.688304366734855
- doorwindow: 0.178401956489991
- wall: 0.7434329969071849
- stairs: 0.5281996026802249
- vault: 0.751621795909349
- roof: 0.8740895438743969

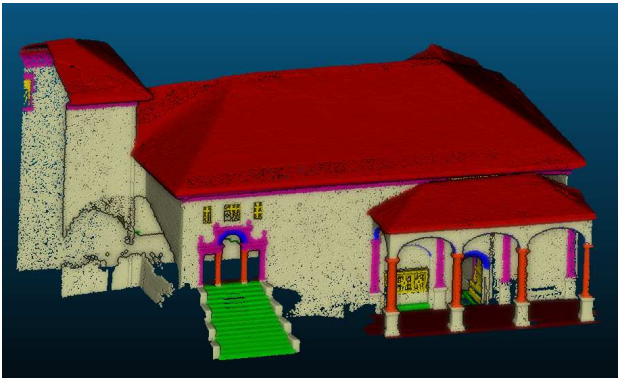




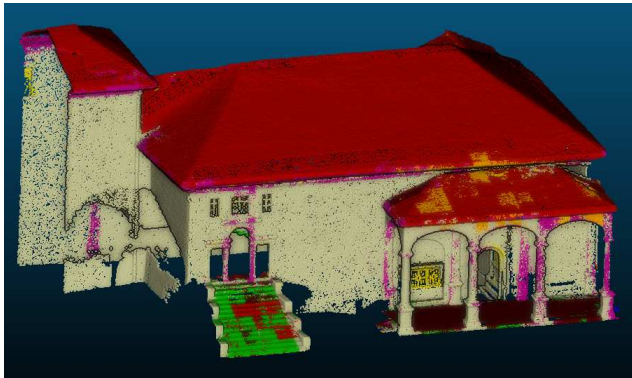
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_5

Overall Accuracy: 0.7466

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Block size: 2x2 m

Stride: 1

N. of points: 8192

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.674451

eval accuracy: 0.746631

report:

	precision	recall	f1-score	support
0	0.2839	0.0625	0.1025	25774
1	0.7500	0.0142	0.0278	25381
2	0.2660	0.1537	0.1948	103783
3	0.6592	0.9198	0.7680	76882
4	0.3041	0.1077	0.1590	27735
5	0.6996	0.9186	0.7943	423030
6	0.8316	0.2002	0.3227	86000
7	0.7763	0.8194	0.7973	143126
8	0.8938	0.9174	0.9055	495400
9	0.0786	0.0435	0.0560	26489
accuracy			0.7466	1433600
macro avg	0.5543	0.4157	0.4128	1433600
weighted avg	0.7230	0.7466	0.7080	1433600

IoU:

0.053993363944096255

0.014117093447315791

0.10793017118884904

0.6233417074353211

0.08638296641305292

0.6587969226283115

0.1923854861600009

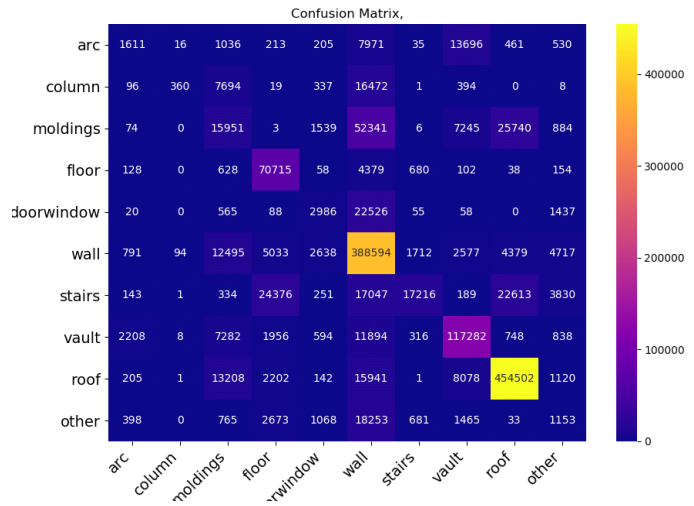
0.6628723223873848

0.8272516799778672

0.02881995650761117

avg IoU:

0.3255891670089811



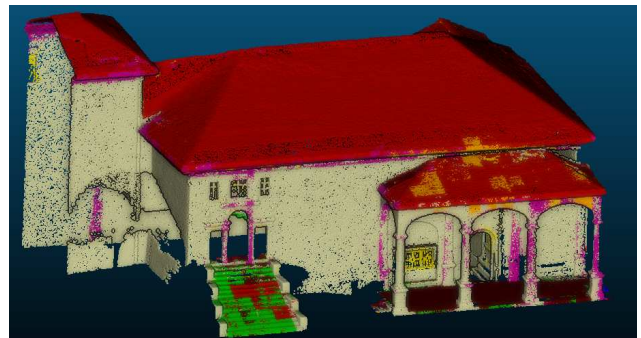
VISUAL INSPECTION



Ground truth



Predicted



Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_6

Overall Accuracy: **0.8351**

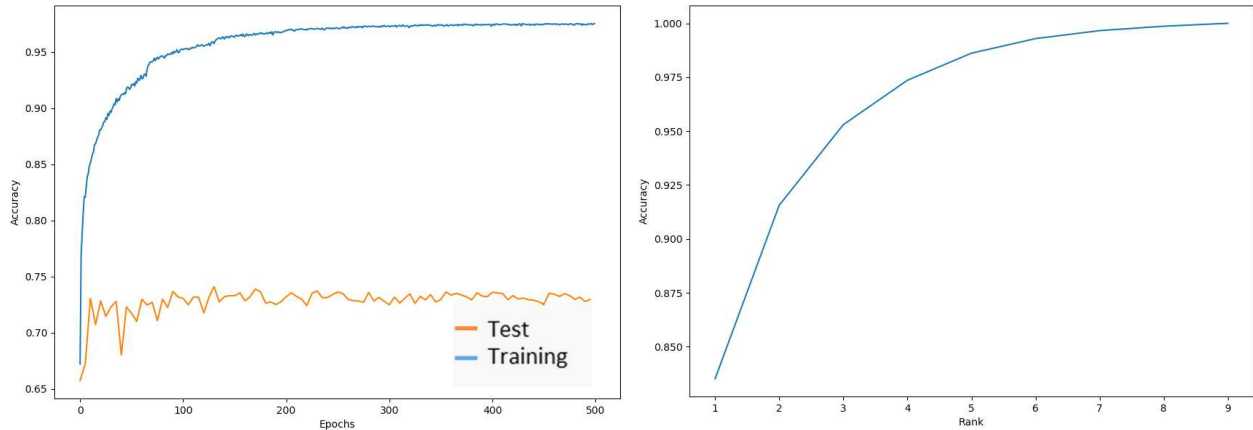
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z H S V Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

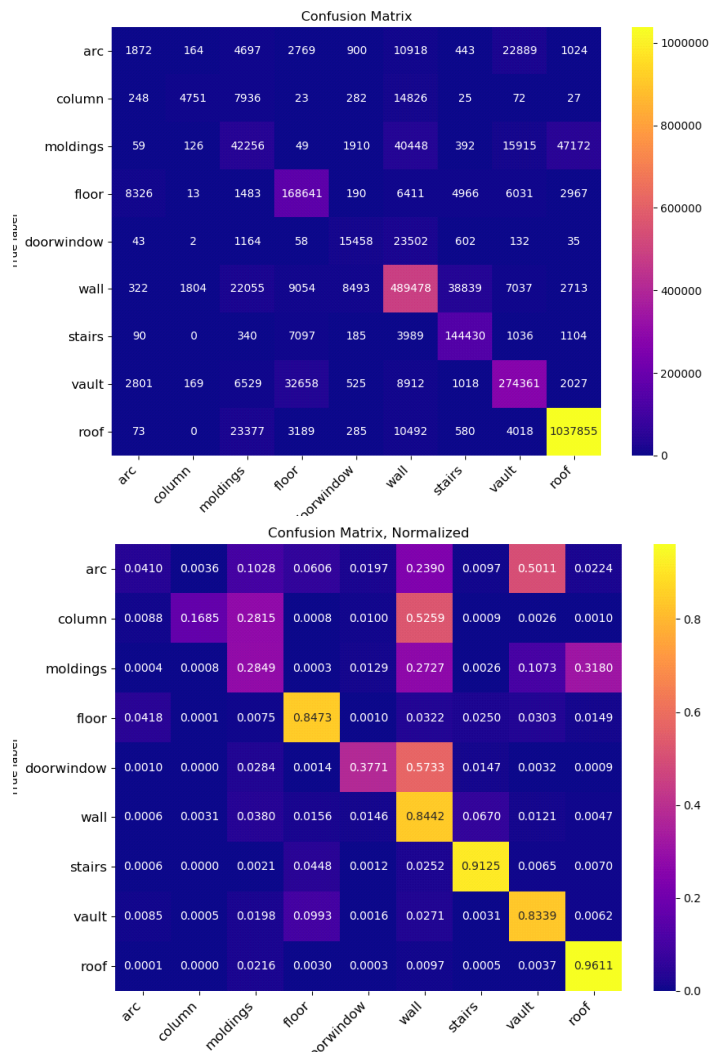
eval mean loss: 1.077225
eval accuracy: 0.835176

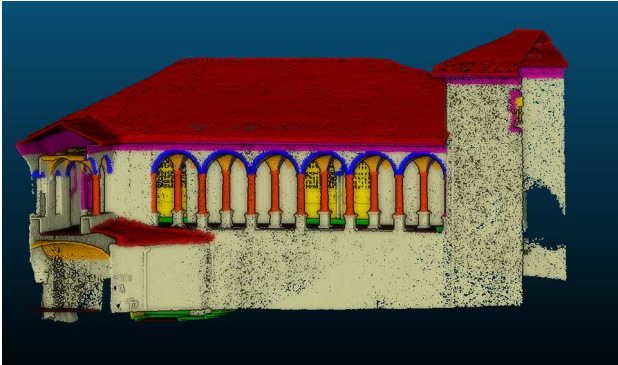
Accuracy:
0.8351763331534537

report:	precision	recall	f1-score	support
arc	0.1353	0.0410	0.0629	45676
column	0.6759	0.1685	0.2698	28190
moldings	0.3847	0.2849	0.3274	148327
floor	0.7544	0.8473	0.7982	199028
doorwindow	0.5476	0.3771	0.4466	40996
wall	0.8038	0.8442	0.8235	579795
stairs	0.7550	0.9125	0.8263	158271
vault	0.8277	0.8339	0.8308	329000
roof	0.9479	0.9611	0.9544	1079869
accuracy			0.8352	2609152
macro avg	0.6480	0.5856	0.5933	2609152
weighted avg	0.8188	0.8352	0.8234	2609152

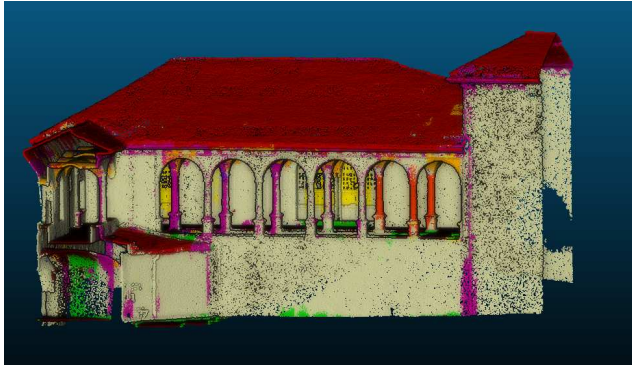
Mean Jaccard (Mean_IoU):
0.48479889577530483

Jaccard:
- arc: 0.032478573163537944
- column: 0.15593409478797426
- moldings: 0.19571298886562796
- floor: 0.6641370483410456
- doorwindow: 0.2875051147565376
- wall: 0.6999612465733248
- stairs: 0.7040694953591764
- vault: 0.7105404915442985
- roof: 0.9128510085862201

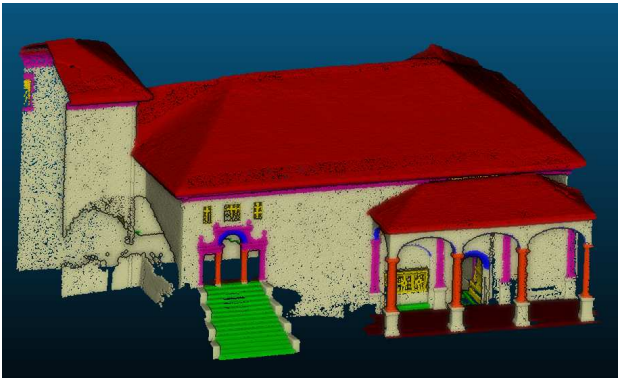




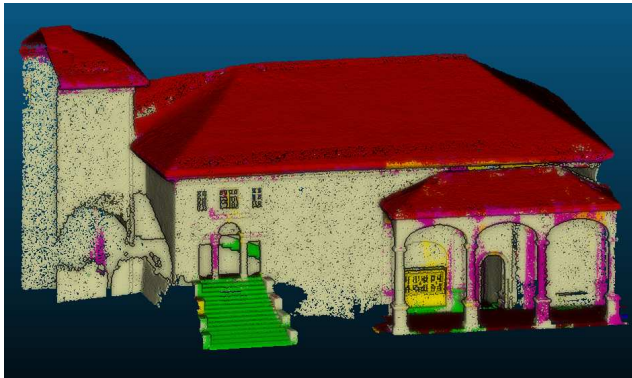
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_7

Overall Accuracy: **0.8278**

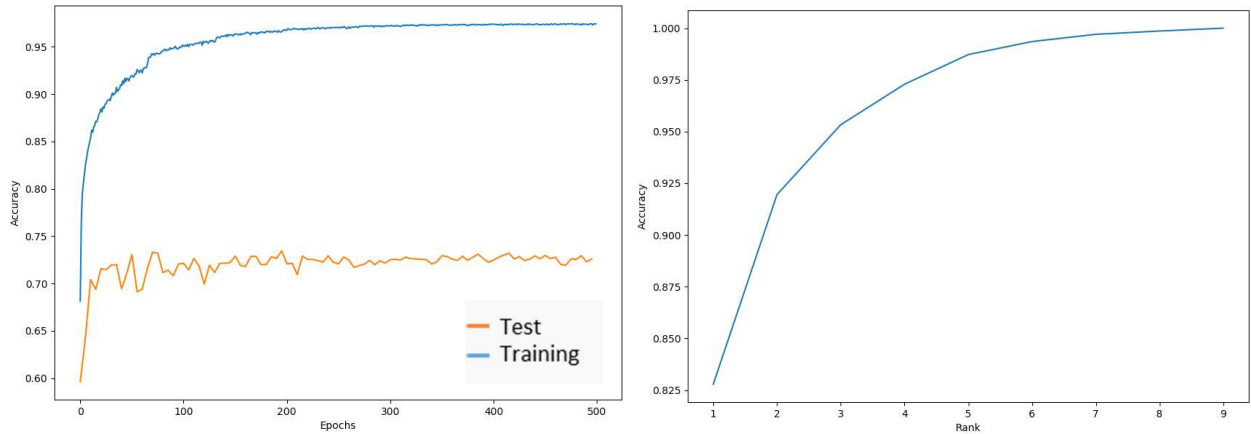
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z L A B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

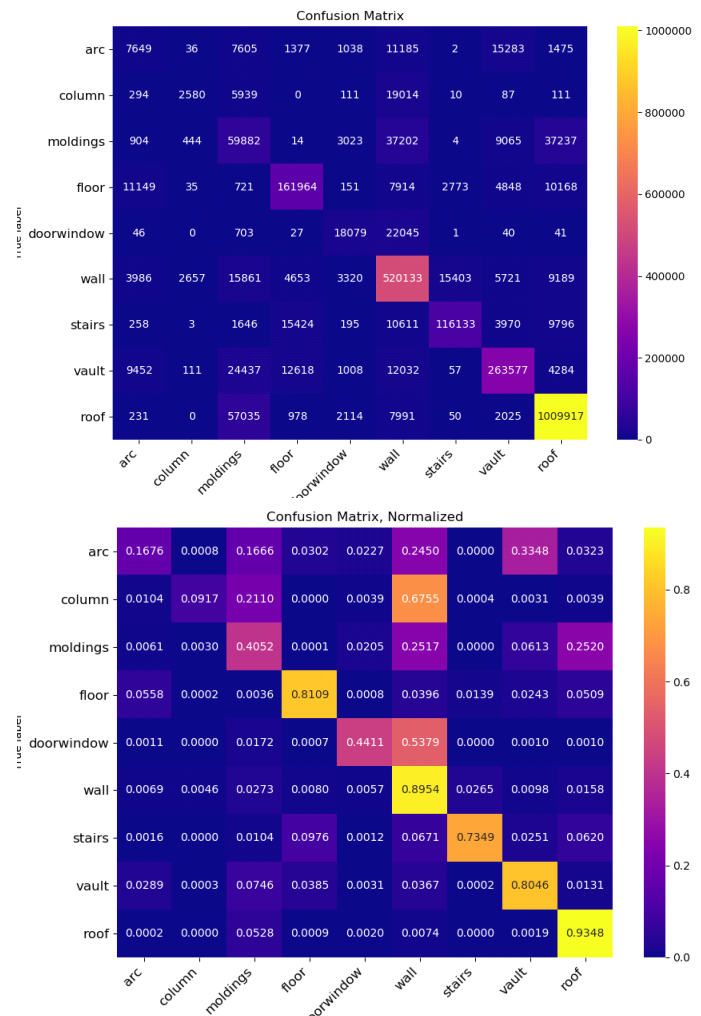
eval mean loss: 1.038342
eval accuracy: 0.827822

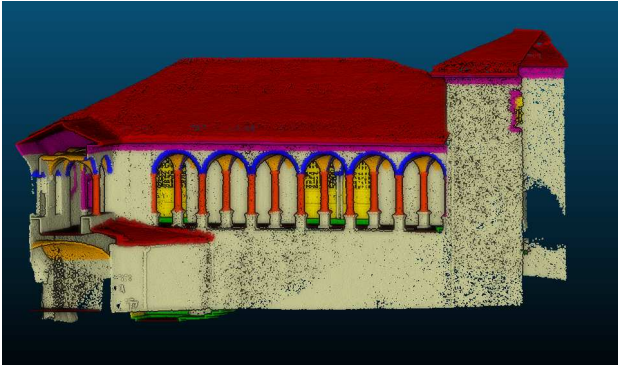
Accuracy:
0.8278222196330455

report:	precision	recall	f1-score	support
arc	0.2252	0.1676	0.1921	45650
column	0.4398	0.0917	0.1517	28146
moldings	0.3445	0.4052	0.3724	147775
floor	0.8219	0.8109	0.8164	199723
doorwindow	0.6226	0.4411	0.5164	40982
wall	0.8025	0.8954	0.8464	580923
stairs	0.8639	0.7349	0.7942	158036
vault	0.8653	0.8046	0.8339	327576
roof	0.9332	0.9348	0.9340	1080341
accuracy			0.8278	2609152
macro avg	0.6576	0.5874	0.6064	2609152
weighted avg	0.8269	0.8278	0.8247	2609152

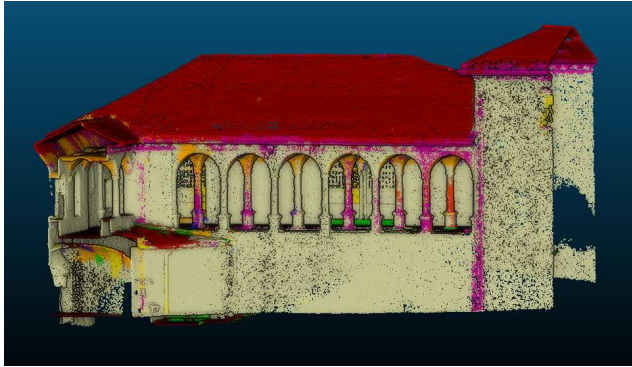
Mean Jaccard (Mean_IoU):
0.4931656538736442

Jaccard:
- arc: 0.1062803946088648
- column: 0.08208195469585136
- moldings: 0.2288002445342768
- floor: 0.6897544439428654
- doorwindow: 0.34806129914135
- wall: 0.7337008422706749
- stairs: 0.6585892840940024
- vault: 0.715046864614842
- roof: 0.8761757770409199

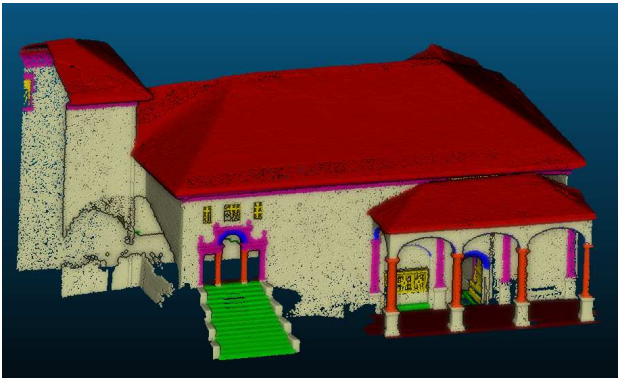




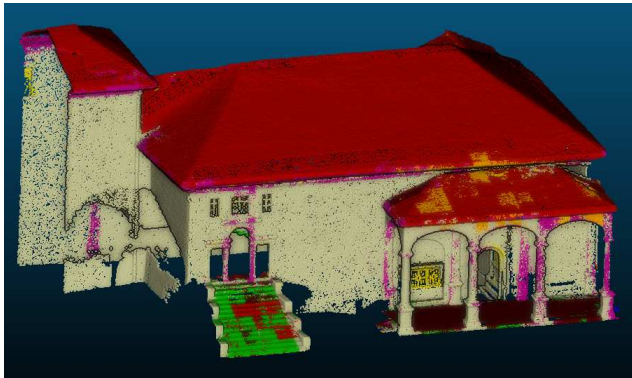
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_8

Overall Accuracy: **0.8038**

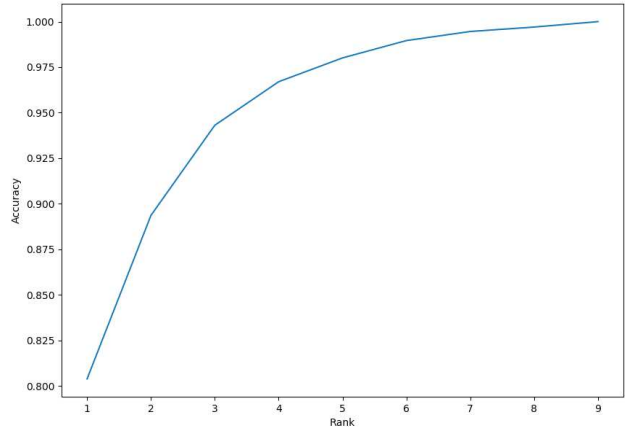
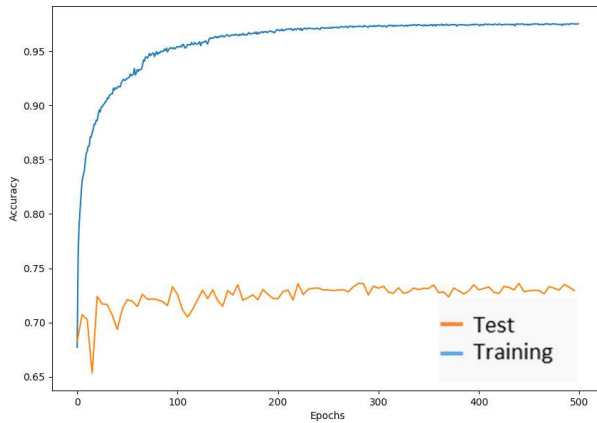
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k -NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 1.217615
eval accuracy: 0.803867

Accuracy:
0.803867310145212

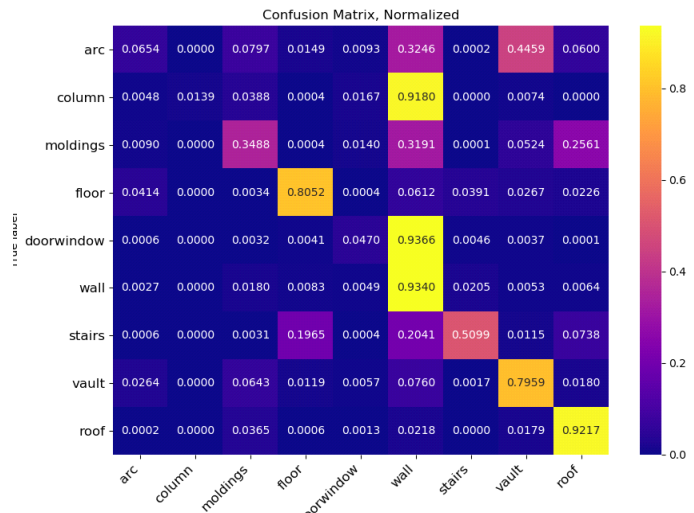
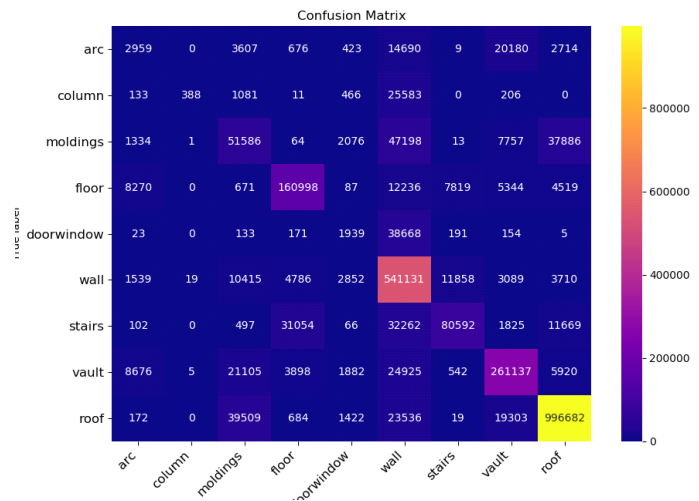
report:

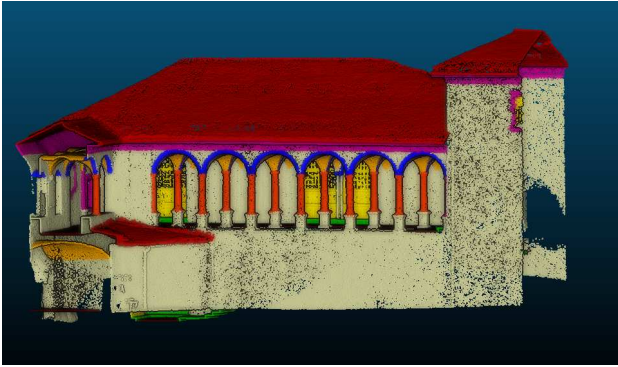
	precision	recall	f1-score	support
arc	0.1275	0.0654	0.0864	45258
column	0.9395	0.0139	0.0274	27868
moldings	0.4011	0.3488	0.3731	147915
floor	0.7957	0.8052	0.8004	199944
doorwindow	0.1729	0.0470	0.0739	41284
wall	0.7118	0.9340	0.8079	579399
stairs	0.7976	0.5099	0.6221	158067
vault	0.8186	0.7959	0.8071	328090
roof	0.9375	0.9217	0.9296	1081327
accuracy			0.8039	2609152
macro avg	0.6336	0.4935	0.5031	2609152
weighted avg	0.7966	0.8039	0.7893	2609152

Mean Jaccard (Mean IoU):
0.40757162992345836

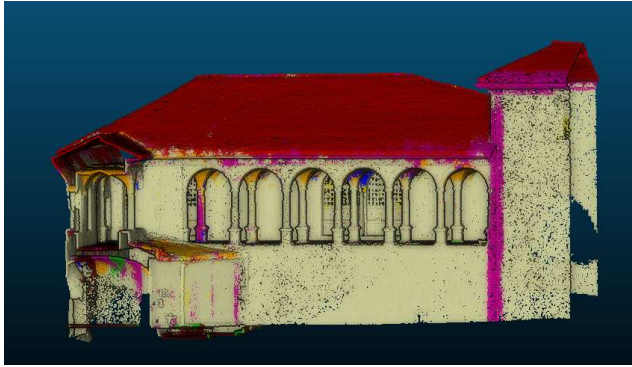
Jaccard:

- arc: 0.04517074511120949
- column: 0.013910300075287707
- moldings: 0.2293394032889794
- floor: 0.667244123205464
- doorwindow: 0.03835199177182642
- wall: 0.6776869543655142
- stairs: 0.45145027392195747
- vault: 0.6766118751748941
- roof: 0.8683790023959922

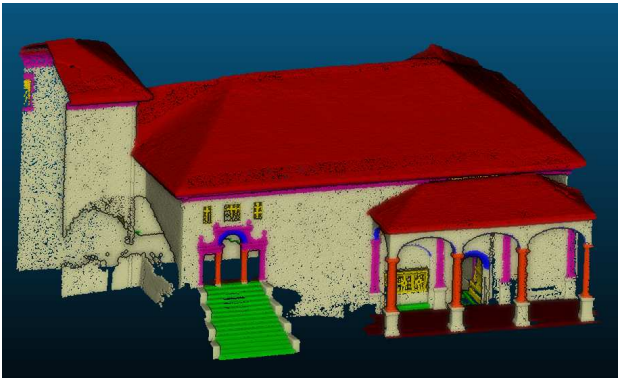




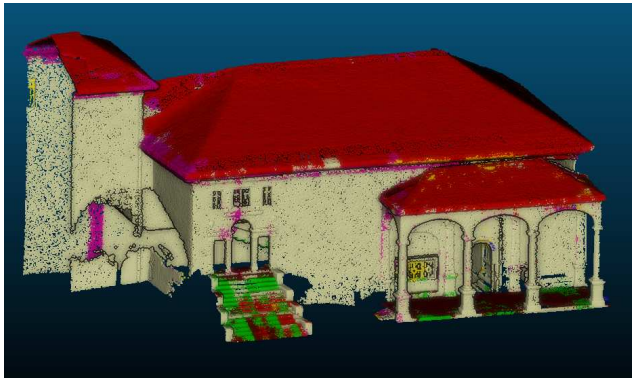
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_9

Overall Accuracy: **0.8087**

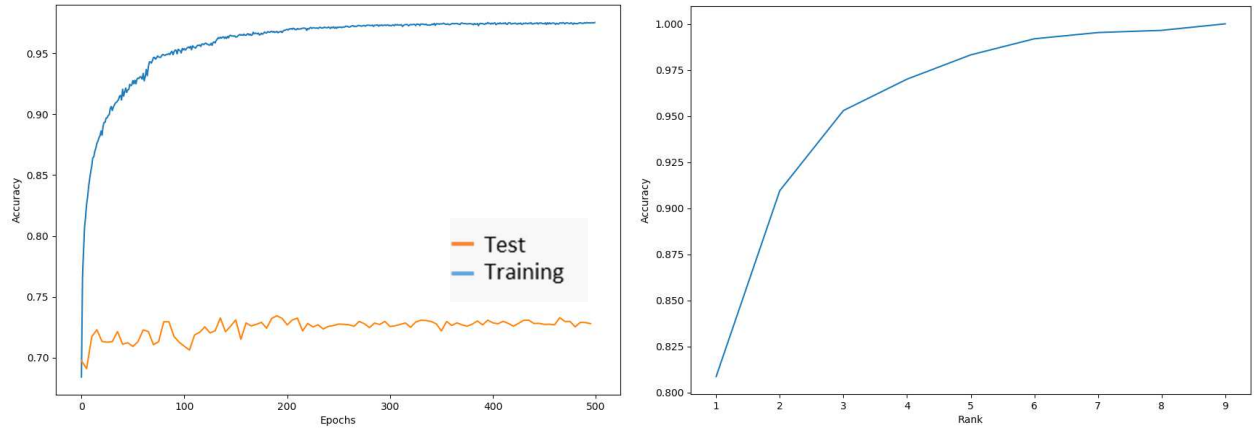
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

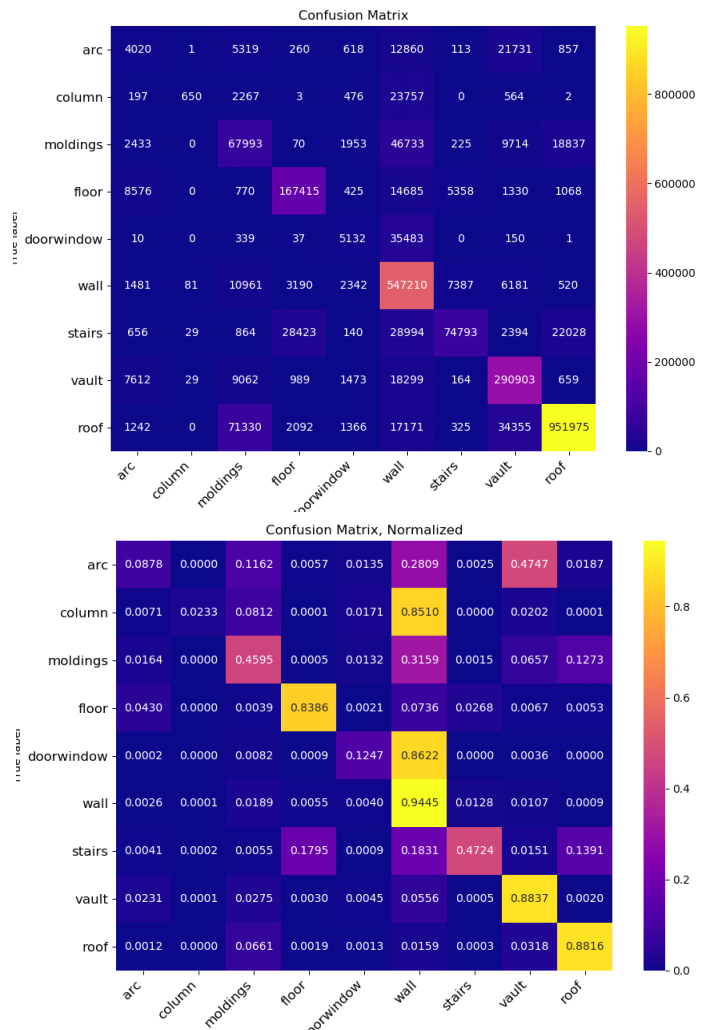
eval mean loss: 1.152464
eval accuracy: 0.808727

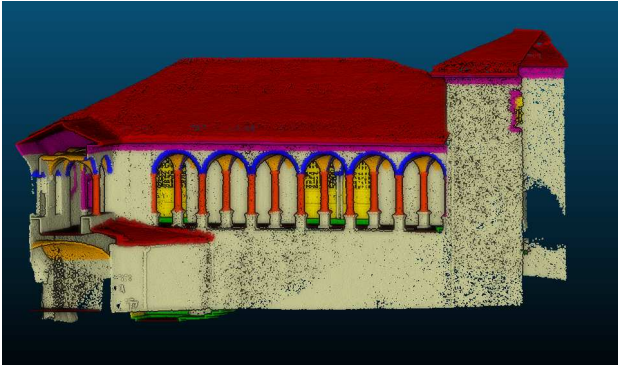
Accuracy:
0.8087267434016876

report:	precision	recall	f1-score	support
arc	0.1533	0.0878	0.1117	45779
column	0.8228	0.0233	0.0453	27916
moldings	0.4026	0.4595	0.4292	147958
floor	0.8268	0.8386	0.8327	199627
doorwindow	0.3685	0.1247	0.1864	41152
wall	0.7343	0.9445	0.8263	579353
stairs	0.8464	0.4724	0.6064	158321
vault	0.7920	0.8837	0.8353	329190
roof	0.9558	0.8816	0.9172	1079856
accuracy			0.8087	2609152
macro avg	0.6558	0.5240	0.5323	2609152
weighted avg	0.8133	0.8087	0.7987	2609152

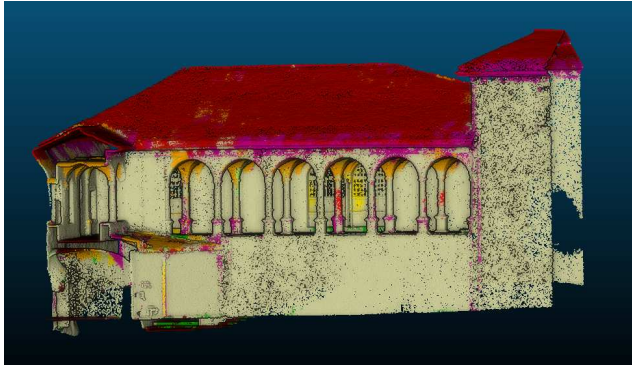
Mean Jaccard (Mean_IoU):
0.4305503462916749

Jaccard:
- arc: 0.05912982084546818
- column: 0.0231679498146564
- moldings: 0.273206895166151
- floor: 0.713342224456839
- doorwindow: 0.10275302833116429
- wall: 0.7039564666456547
- stairs: 0.4351137044556788
- vault: 0.7172005552145047
- roof: 0.8470824716949569

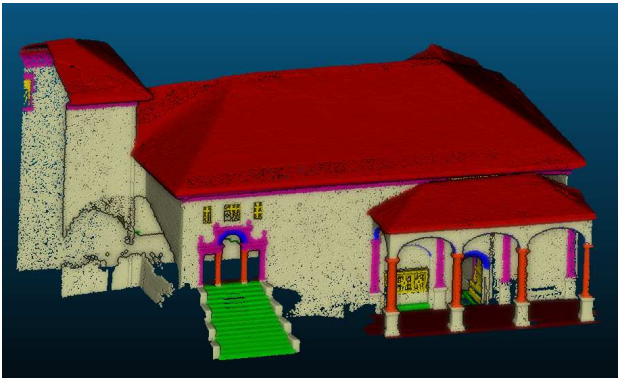




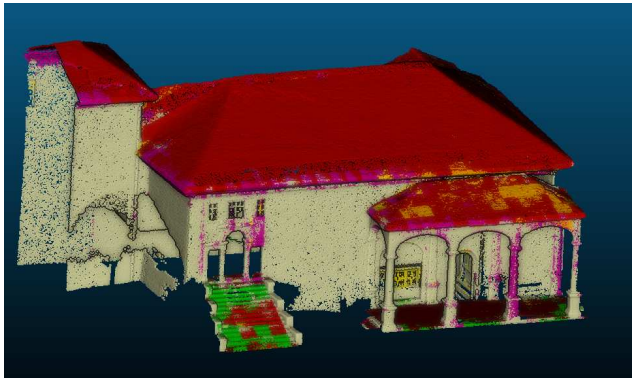
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_10

Overall Accuracy: **0.8108**

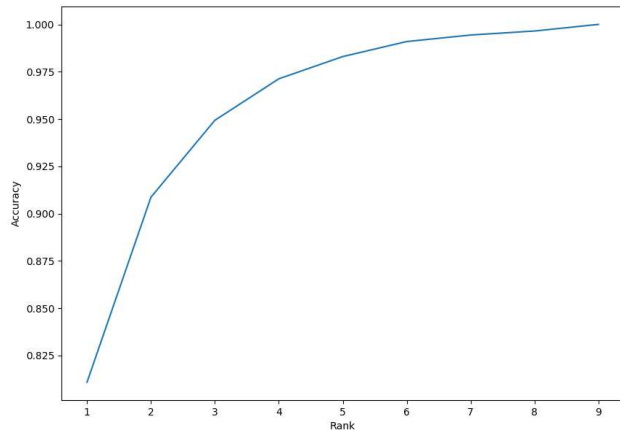
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

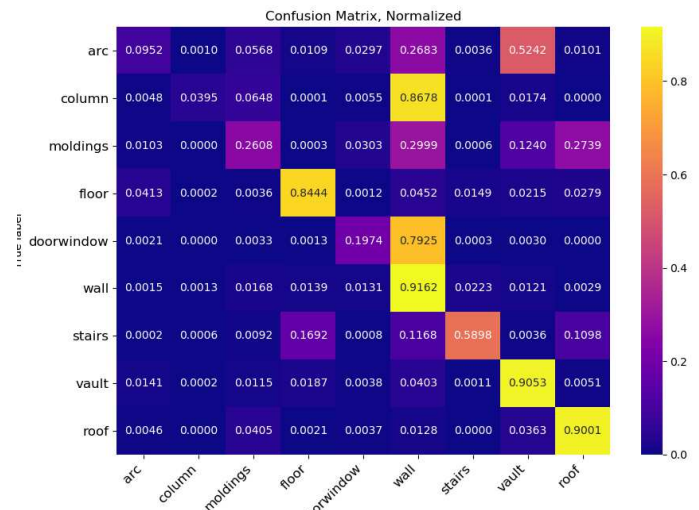
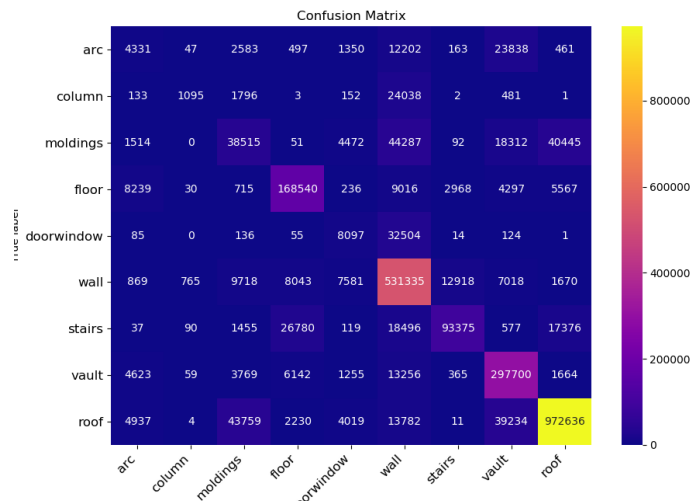
eval mean loss: 902.099567
eval accuracy: 0.810847

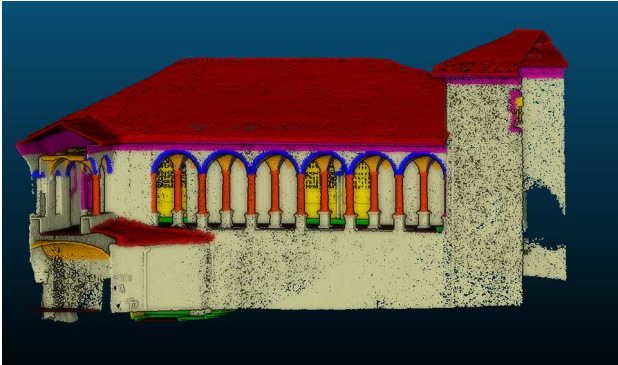
Accuracy:
0.8108473557692307

report:	precision	recall	f1-score	support
arc	0.1749	0.0952	0.1233	45472
column	0.5239	0.0395	0.0735	27701
moldings	0.3760	0.2608	0.3080	147688
floor	0.7937	0.8444	0.8183	199608
doorwindow	0.2968	0.1974	0.2371	41016
wall	0.7602	0.9162	0.8310	579917
stairs	0.8496	0.5898	0.6963	158305
vault	0.7603	0.9053	0.8265	328833
roof	0.9354	0.9001	0.9174	1080612
accuracy			0.8108	2609152
macro avg	0.6079	0.5276	0.5368	2609152
weighted avg	0.7990	0.8108	0.7977	2609152

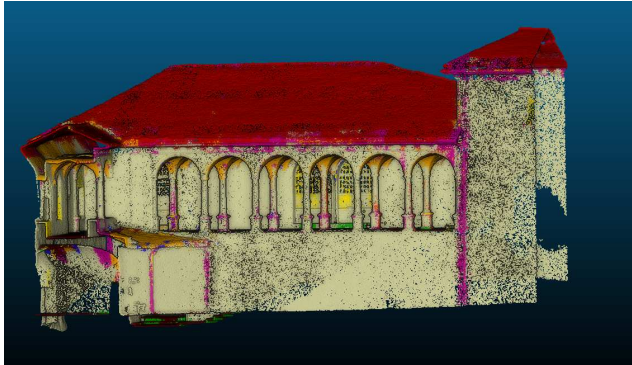
Mean Jaccard (Mean_IoU):
0.4343694154364298

Jaccard:
- arc: 0.06571181477491693
- column: 0.03815862838026206
- moldings: 0.1820016161197482
- floor: 0.692414824431307
- doorwindow: 0.1345016611295681
- wall: 0.7108179553657669
- stairs: 0.5340658209313764
- vault: 0.7042586713475305
- roof: 0.8473937464551659

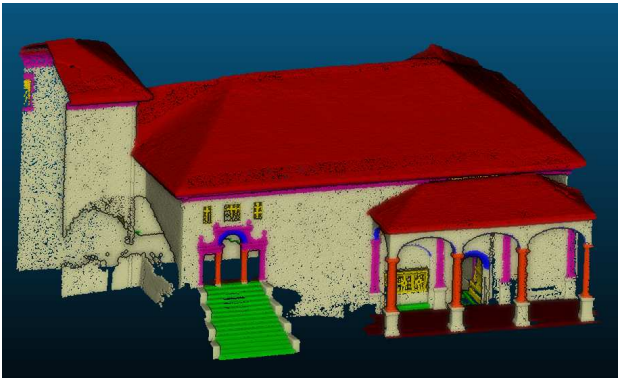




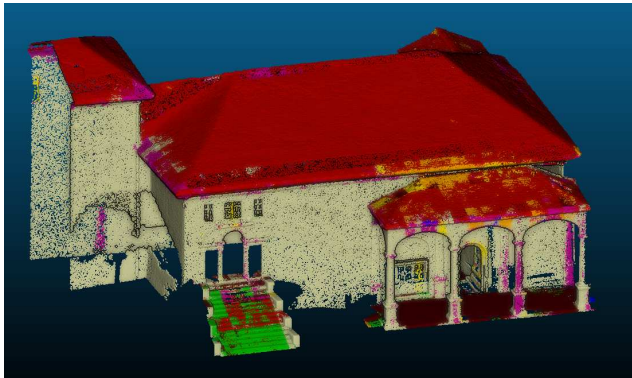
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_11

Overall Accuracy: **0.8152**

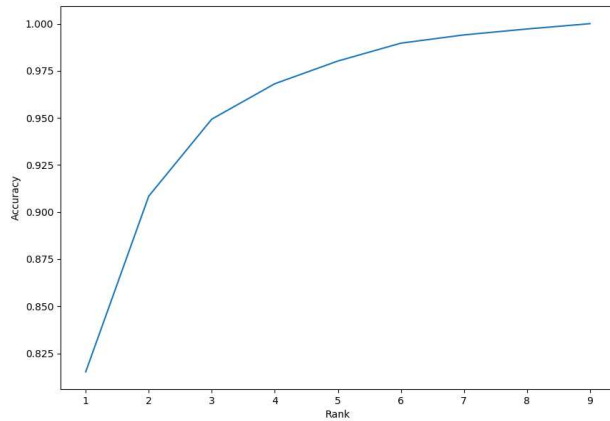
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 818.497611
eval accuracy: 0.815222

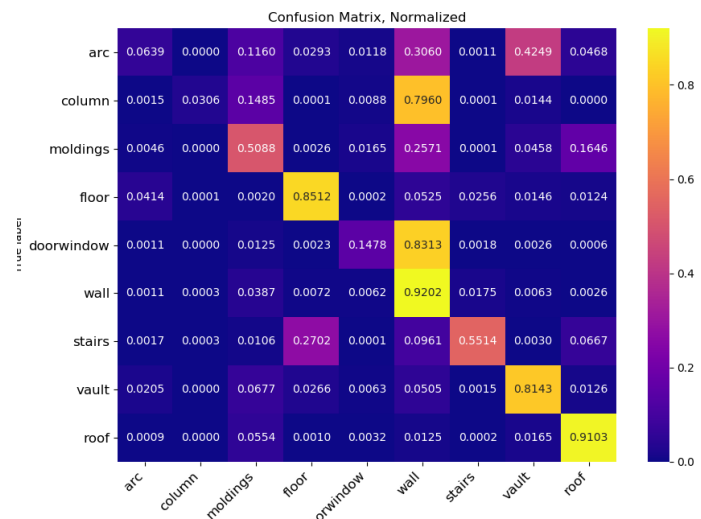
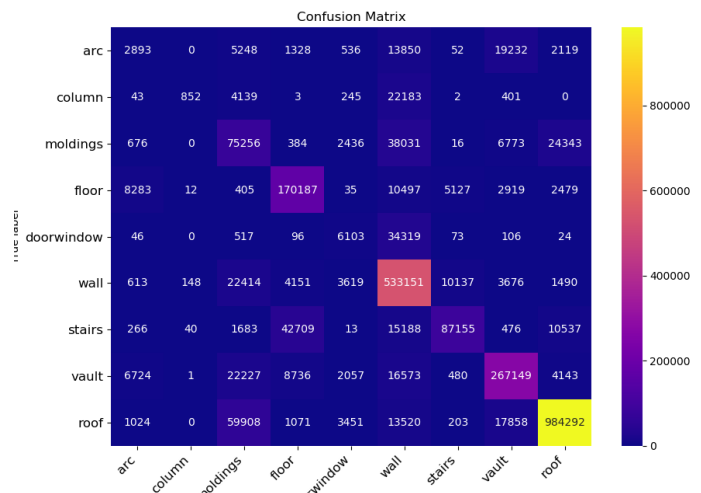
Accuracy:
0.815221957172292

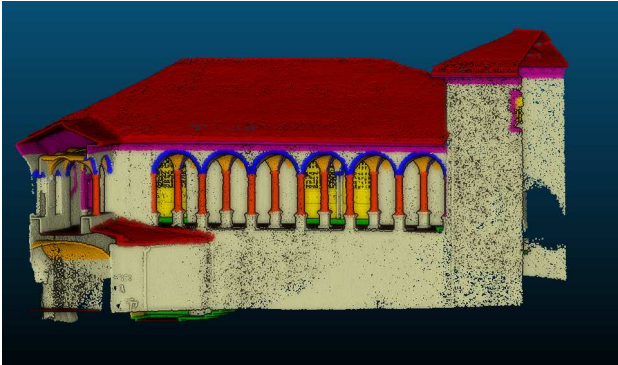
report:	precision	recall	f1-score	support
arc	0.1407	0.0639	0.0879	45258
column	0.8091	0.0306	0.0589	27868
moldings	0.3924	0.5088	0.4431	147915
floor	0.7443	0.8512	0.7941	199944
doorwindow	0.3300	0.1478	0.2042	41284
wall	0.7646	0.9202	0.8352	579399
stairs	0.8442	0.5514	0.6671	158067
vault	0.8385	0.8143	0.8262	328090
roof	0.9562	0.9103	0.9326	1081327
accuracy			0.8152	2609152
macro avg	0.6466	0.5332	0.5388	2609152
weighted avg	0.8182	0.8152	0.8077	2609152

Mean Jaccard (Mean IoU):
0.43647807520084164

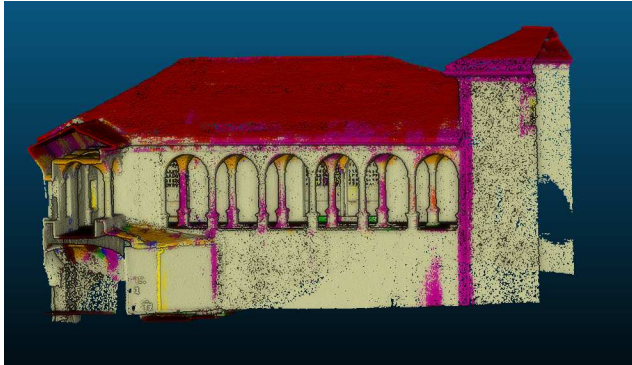
Jaccard:

- arc: 0.04596952314366072
- column: 0.03035377106416331
- moldings: 0.28456907765374956
- floor: 0.658562351502581
- doorwindow: 0.11370072285565243
- wall: 0.7170248534079294
- stairs: 0.5004392588296767
- vault: 0.7038924356640169
- roof: 0.8737906826861448

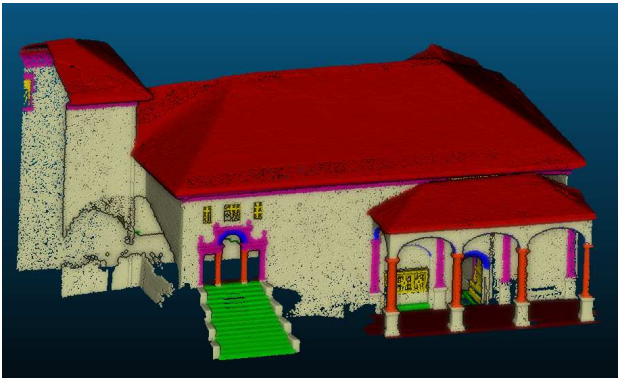




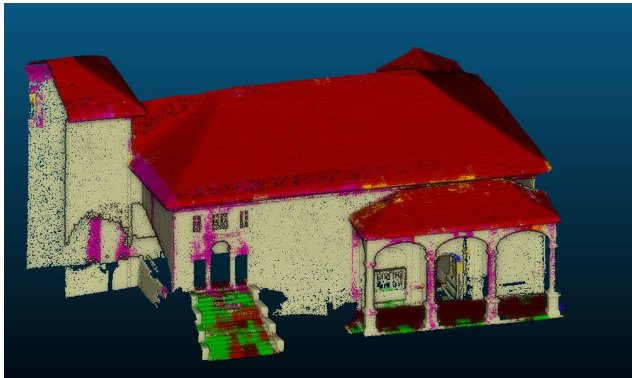
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_12

Overall Accuracy: **0.8004**

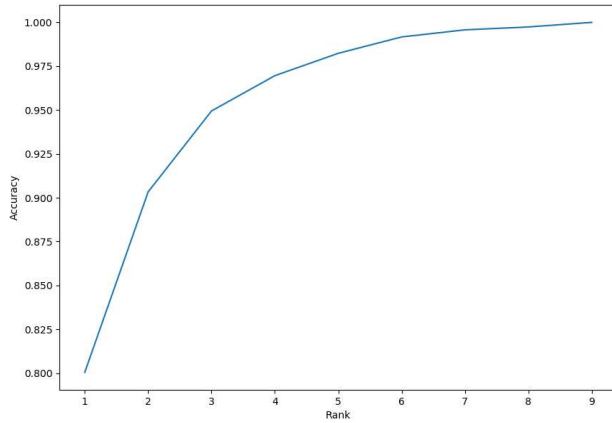
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

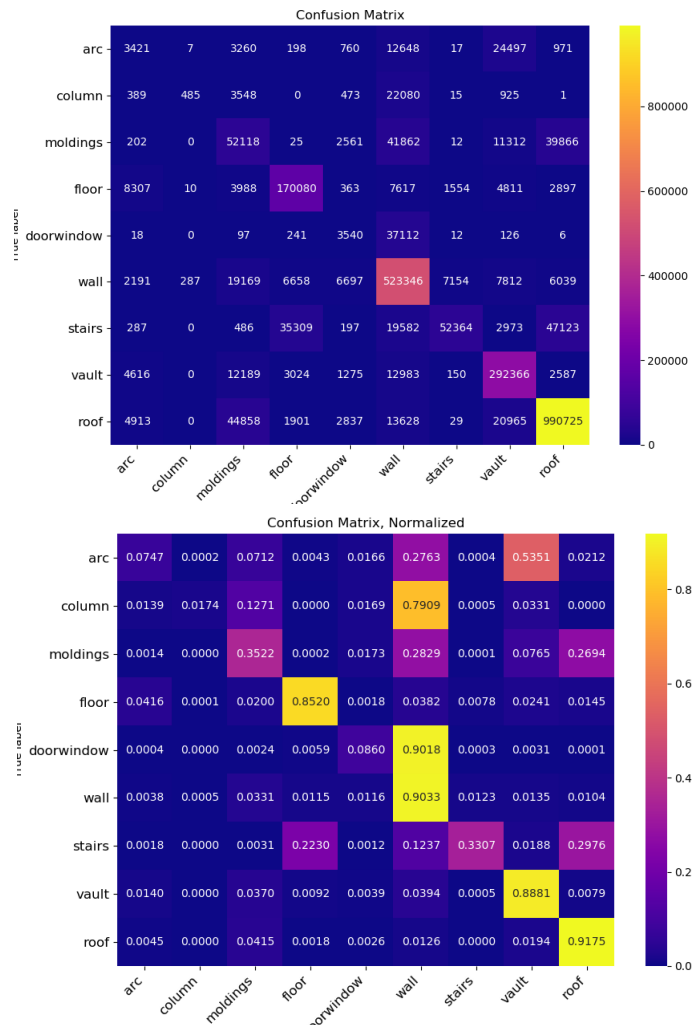
eval mean loss: 954.651660
eval accuracy: 0.800431

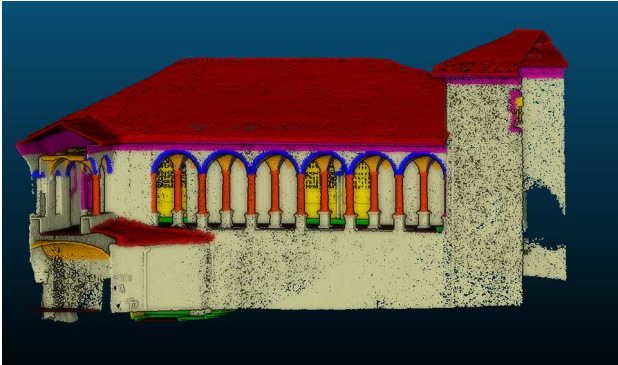
Accuracy:
0.800430561347135

report:	precision	recall	f1-score	support
arc	0.1405	0.0747	0.0976	45779
column	0.6147	0.0174	0.0338	27916
moldings	0.3730	0.3522	0.3623	147958
floor	0.7822	0.8520	0.8156	199627
doorwindow	0.1893	0.0860	0.1183	41152
wall	0.7575	0.9033	0.8240	579353
stairs	0.8541	0.3307	0.4768	158321
vault	0.7993	0.8881	0.8414	329190
roof	0.9087	0.9175	0.9131	1079856
accuracy			0.8004	2609152
macro avg	0.6022	0.4913	0.4981	2609152
weighted avg	0.7900	0.8004	0.7828	2609152

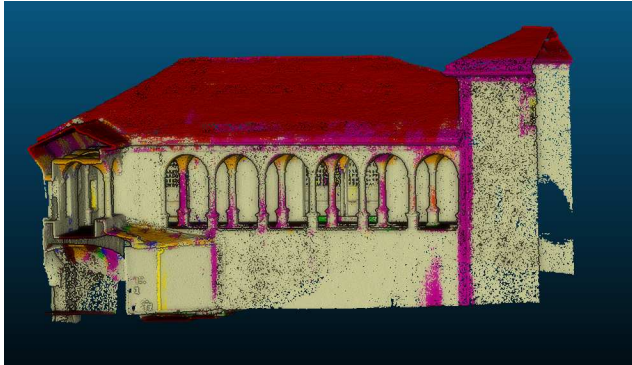
Mean Jaccard (Mean_IoU):
0.40236077551087673

Jaccard:
- arc: 0.051287817456747924
- column: 0.017186392629340894
- moldings: 0.22125806081858435
- floor: 0.6886303915654114
- doorwindow: 0.06286069430879872
- wall: 0.7007236916979641
- stairs: 0.31306198584273964
- vault: 0.7261748933834395
- roof: 0.8400630518948637

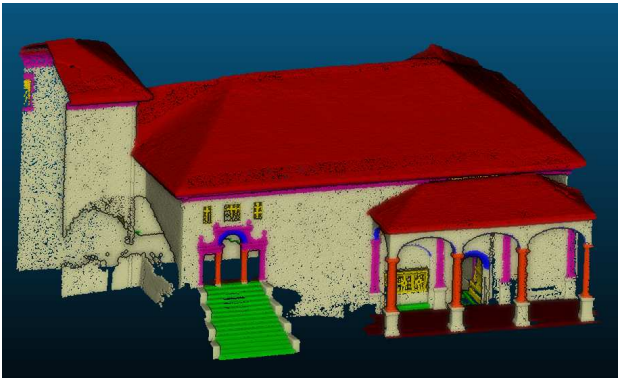




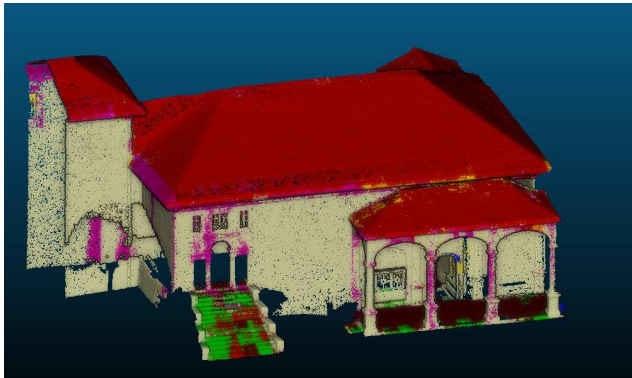
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_13

Overall Accuracy: **0.8188**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8 - "other":9

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.161400
eval accuracy: 0.818891

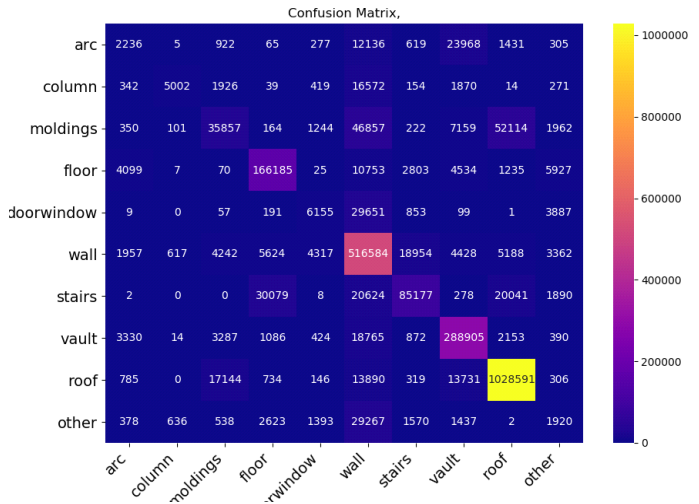
Accuracy:
0.8188913486067504

report:	precision	recall	f1-score	support
arc	0.1658	0.0533	0.0806	41964
column	0.7838	0.1880	0.3032	26609
moldings	0.5599	0.2455	0.3414	146030
floor	0.8036	0.8495	0.8259	195638
doorwindow	0.4272	0.1505	0.2226	40903
wall	0.7224	0.9139	0.8069	565273
stairs	0.7636	0.5388	0.6318	158099
vault	0.8340	0.9050	0.8681	319226
roof	0.9260	0.9563	0.9409	1075646
other	0.0950	0.0483	0.0640	39764

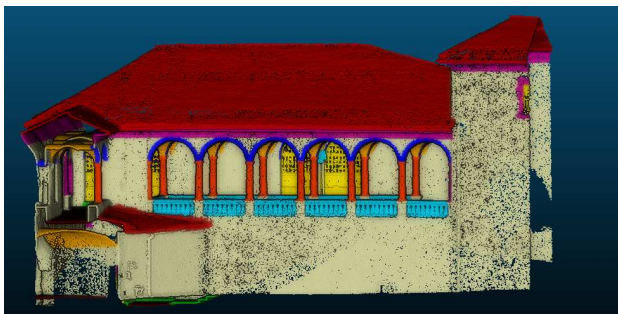
accuracy
macro avg 0.6081 0.4849 0.5085 2609152
weighted avg 0.7970 0.8189 0.7971 2609152

Mean Jaccard (Mean_IoU):
0.40816335712911556

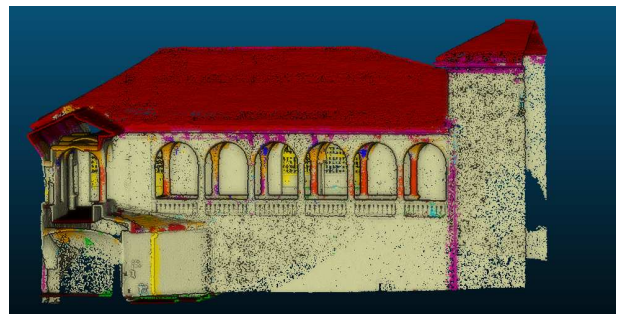
Jaccard:
- arc: 0.04201743836440169
- column: 0.17871306584729715
- moldings: 0.20581921293107408
- floor: 0.7034494143741825
- doorwindow: 0.1252136056636016
- wall: 0.6763447448768506
- stairs: 0.46175155178489147
- vault: 0.766875481113795
- roof: 0.888382095739857
- other: 0.033066960595205294
all room eval accuracy: 0.818891



VISUAL INSPECTION



Ground truth



Predicted



Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: SMV_14

Overall Accuracy: **0.8024**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8 - "other":9

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

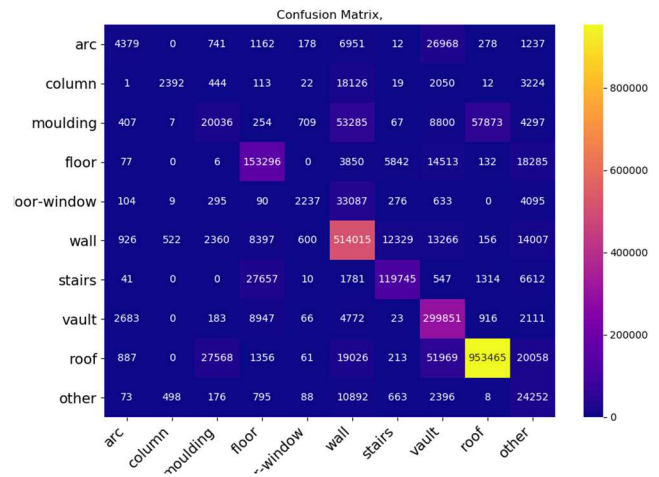
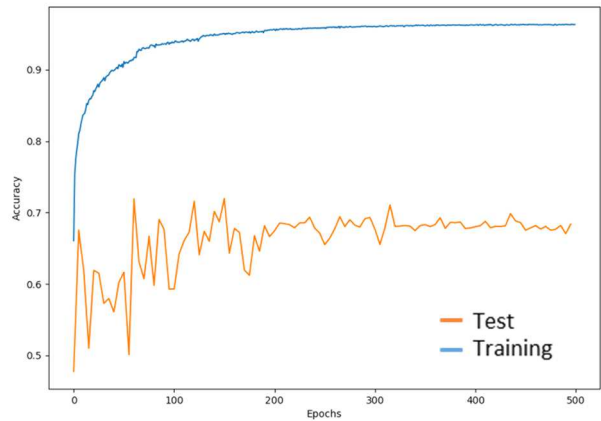
eval mean loss: 1.123948
eval accuracy: 0.802432

Accuracy:
0.8024323611656201

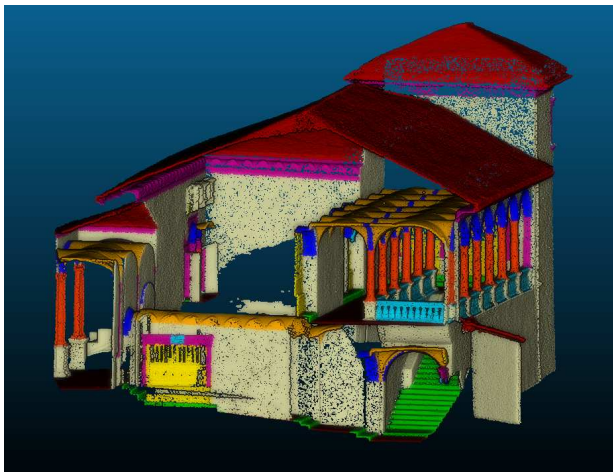
report:	precision	recall	f1-score	support
arc	0.4572	0.1045	0.1701	41906
column	0.6978	0.0906	0.1604	26403
moulding	0.3867	0.1375	0.2029	145735
floor	0.7586	0.7821	0.7702	196001
door-window	0.5633	0.0548	0.0999	40826
wall	0.7720	0.9072	0.8342	566578
stairs	0.8603	0.7593	0.8066	157707
vault	0.7122	0.9383	0.8098	319552
roof	0.9402	0.8873	0.9129	1074603
other	0.2470	0.6087	0.3514	39841
accuracy			0.8024	2609152
macro avg	0.6395	0.5270	0.5118	2609152
weighted avg	0.7997	0.8024	0.7856	2609152

Mean Jaccard (Mean_IoU):
0.4096773761116791

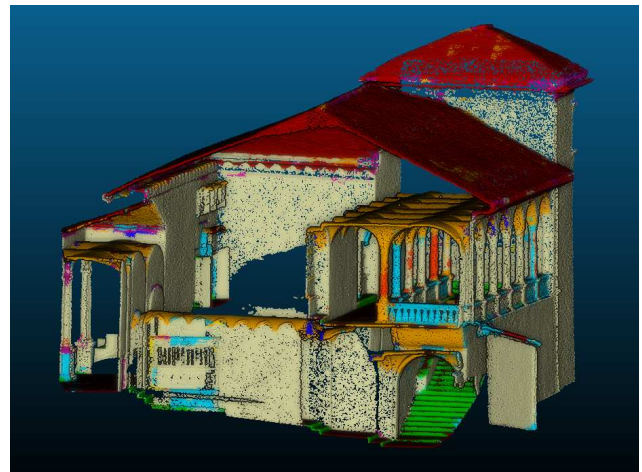
Jaccard:
- arc: 0.09296253051693026
- column: 0.08717518860016764
- moulding: 0.11287378597020979
- floor: 0.6262807837497752
- door-window: 0.05256109022556391
- wall: 0.71555154214949
- stairs: 0.6759487668712003
- vault: 0.6804063590609357
- roof: 0.8398412038488776
- other: 0.21317253685163537
all room eval accuracy: 0.802432



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: SMV_15

Overall Accuracy: **0.7926**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8 - "other":9

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION, METRICS and CONFUSION MATRIX

eval mean loss: 1.213272
eval accuracy: 0.792647

Accuracy:
0.7926468063186813

report:

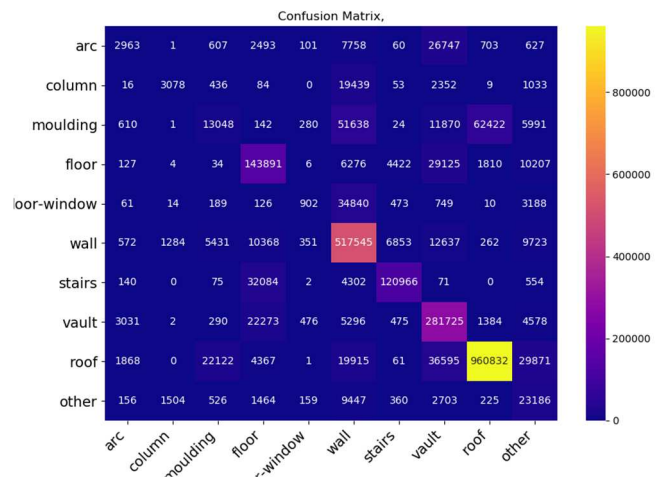
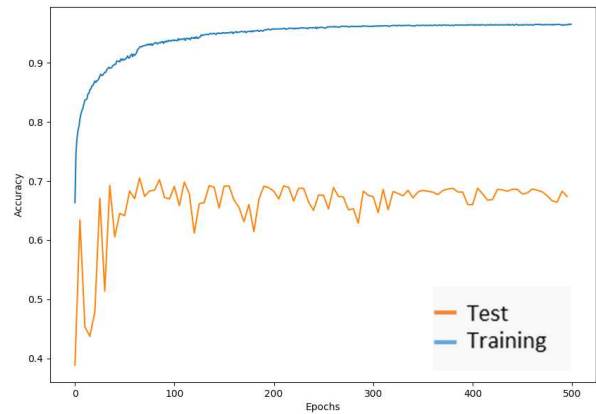
	precision	recall	f1-score	support
arc	0.3105	0.0704	0.1148	42060
column	0.5228	0.1162	0.1901	26500
moulding	0.3052	0.0894	0.1382	146026
floor	0.6622	0.7345	0.6965	195902
door-window	0.3960	0.0222	0.0421	40552
wall	0.7651	0.9160	0.8338	565026
stairs	0.9044	0.7647	0.8287	158194
vault	0.6963	0.8817	0.7781	319530
roof	0.9350	0.8933	0.9136	1075632
other	0.2606	0.5836	0.3603	39730
accuracy			0.7926	2609152
macro avg	0.5758	0.5072	0.4896	2609152
weighted avg	0.7785	0.7926	0.7727	2609152

Mean Jaccard (Mean_IoU):
0.39160427162398226

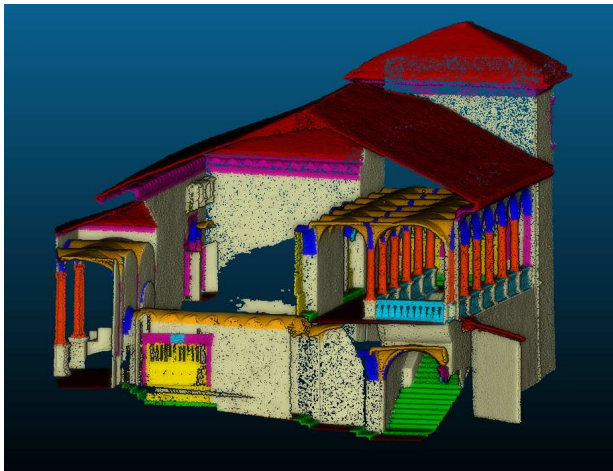
Jaccard:

- arc: 0.06091568841101129
- column: 0.10501535312180144
- moulding: 0.07424773523922247
- floor: 0.5343089382591356
- door-window: 0.021513070024804428
- wall: 0.7149033686632953
- stairs: 0.7075069454598626
- vault: 0.6368408084470556
- roof: 0.8410224629898543
- other: 0.21976834562377964

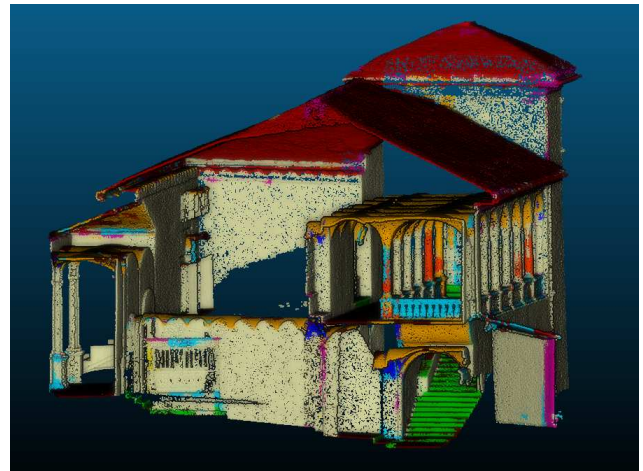
all room eval accuracy: 0.792647



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door Other

TEST: SMV_16

Overall Accuracy: **0.8082**

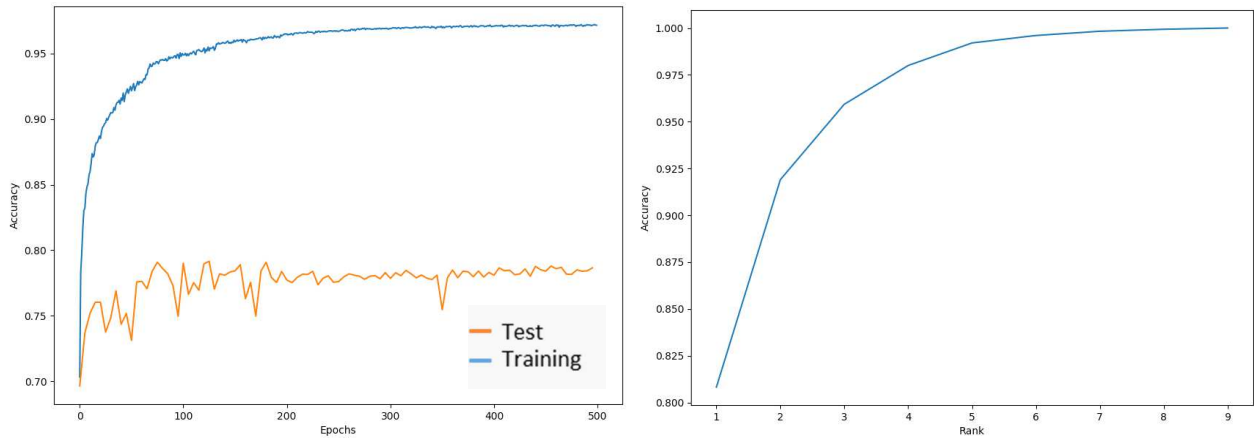
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

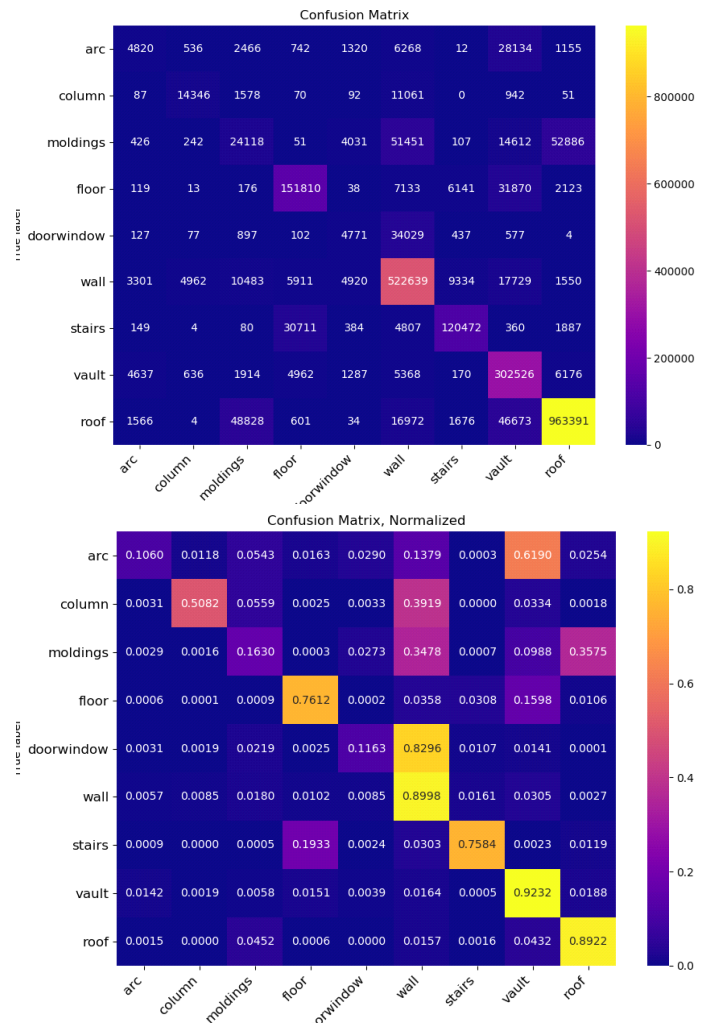
eval mean loss: 1.091786
eval accuracy: 0.808268

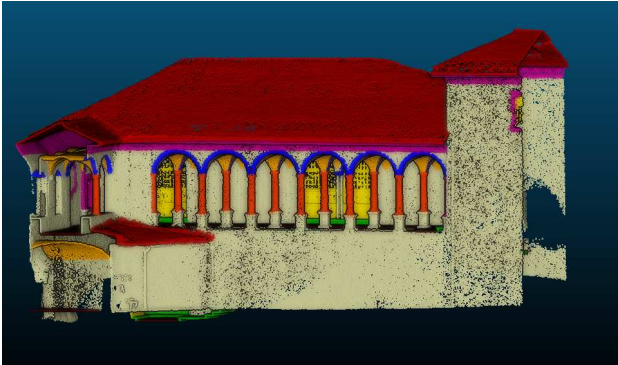
Accuracy:
0.8082675903895212

report:	precision	recall	f1-score	support
arc	0.3164	0.1060	0.1589	45453
column	0.6890	0.5082	0.5850	28227
moldings	0.2664	0.1630	0.2023	147924
floor	0.7787	0.7612	0.7699	199423
doorwindow	0.2827	0.1163	0.1648	41021
wall	0.7922	0.8998	0.8426	580829
stairs	0.8708	0.7584	0.8107	158854
vault	0.6823	0.9232	0.7847	327676
roof	0.9360	0.8922	0.9136	1079745
accuracy			0.8083	2609152
macro avg	0.6238	0.5698	0.5814	2609152
weighted avg	0.7944	0.8083	0.7955	2609152

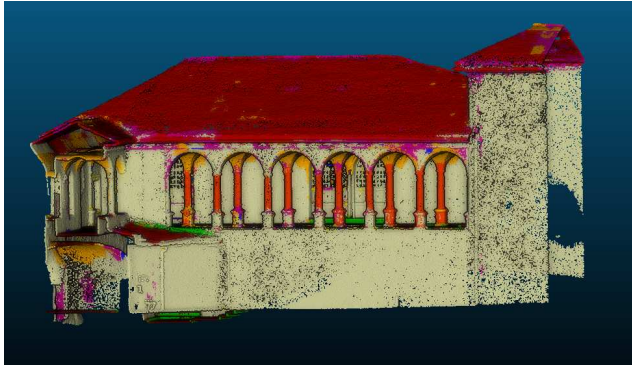
Mean Jaccard (Mean_IoU):
0.4693457225224912

Jaccard:
- arc: 0.08627942361048957
- column: 0.4134174807642431
- moldings: 0.11251901131814916
- floor: 0.625832223701731
- doorwindow: 0.08980367797918196
- wall: 0.7279926119696122
- stairs: 0.6816687508133831
- vault: 0.6456325908663111
- roof: 0.8409657316793197

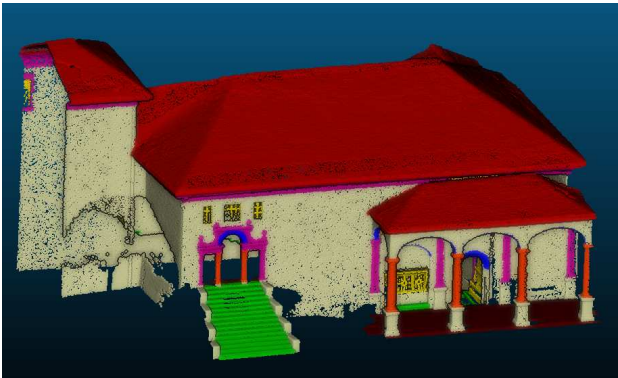




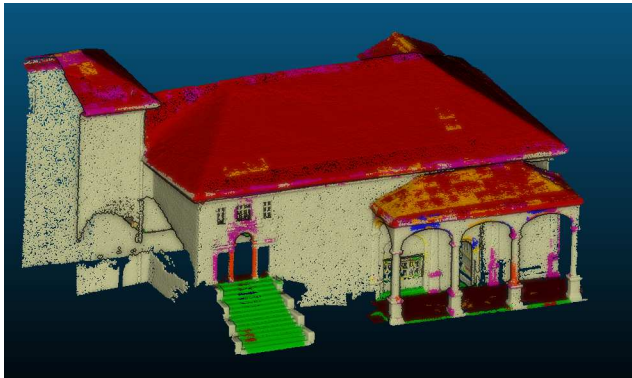
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_17

Overall Accuracy: **0.763**

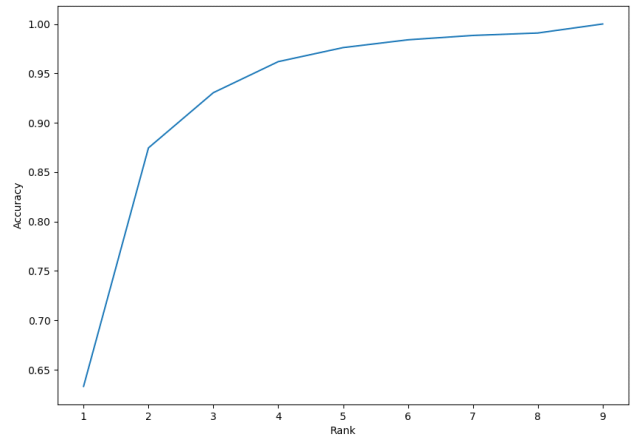
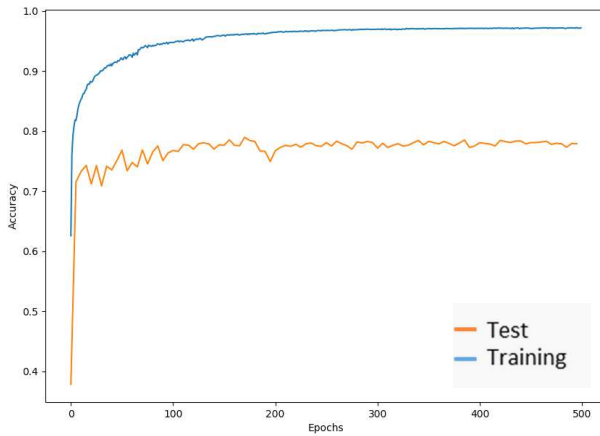
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 2854.405983
eval accuracy: 0.633228

Accuracy:
0.6332275773891287

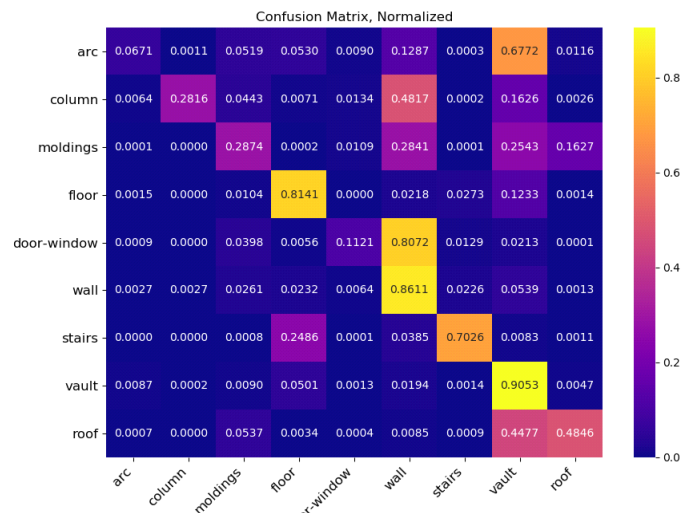
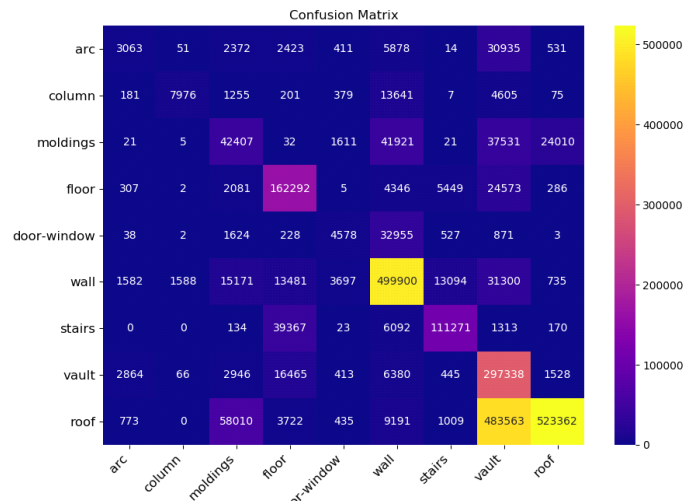
report:

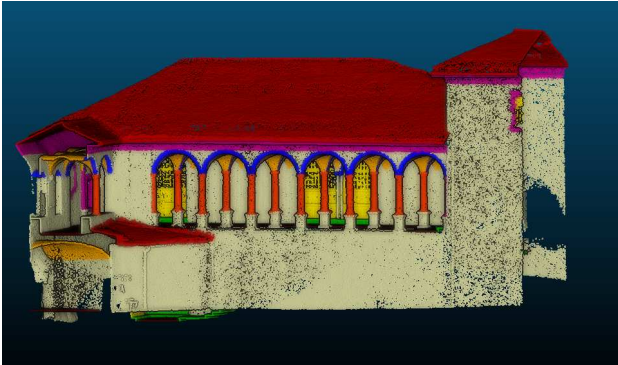
	precision	recall	f1-score	support
arc	0.3469	0.0671	0.1124	45678
column	0.8231	0.2816	0.4197	28320
moldings	0.3366	0.2874	0.3100	147559
floor	0.6813	0.8141	0.7418	199341
door-window	0.3963	0.1121	0.1748	40826
wall	0.8059	0.8611	0.8326	580548
stairs	0.8440	0.7026	0.7668	158370
vault	0.3260	0.9053	0.4794	328445
roof	0.9504	0.4846	0.6419	1080065
accuracy			0.6332	2609152
macro avg	0.6123	0.5018	0.4977	2609152
weighted avg	0.7573	0.6332	0.6413	2609152

Mean Jaccard (Mean_IoU):
0.3685360133606994

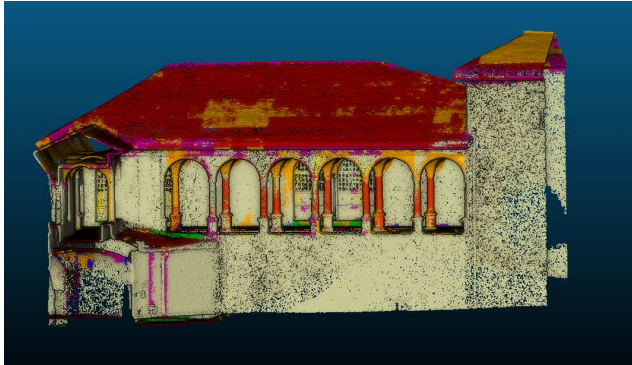
Jaccard:

- arc: 0.05954047119197574
- column: 0.2655656922154891
- moldings: 0.18345936872707136
- floor: 0.589595291724188
- door-window: 0.09577405857740585
- wall: 0.7131729419418162
- stairs: 0.6218480350516385
- vault: 0.3152652427645642
- roof: 0.47260301805214544

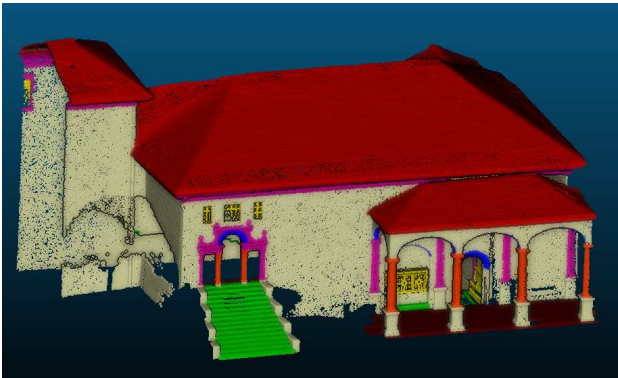




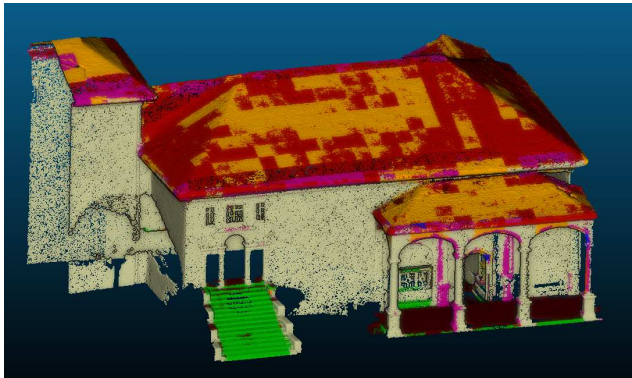
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_18

Overall Accuracy: **0.7841**

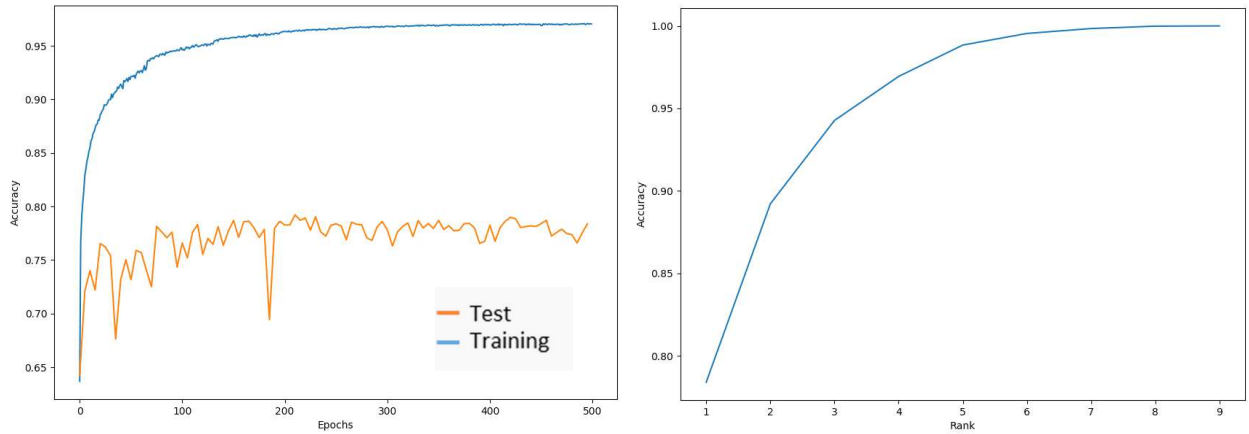
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

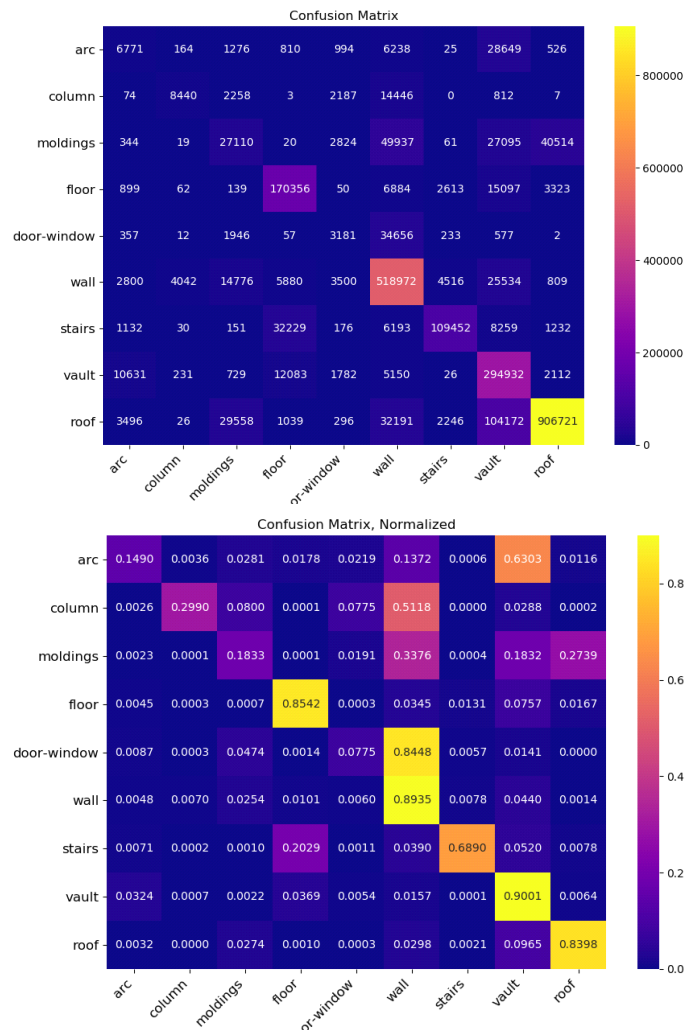
eval mean loss: 1023.666220
eval accuracy: 0.784138

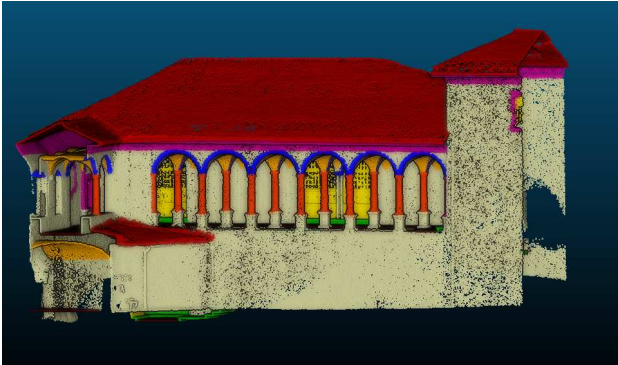
Accuracy:
0.784137911474686

report:	precision	recall	f1-score	support
arc	0.2555	0.1490	0.1882	45453
column	0.6479	0.2990	0.4092	28227
moldings	0.3478	0.1833	0.2401	147924
floor	0.7657	0.8542	0.8076	199423
door-window	0.2122	0.0775	0.1136	41021
wall	0.7692	0.8935	0.8267	580829
stairs	0.9184	0.6890	0.7874	158854
vault	0.5839	0.9001	0.7083	327676
roof	0.9492	0.8398	0.8911	1079745
accuracy			0.7841	2609152
macro avg	0.6055	0.5428	0.5525	2609152
weighted avg	0.7863	0.7841	0.7745	2609152

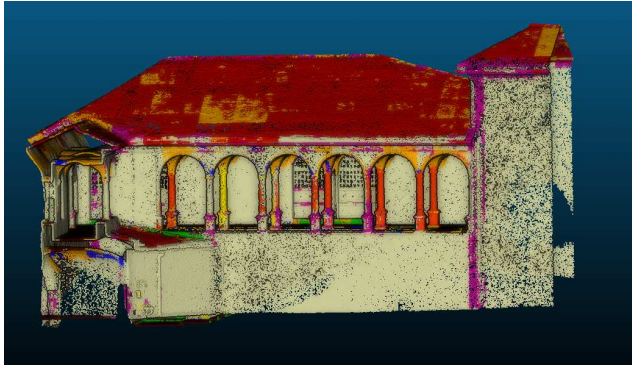
Mean Jaccard (Mean_IoU):
0.43786818772346436

Jaccard:
- arc: 0.10387199705458228
- column: 0.2572151281504282
- moldings: 0.13639771177870466
- floor: 0.6772413573768407
- door-window: 0.06021200075714556
- wall: 0.7046233388185585
- stairs: 0.6492816211278133
- vault: 0.548332209228607
- roof: 0.8036383135242451

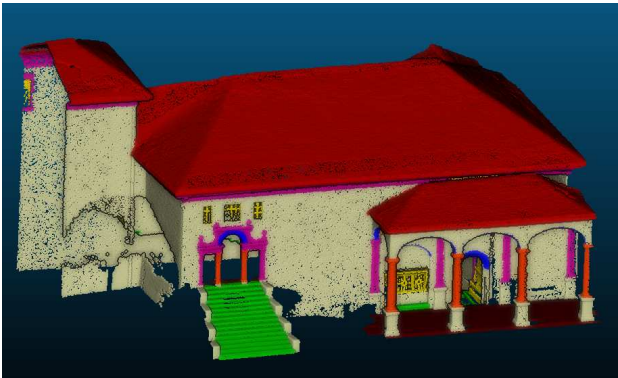




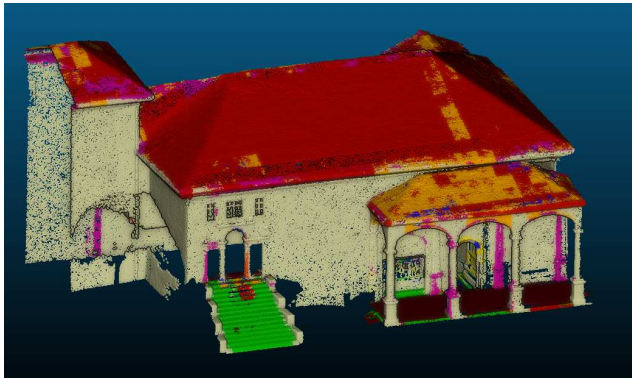
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_19

Overall Accuracy: **0.7881**

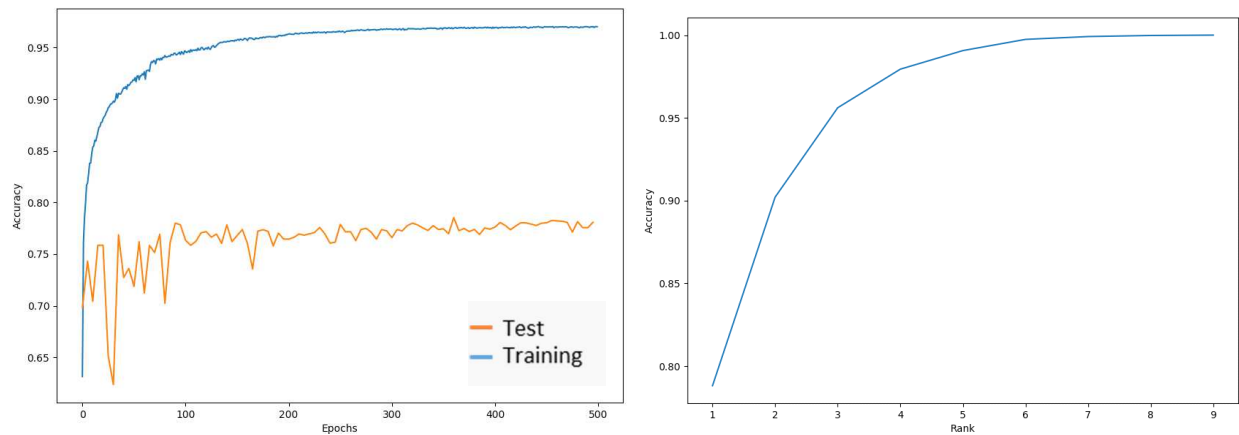
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

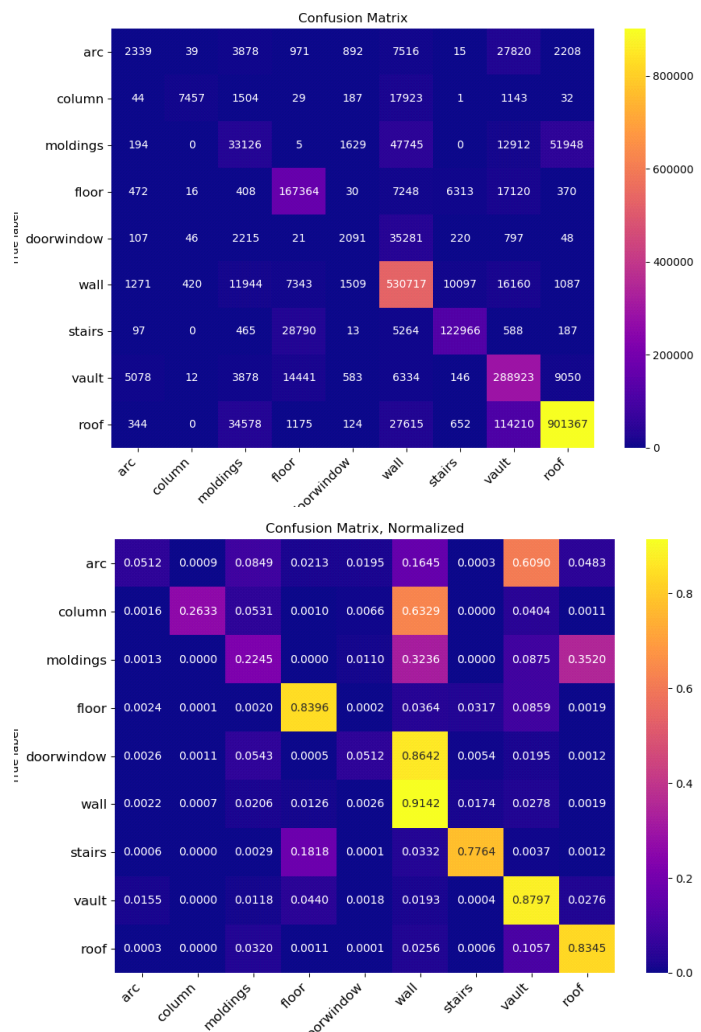
eval mean loss: 1137.992786
eval accuracy: 0.788130

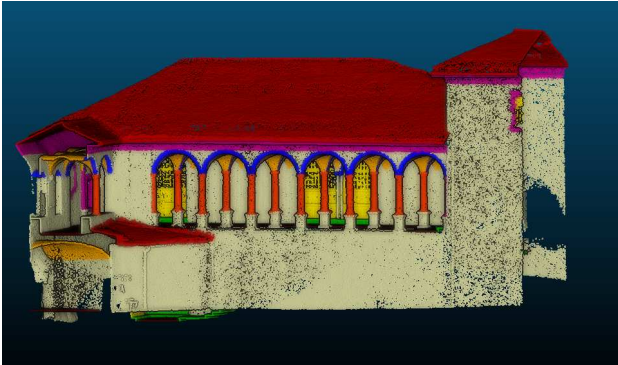
Accuracy:
0.7881296298567504

report:	precision	recall	f1-score	support
arc	0.2352	0.0512	0.0841	45678
column	0.9333	0.2633	0.4107	28320
moldings	0.3601	0.2245	0.2766	147559
floor	0.7603	0.8396	0.7980	199341
doorwindow	0.2963	0.0512	0.0873	40826
wall	0.7740	0.9142	0.8383	580548
stairs	0.8758	0.7764	0.8231	158370
vault	0.6023	0.8797	0.7151	328445
roof	0.9328	0.8345	0.8809	108065
accuracy			0.7881	2609152
macro avg	0.6411	0.5372	0.5460	2609152
weighted avg	0.7847	0.7881	0.7751	2609152

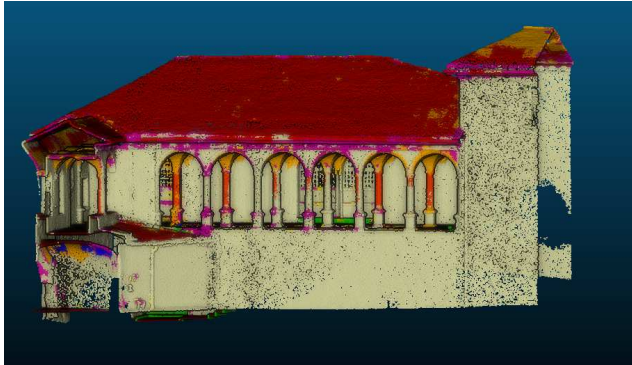
Mean Jaccard (Mean IoU):
0.43744769946138895

Jaccard:
- arc: 0.04389603077789247
- column: 0.2584479950091845
- moldings: 0.16047163915922666
- floor: 0.6638372812514874
- doorwindow: 0.04566200074247156
- wall: 0.721598588121402
- stairs: 0.6994096033307927
- vault: 0.5564826317664846
- roof: 0.787223524993559

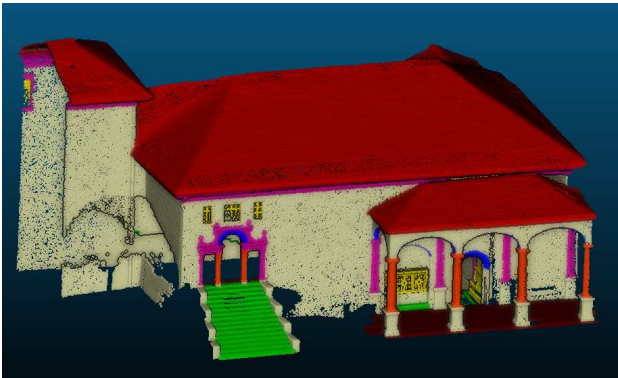




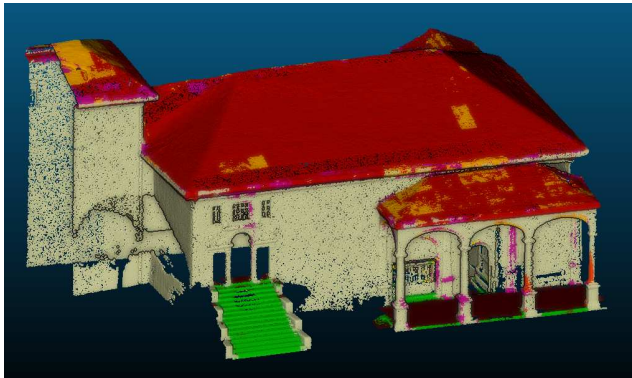
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_20

Overall Accuracy: **0.8352**

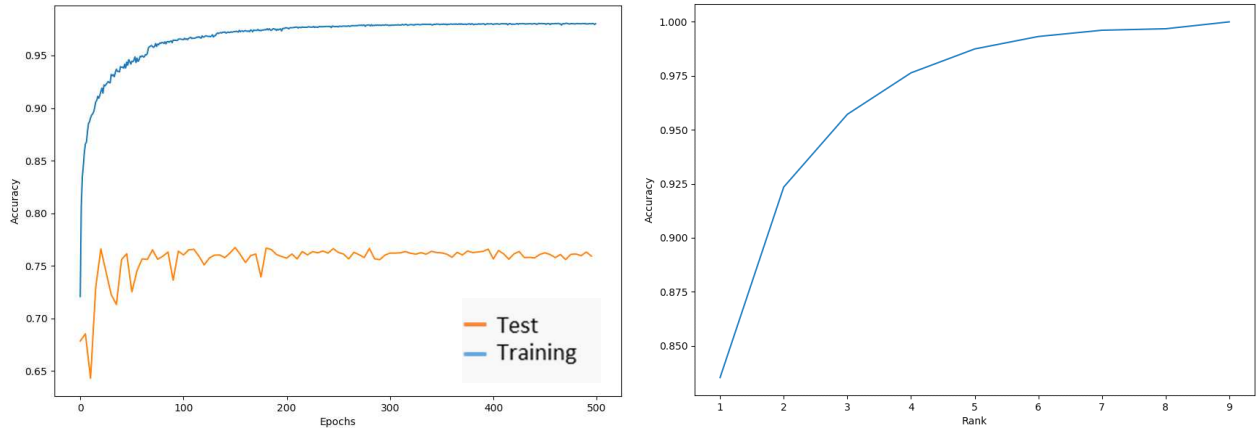
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 1.132991

eval accuracy: 0.835224

Accuracy:

0.835224214393642

report:

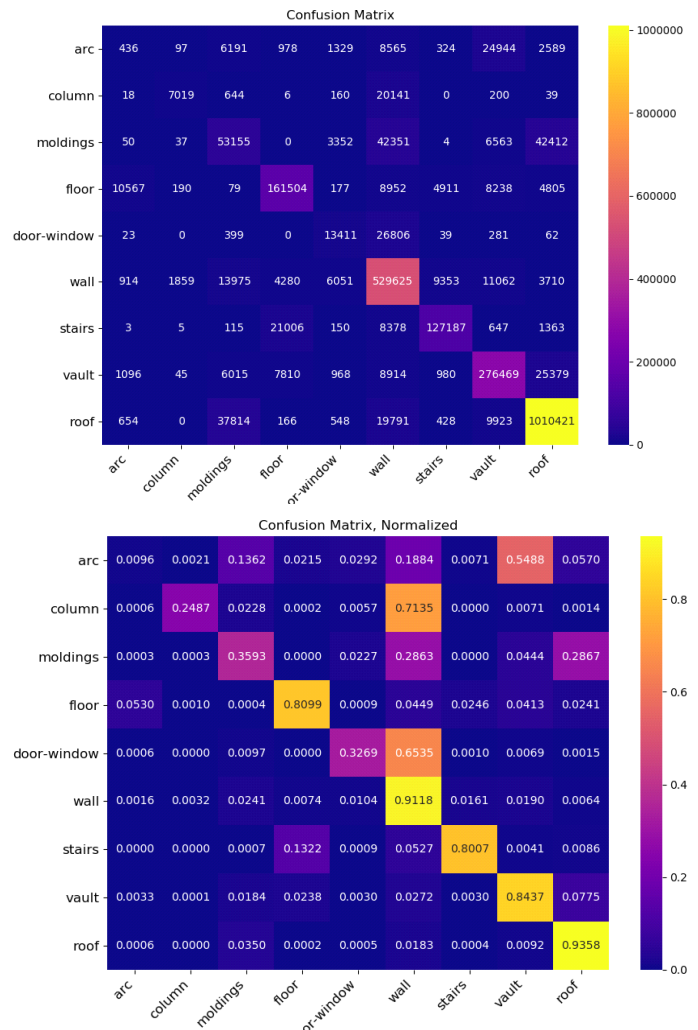
	precision	recall	f1-score	support
arc	0.0317	0.0096	0.0147	45453
column	0.7586	0.2487	0.3746	28227
moldings	0.4490	0.3593	0.3992	147924
floor	0.8251	0.8099	0.8174	199423
door-window	0.5129	0.3269	0.3993	41021
wall	0.7864	0.9118	0.8445	580829
stairs	0.8880	0.8007	0.8421	158854
vault	0.8172	0.8437	0.8302	327676
roof	0.9263	0.9358	0.9310	1079745
accuracy			0.8352	2609152
macro avg	0.6661	0.5829	0.6059	2609152
weighted avg	0.8204	0.8352	0.8245	2609152

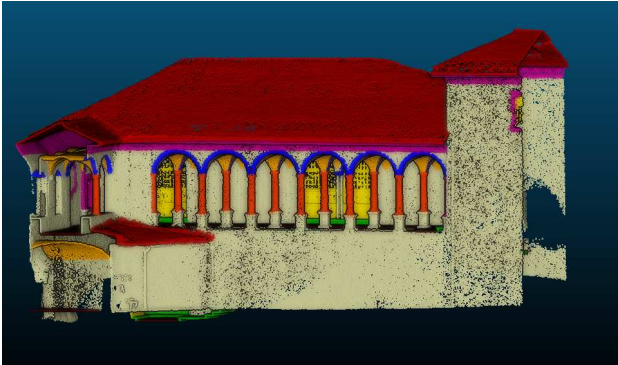
Mean Jaccard (Mean_IoU):

0.4962894039373212

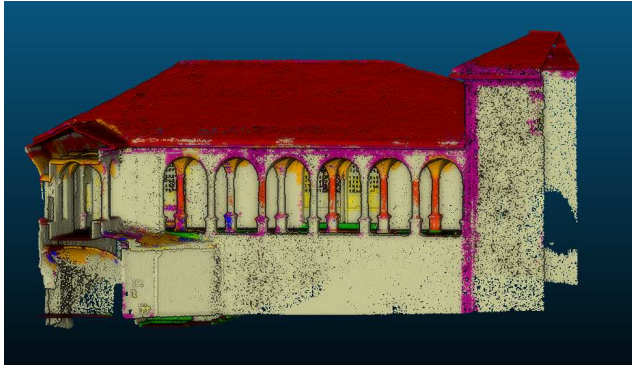
Jaccard:

- arc: 0.007417741331790806
- column: 0.2304333552199606
- moldings: 0.24937135243671302
- floor: 0.691165708758971
- door-window: 0.24947912791130292
- wall: 0.7307924225259994
- stairs: 0.7272275048172311
- vault: 0.7097429235958864
- roof: 0.8709744988380352

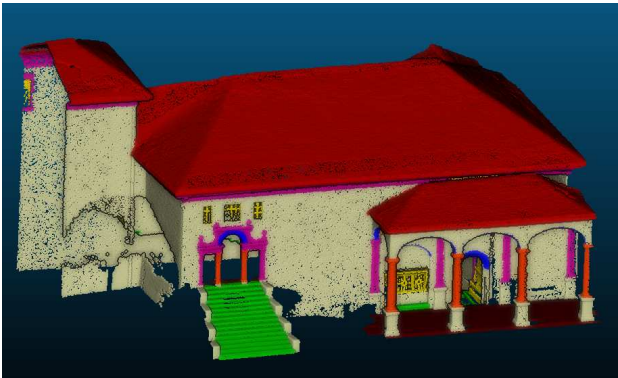




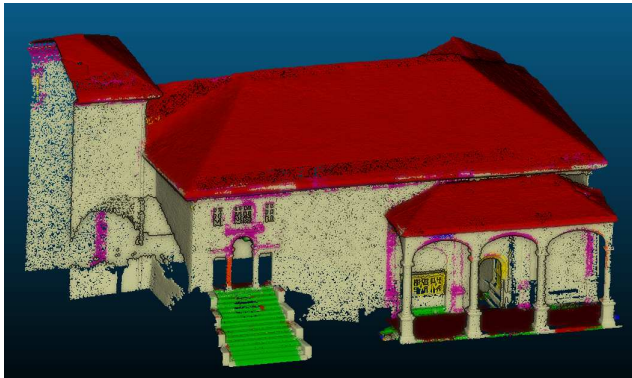
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_21

Overall Accuracy: **0.6882**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

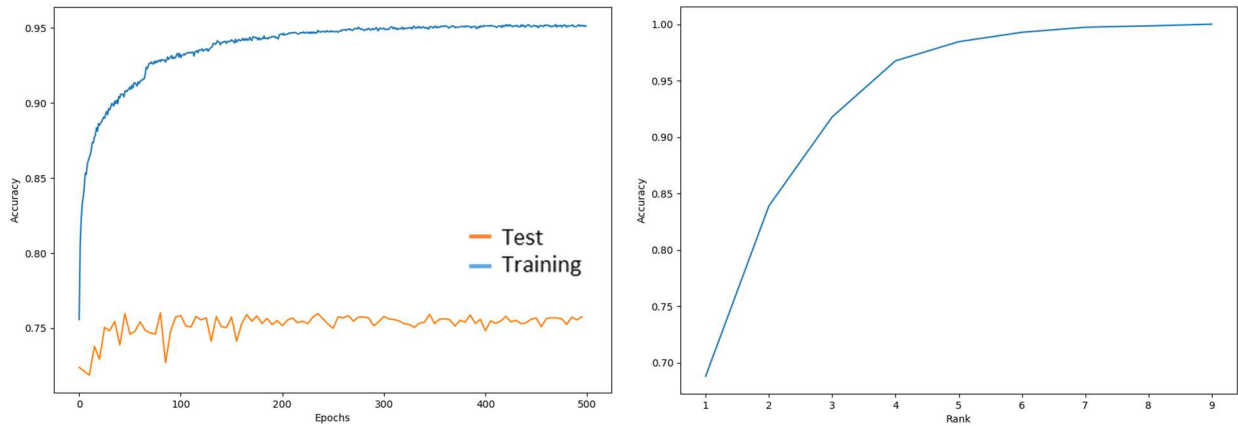
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No layer 4 (exclusion of global features)

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 1.568848
eval accuracy: 0.688205

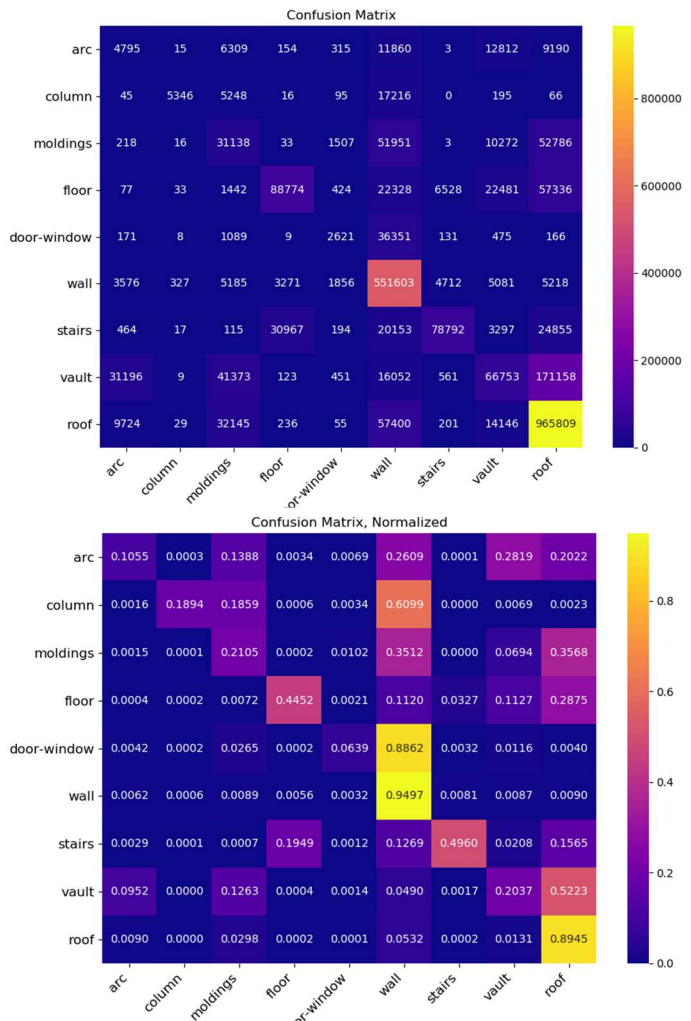
Accuracy:
0.6882048267023155

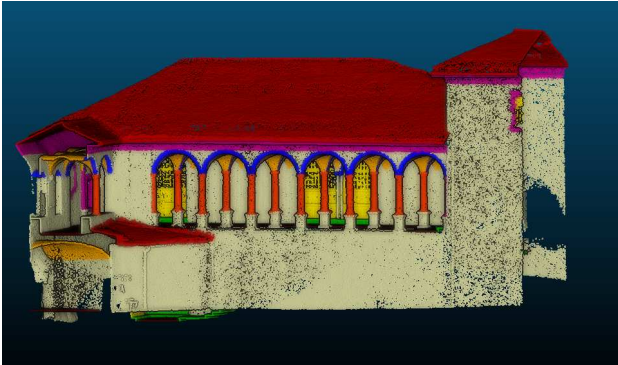
report:	precision	recall	f1-score	support
arc	0.0954	0.1055	0.1002	45453
column	0.9217	0.1894	0.3142	28227
moldings	0.2510	0.2105	0.2290	147924
floor	0.7183	0.4452	0.5497	199423
door-window	0.3486	0.0639	0.1080	41021
wall	0.7028	0.9497	0.8078	580829
stairs	0.8665	0.4960	0.6309	158854
vault	0.4926	0.2037	0.2882	327676
roof	0.7507	0.8945	0.8163	1079745
accuracy			0.6882	2609152
macro avg	0.5720	0.3954	0.4271	2609152
weighted avg	0.6680	0.6882	0.6541	2609152

Mean Jaccard (Mean_IoU):
0.3112018047651294

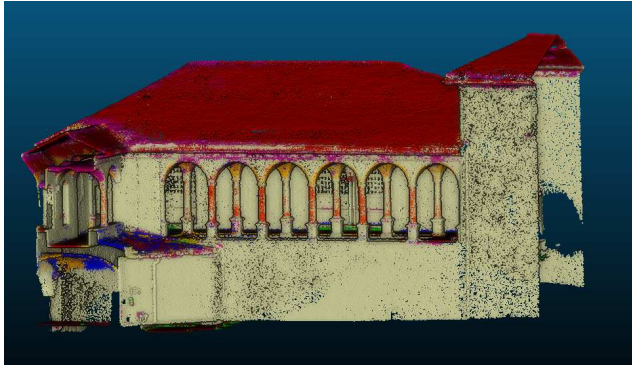
Jaccard:

- arc: 0.0527363512383969
- column: 0.18639517450577037
- moldings: 0.12929452310758627
- floor: 0.37900030738754736
- door-window: 0.05708001219565312
- wall: 0.6775284349129143
- stairs: 0.46079079260554523
- vault: 0.1683832154073177
- roof: 0.6896074315254334

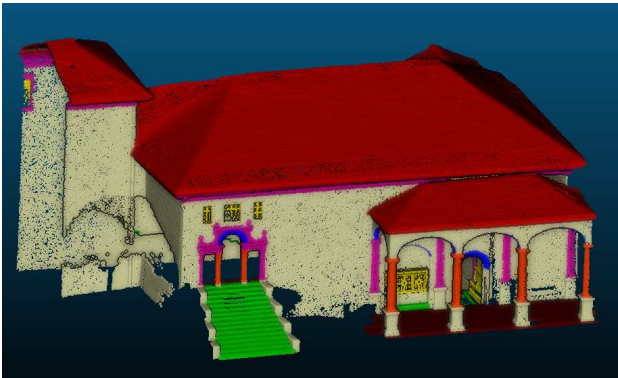




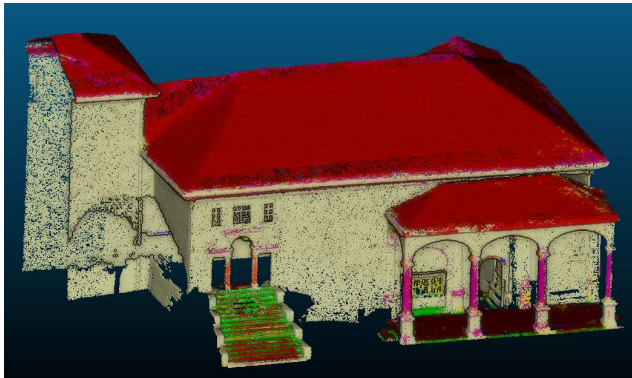
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_22

Overall Accuracy: **0.8445**

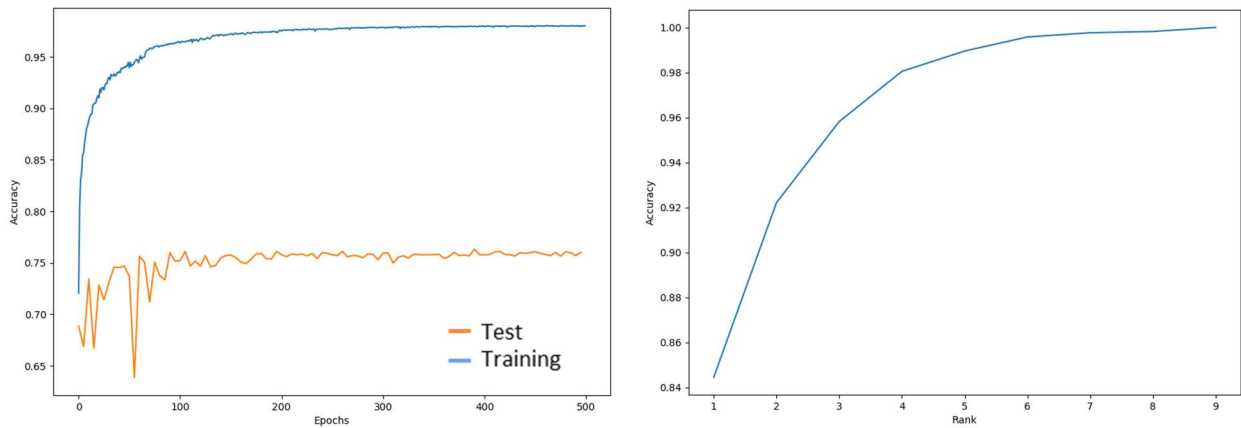
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

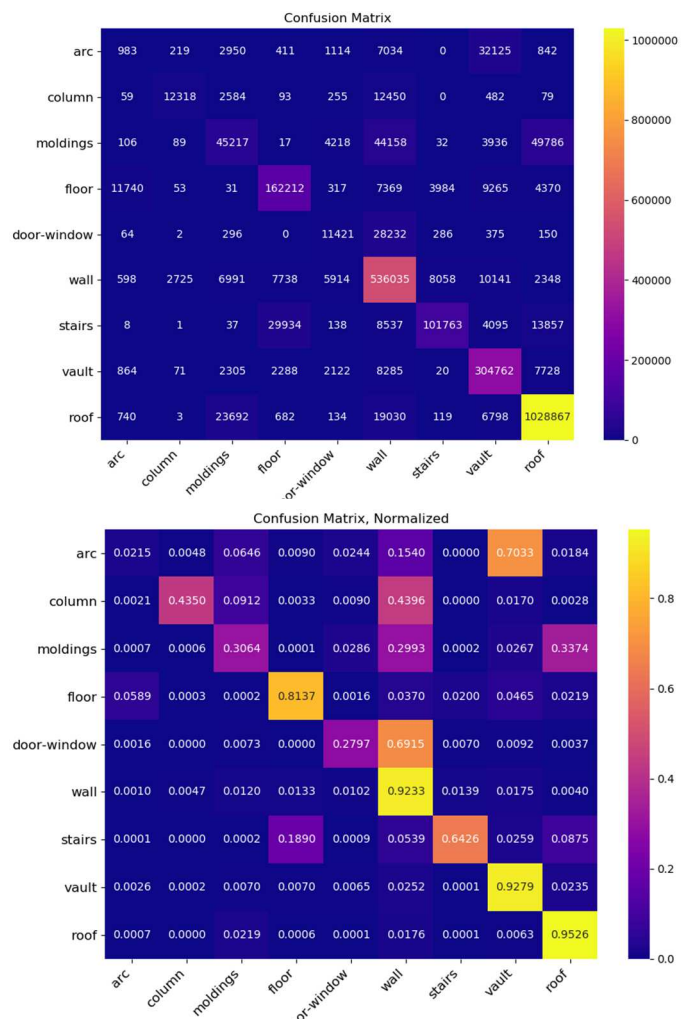
eval mean loss: 1.104846
eval accuracy: 0.844557

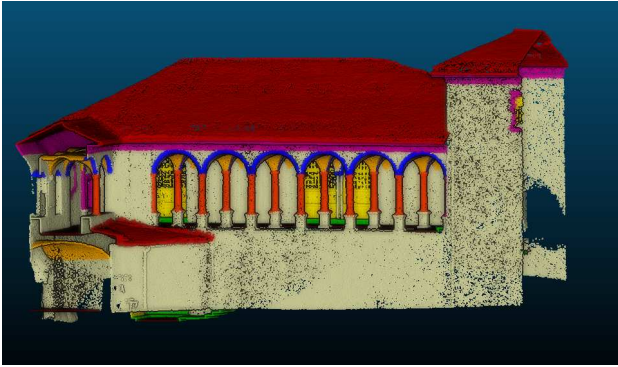
Accuracy:
0.8445571588010204

report:	precision	recall	f1-score	support
arc	0.0648	0.0215	0.0323	45678
column	0.7957	0.4350	0.5625	28320
moldings	0.5376	0.3064	0.3904	147559
floor	0.7976	0.8137	0.8056	199341
door-window	0.4456	0.2797	0.3437	40826
wall	0.7987	0.9233	0.8565	580548
stairs	0.8906	0.6426	0.7465	158370
vault	0.8193	0.9279	0.8702	328445
roof	0.9286	0.9526	0.9404	1080065
accuracy			0.8446	2609152
macro avg	0.6754	0.5892	0.6165	2609152
weighted avg	0.8274	0.8446	0.8304	2609152

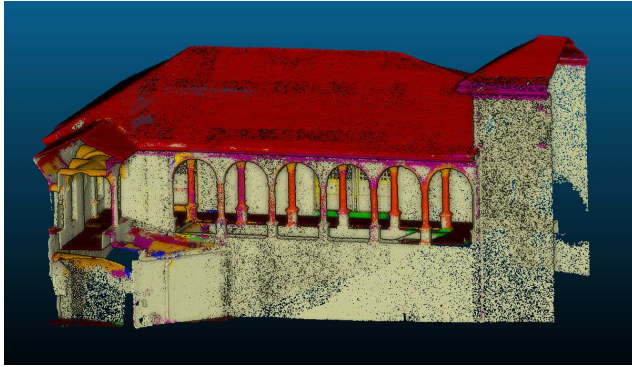
Mean Jaccard (Mean_IoU):
0.5038415831544446

Jaccard:
- arc: 0.01642247356198941
- column: 0.39125877457675573
- moldings: 0.24252192335541312
- floor: 0.6744669527325949
- door-window: 0.207511174097896
- wall: 0.7490257013622714
- stairs: 0.595561512035536
- vault: 0.7702584529219384
- roof: 0.8875472837456059

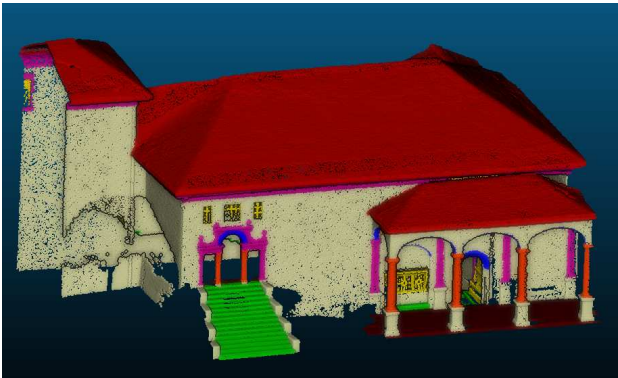




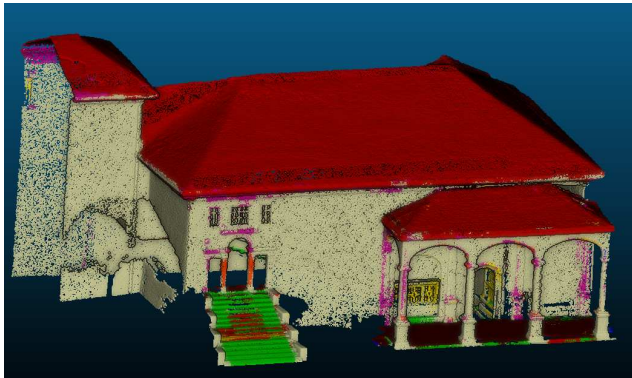
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_23

Overall Accuracy: **0.8364**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Block size: 2x2 m

Stride: 1

N. of points: 8192

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.950300
eval accuracy: 0.836497

Accuracy:
0.8364972277239828

report:

	precision	recall	f1-score	support
arc	0.3434	0.0557	0.0959	113848
column	0.8525	0.4027	0.5470	104011
moldings	0.5416	0.3078	0.3925	312062
floor	0.7667	0.8883	0.8231	327711
door-window	0.5027	0.3010	0.3766	118573
wall	0.8251	0.9108	0.8658	1566844
stairs	0.8776	0.7088	0.7843	292212
vault	0.7752	0.9108	0.8375	604437
roof	0.9248	0.9598	0.9420	1794990

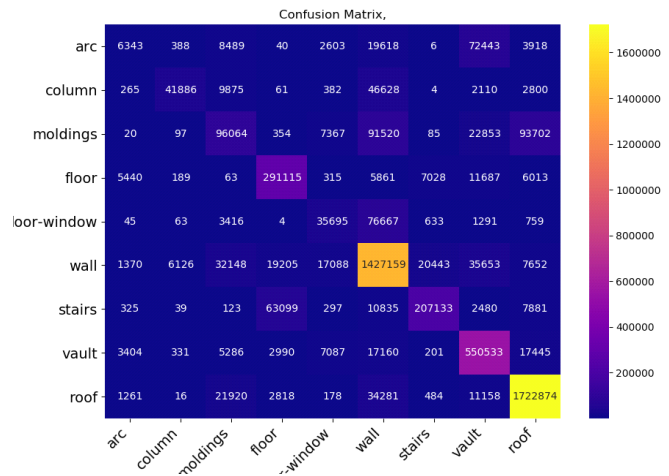
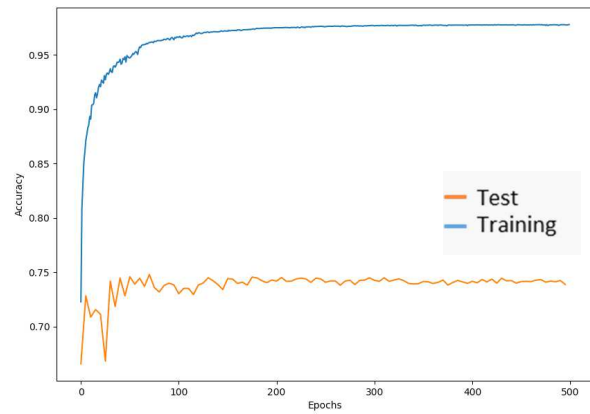
accuracy			0.8365	5234688
macro avg	0.7122	0.6051	0.6294	5234688
weighted avg	0.8186	0.8365	0.8191	5234688

Mean Jaccard (Mean_IoU):
0.5135097593981051

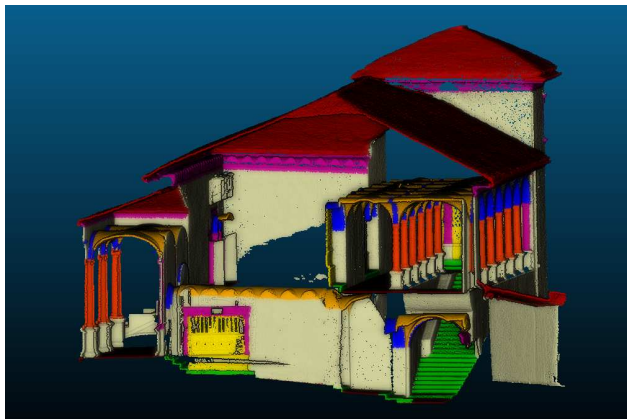
Jaccard:

- arc: 0.05035006112178317
- column: 0.37646953082868956
- moldings: 0.2442002938619459
- floor: 0.6993216137137805
- door-window: 0.23195139385275196
- wall: 0.7634258650036857
- stairs: 0.6450812218152826
- vault: 0.7204873107607261
- roof: 0.8903005436242998

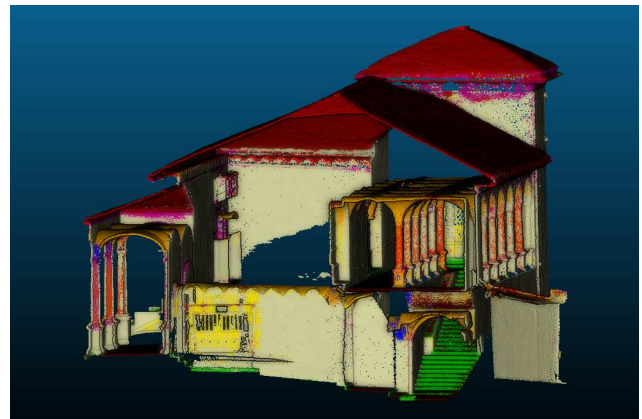
all room eval accuracy: 0.836497



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_24

Overall Accuracy: **0.8265**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Block size: 2x2 m

Stride: 1

N. of points: 8192

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.910542
eval accuracy: 0.826525

Accuracy:

0.8265250956695032

report:

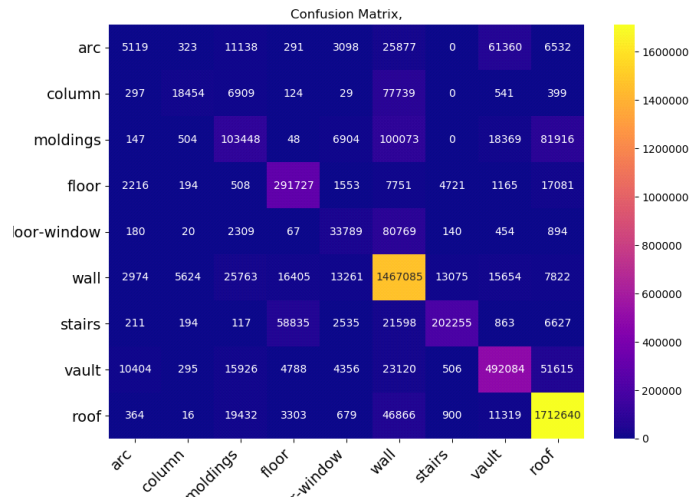
	precision	recall	f1-score	support
arc	0.2336	0.0450	0.0755	113738
column	0.7202	0.1766	0.2837	104492
moldings	0.5575	0.3322	0.4163	311409
floor	0.7767	0.8924	0.8305	326916
door-window	0.5104	0.2848	0.3656	118622
wall	0.7926	0.9358	0.8583	1567663
stairs	0.9127	0.6897	0.7857	293235
vault	0.8177	0.8159	0.8168	603094
roof	0.9083	0.9538	0.9305	1795519
accuracy			0.8265	5234688
macro avg	0.6922	0.5696	0.5959	5234688
weighted avg	0.8070	0.8265	0.8066	5234688

Mean Jaccard (Mean_IoU):
0.48450125171816705

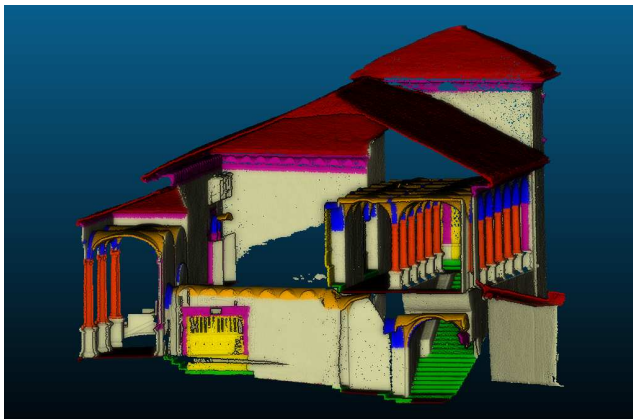
Jaccard:

- arc: 0.03921673778642621
- column: 0.16526660815675878
- moldings: 0.26288464617253393
- floor: 0.7101833841719473
- door-window: 0.2237133947310924
- wall: 0.7517899455585983
- stairs: 0.6470565652623194
- vault: 0.6903351341644933
- roof: 0.8700648494593338

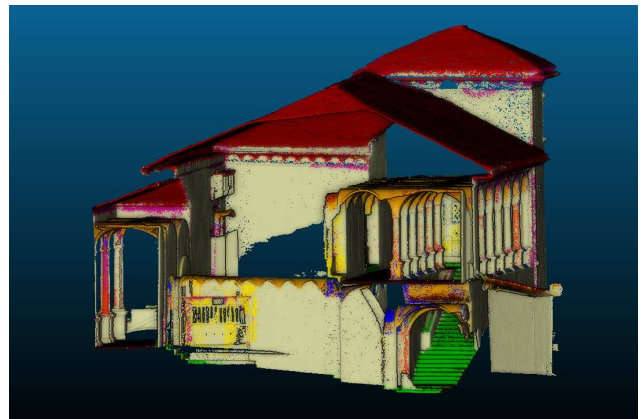
all room eval accuracy: 0.826525



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_25

Overall Accuracy: **0.8441**

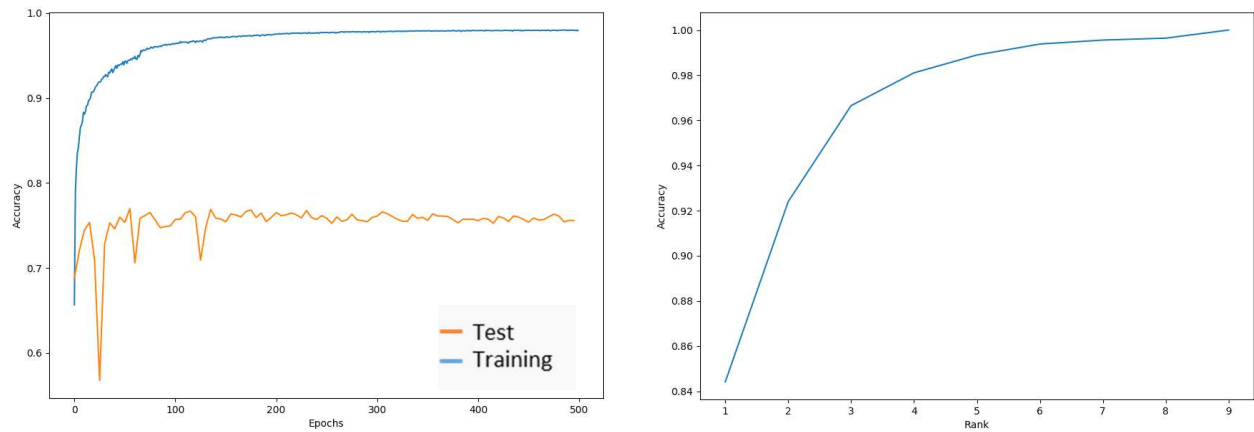
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

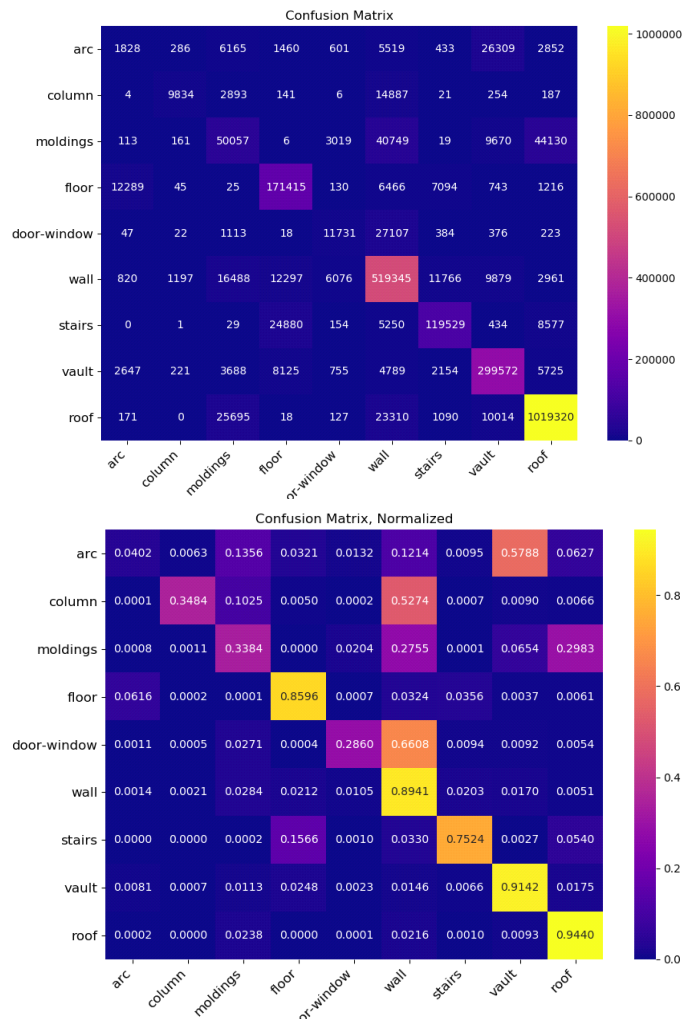
eval mean loss: 957.604350
eval accuracy: 0.844194

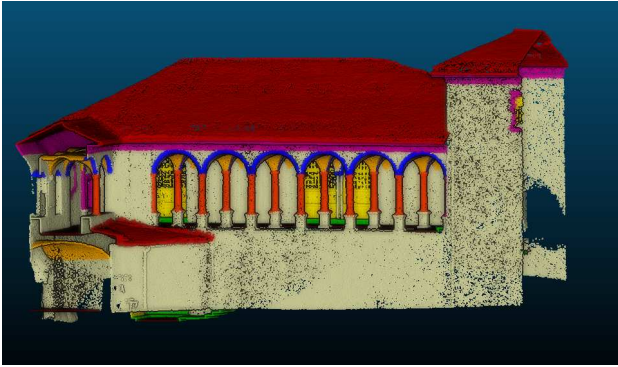
Accuracy:
0.8441942056269623

report:	precision	recall	f1-score	support
arc	0.1020	0.0402	0.0577	45453
column	0.8357	0.3484	0.4918	28227
moldings	0.4716	0.3384	0.3940	147924
floor	0.7850	0.8596	0.8206	199423
door-window	0.5191	0.2860	0.3688	41021
wall	0.8022	0.8941	0.8457	580829
stairs	0.8389	0.7524	0.7933	158854
vault	0.8385	0.9142	0.8748	327676
roof	0.9393	0.9440	0.9417	1079745
accuracy			0.8442	2609152
macro avg	0.6814	0.5975	0.6209	2609152
weighted avg	0.8294	0.8442	0.8333	2609152

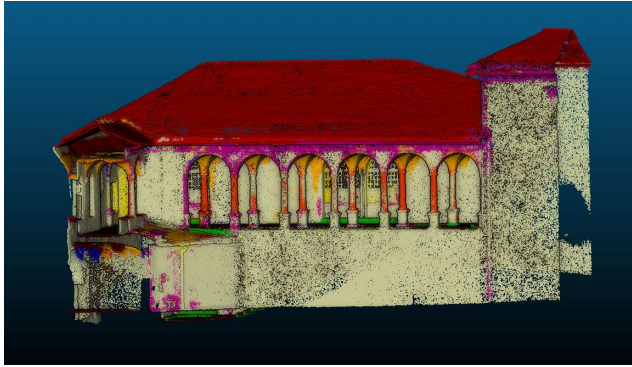
Mean Jaccard (Mean_IoU):
0.5089038507375627

Jaccard:
- arc: 0.029702326790588846
- column: 0.32606100795755966
- moldings: 0.2453533967258112
- floor: 0.6957681192362645
- door-window: 0.22607874501339398
- wall: 0.7326006550939053
- stairs: 0.6574210048675851
- vault: 0.7773922746558368
- roof: 0.8897571262971188

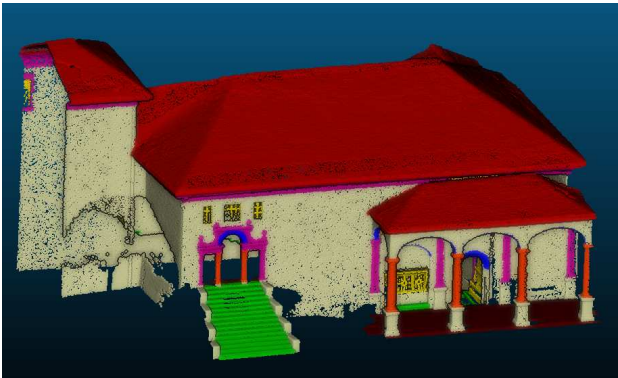




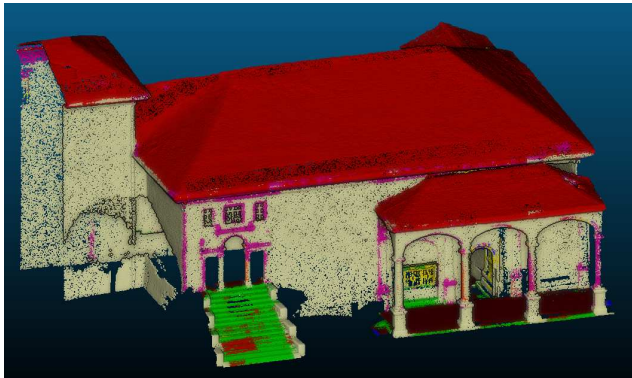
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_26

Overall Accuracy: **0.8452**

With normal vectors erroneously oriented on a portion of the roof: **0.8448**

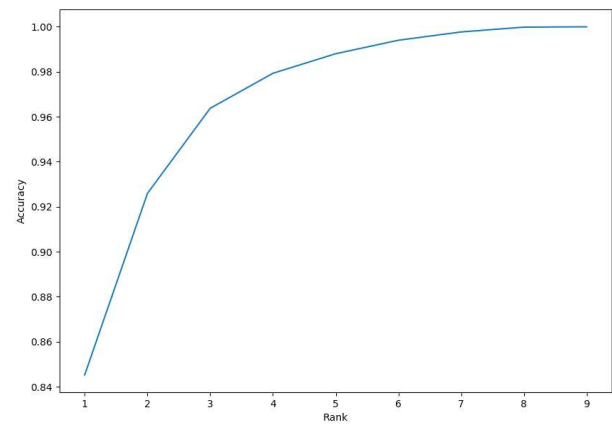
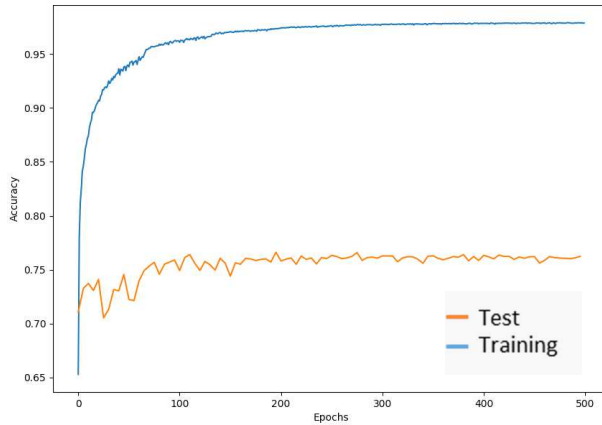
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 881.551627
eval accuracy: 0.845239

Accuracy:
0.8452389895260989

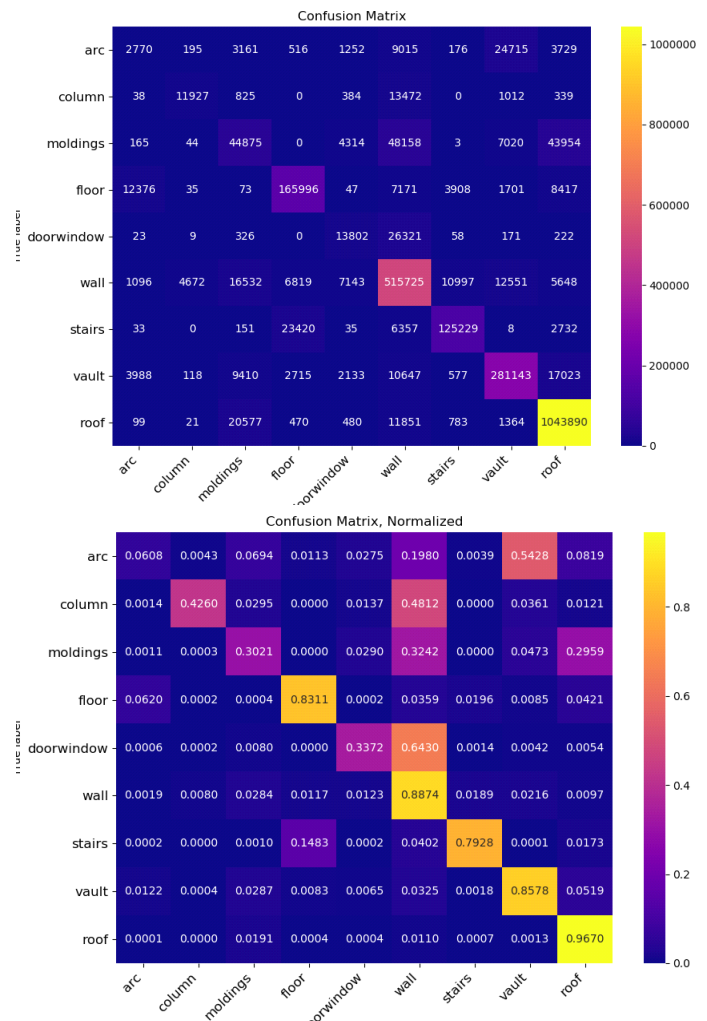
report:

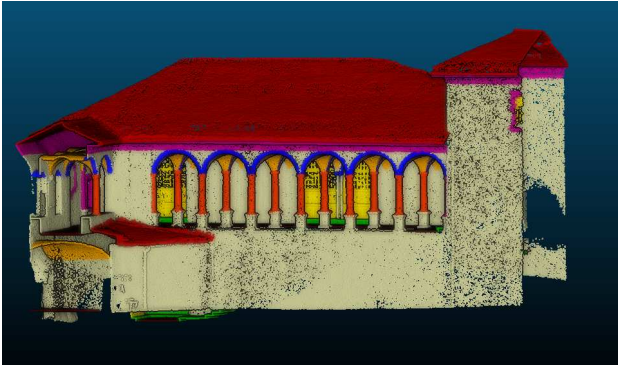
	precision	recall	f1-score	support
arc	0.1345	0.0608	0.0838	45529
column	0.7007	0.4260	0.5299	27997
moldings	0.4678	0.3021	0.3671	148533
floor	0.8302	0.8311	0.8307	199724
doorwindow	0.4664	0.3372	0.3914	40932
wall	0.7950	0.8874	0.8386	581183
stairs	0.8836	0.7928	0.8357	157965
vault	0.8528	0.8578	0.8553	327754
roof	0.9271	0.9670	0.9466	1079535
accuracy			0.8452	2609152
macro avg	0.6731	0.6069	0.6310	2609152
weighted avg	0.8287	0.8452	0.8343	2609152

Mean Jaccard (Mean_IoU):
0.5187158469197288

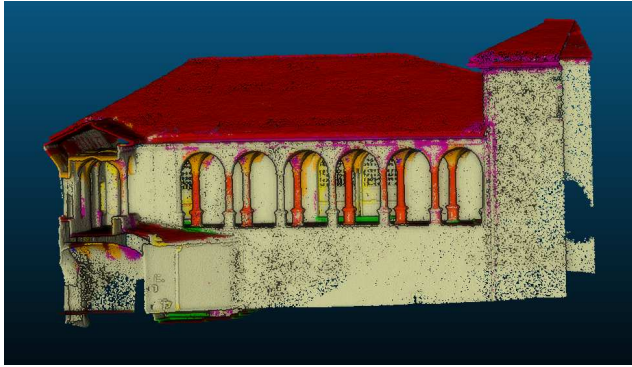
Jaccard:

- arc: 0.04372740619129556
- column: 0.3604303284881086
- moldings: 0.22483816662324388
- floor: 0.7104046836483155
- doorwindow: 0.24333568406205924
- wall: 0.7221269296740995
- stairs: 0.7177804398539552
- vault: 0.7471325764823437
- roof: 0.8986664072541385

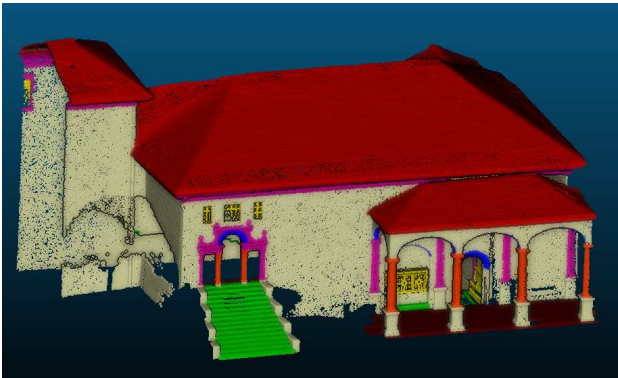




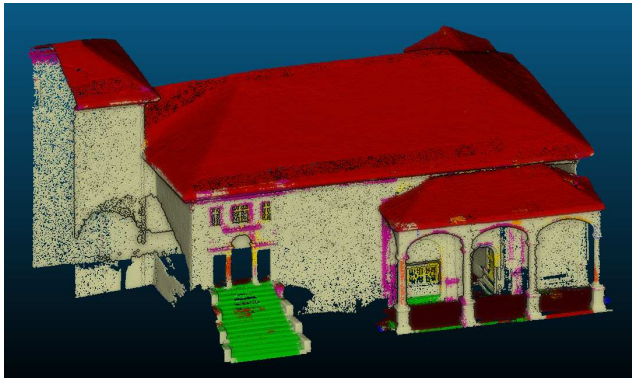
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_27

Overall Accuracy: **0.8350**

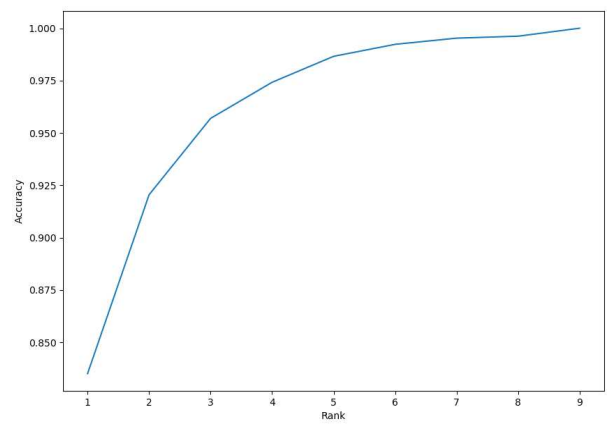
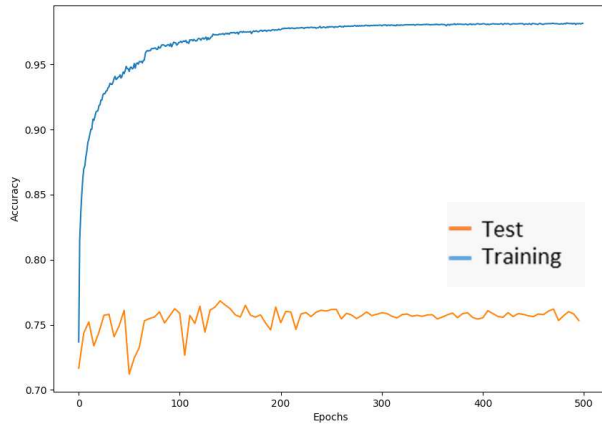
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 1.088251
eval accuracy: 0.835071

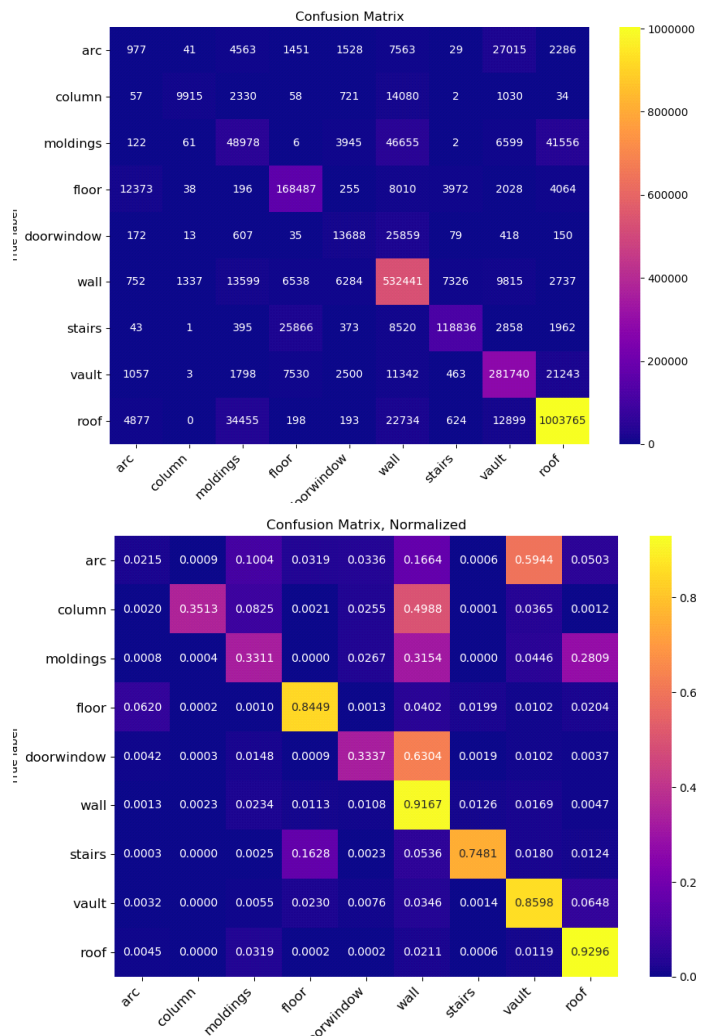
Accuracy:
0.8350709349244505

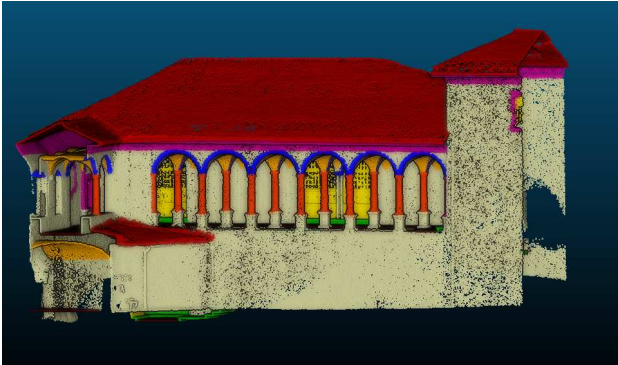
report:	precision	recall	f1-score	support
arc	0.0478	0.0215	0.0297	45453
column	0.8691	0.3513	0.5003	28227
moldings	0.4581	0.3311	0.3844	147924
floor	0.8017	0.8449	0.8227	199423
doorwindow	0.4642	0.3337	0.3883	41021
wall	0.7862	0.9167	0.8465	580829
stairs	0.9048	0.7481	0.8190	158854
vault	0.8181	0.8598	0.8384	327676
roof	0.9313	0.9296	0.9305	1079745
accuracy			0.8351	2609152
macro avg	0.6757	0.5930	0.6177	2609152
weighted avg	0.8230	0.8351	0.8254	2609152

Mean Jaccard (Mean_IoU):
0.5050412517599326

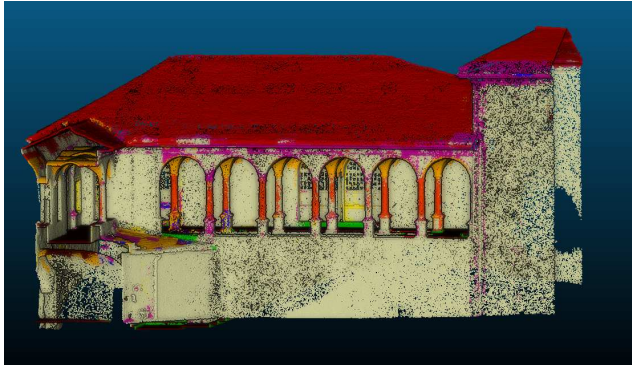
Jaccard:

- arc: 0.015052537515792068
- column: 0.3336025032805087
- moldings: 0.2379108842116512
- floor: 0.6988117210344041
- doorwindow: 0.2409010911650827
- wall: 0.733802191865401
- stairs: 0.6935238195283365
- vault: 0.7217847096618828
- roof: 0.869981807576334

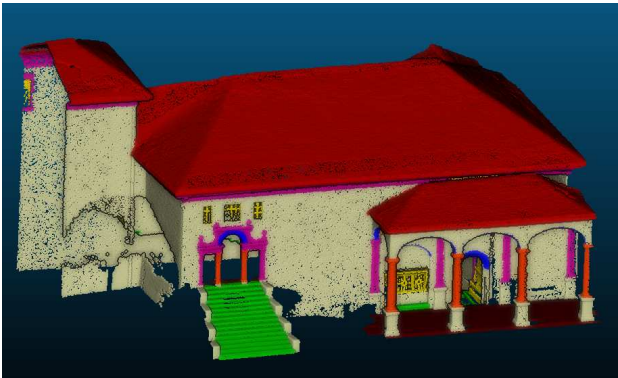




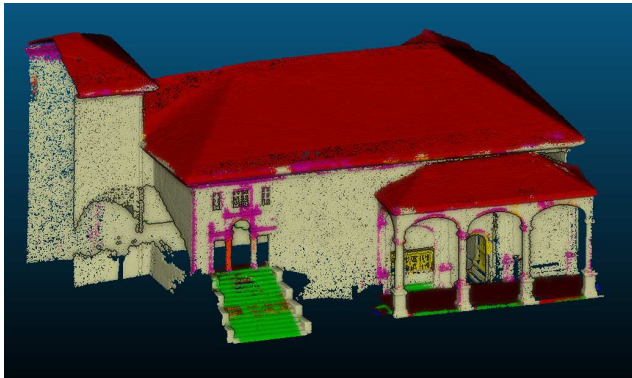
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_28

Overall Accuracy: **0.8448**

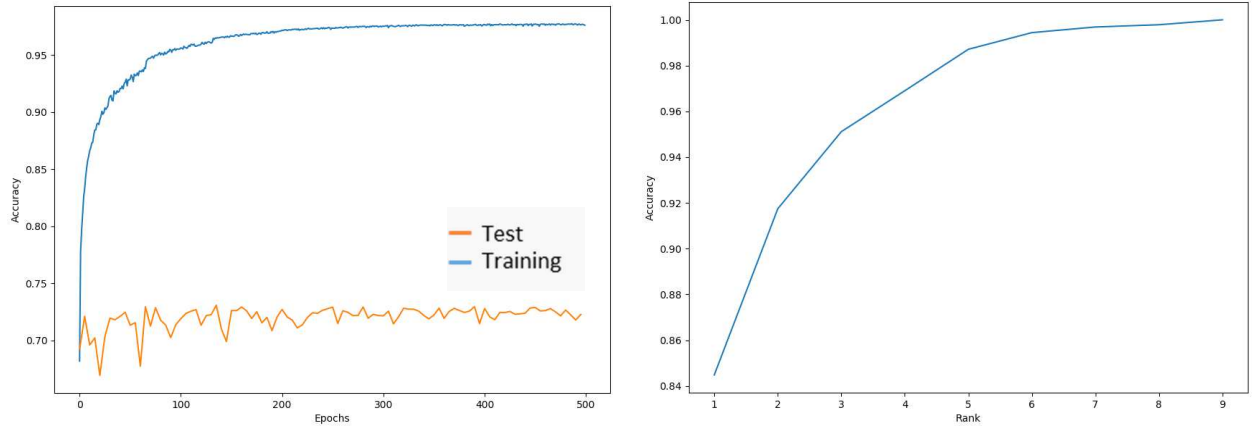
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

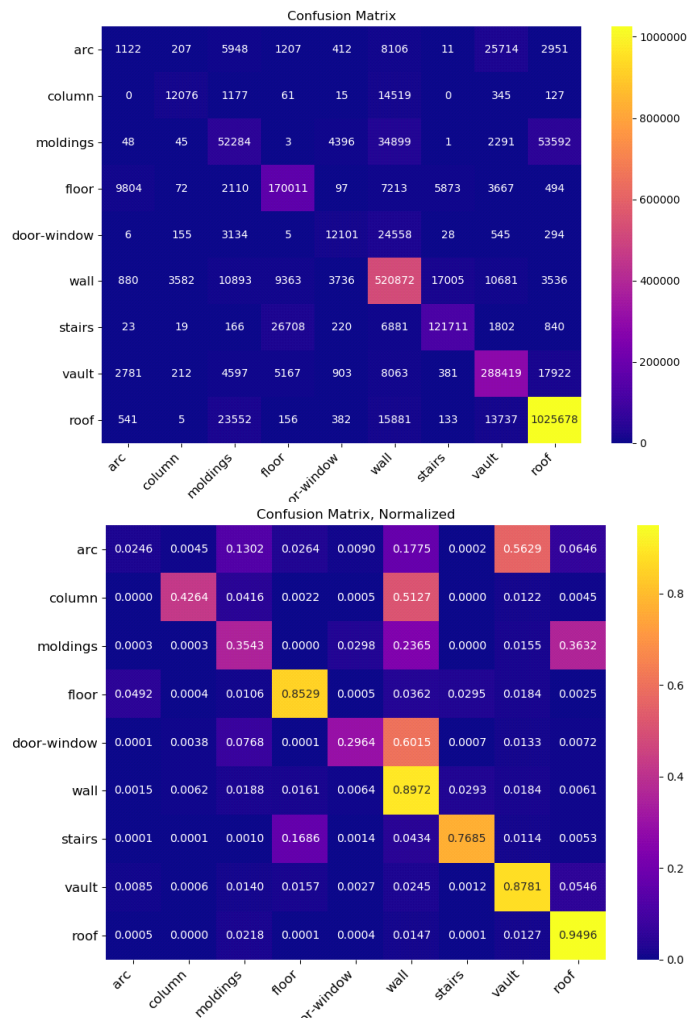
eval mean loss: 1031.192518
eval accuracy: 0.844824

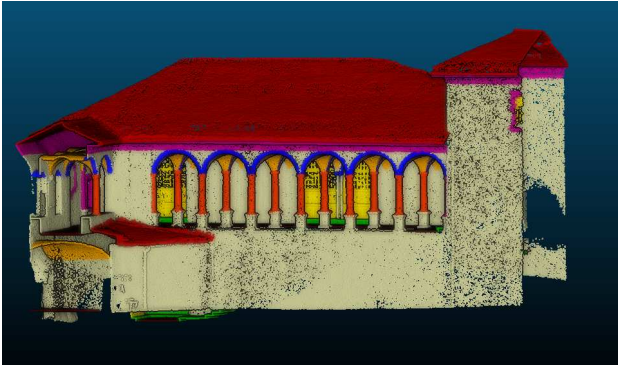
Accuracy:
0.8448239121369702

report:	precision	recall	f1-score	support
arc	0.0738	0.0246	0.0369	45678
column	0.7376	0.4264	0.5404	28320
moldings	0.5034	0.3543	0.4159	147559
floor	0.7994	0.8529	0.8253	199341
door-window	0.5436	0.2964	0.3836	40826
wall	0.8126	0.8972	0.8528	580548
stairs	0.8386	0.7685	0.8020	158370
vault	0.8307	0.8781	0.8538	328445
roof	0.9279	0.9496	0.9386	1080065
accuracy			0.8448	2609152
macro avg	0.6742	0.6053	0.6277	2609152
weighted avg	0.8277	0.8448	0.8335	2609152

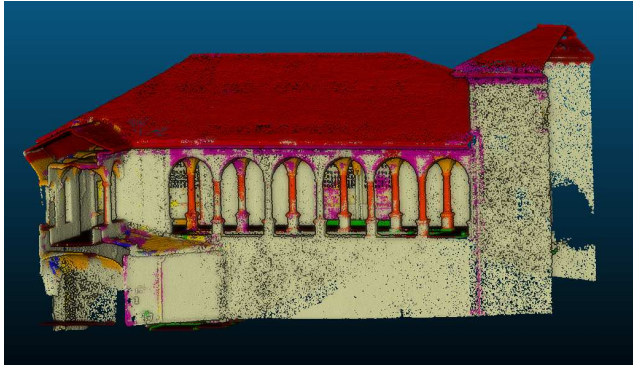
Mean Jaccard (Mean_IoU):
0.5148255864126497

Jaccard:
- arc: 0.01877478623182343
- column: 0.3702363798019438
- moldings: 0.26255423429214203
- floor: 0.7024928618947073
- door-window: 0.23733500696255908
- wall: 0.7433934473959136
- stairs: 0.6694700828373725
- vault: 0.7448318428208777
- roof: 0.8843416354765089

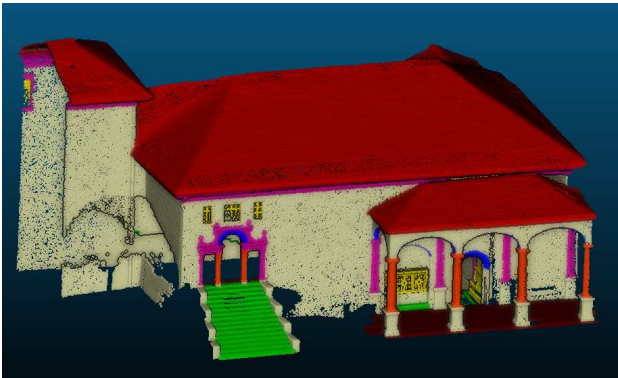




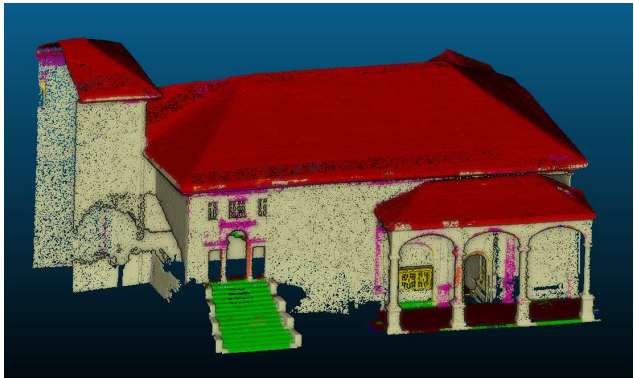
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_29

Overall Accuracy: **0.7744**

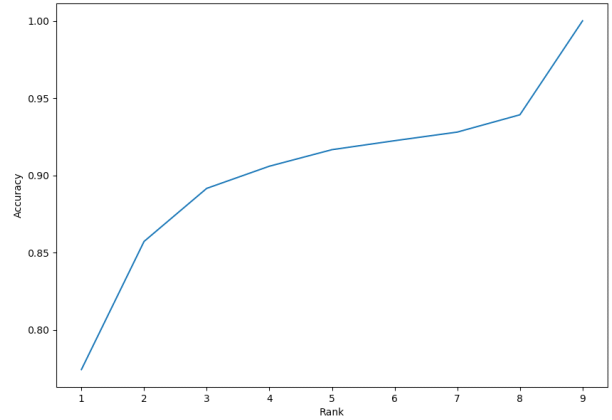
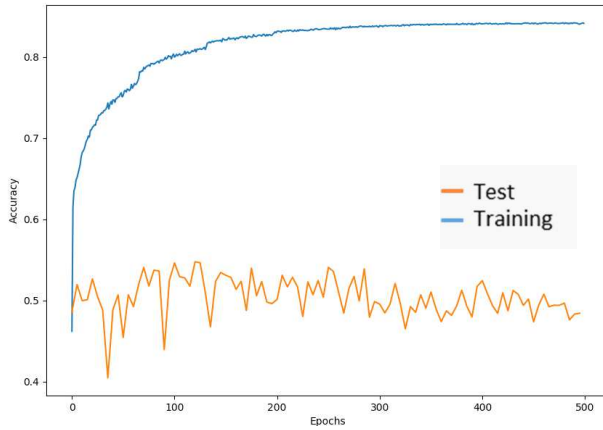
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 2174.671181

eval accuracy: 0.774450

Accuracy:

0.7744497062647174

report:

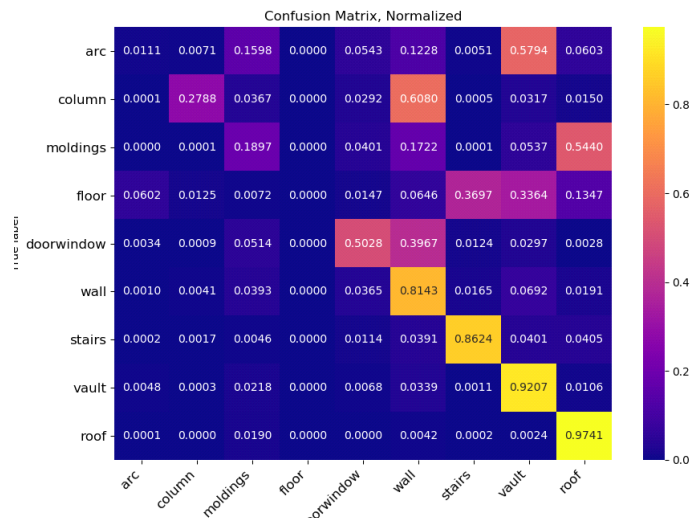
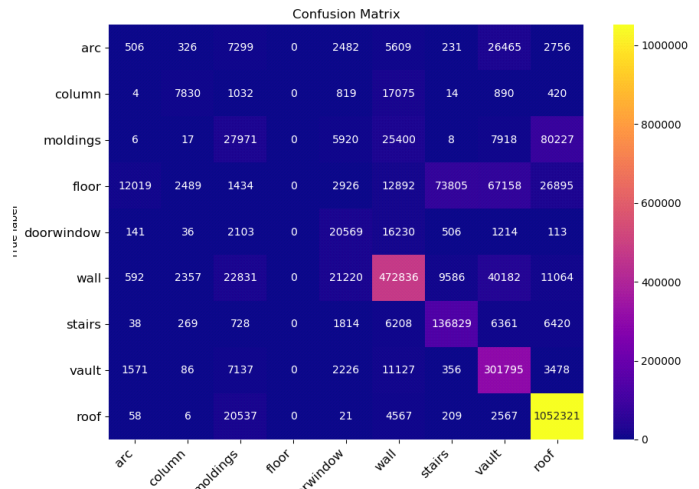
	precision	recall	f1-score	support
arc	0.0339	0.0111	0.0167	45674
column	0.5836	0.2788	0.3773	28084
moldings	0.3071	0.1897	0.2345	147467
floor	0.0000	0.0000	0.0000	199618
doorwindow	0.3547	0.5028	0.4159	40912
wall	0.8267	0.8143	0.8205	580668
stairs	0.6176	0.8624	0.7198	158667
vault	0.6639	0.9207	0.7715	327776
roof	0.8890	0.9741	0.9296	1080286
accuracy			0.7744	2609152
macro avg	0.4752	0.5060	0.4762	2609152
weighted avg	0.7028	0.7744	0.7323	2609152

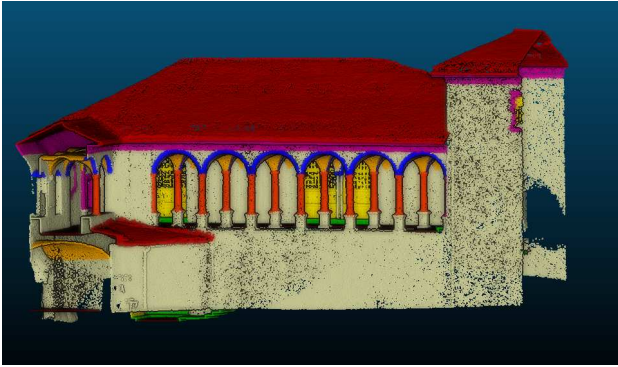
Mean Jaccard (Mean_IoU):

0.3767424685665054

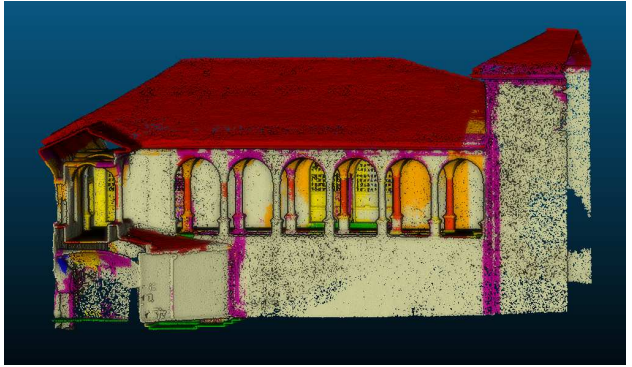
Jaccard:

- arc: 0.00841888092108547
- column: 0.23255123255123256
- moldings: 0.1328359484822005
- floor: 0.0
- doorwindow: 0.2625606331376053
- wall: 0.6955761898037001
- stairs: 0.5621985192002695
- vault: 0.6280448087636386
- roof: 0.8684960042388163

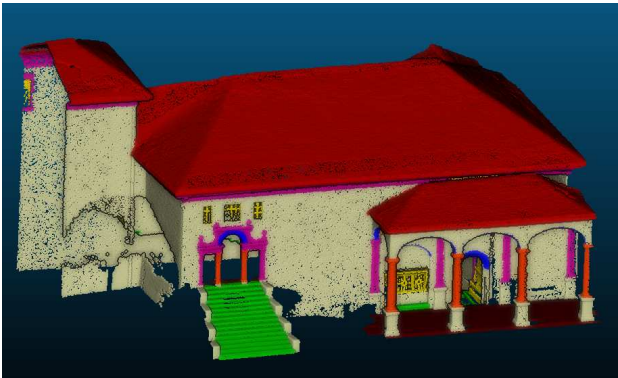




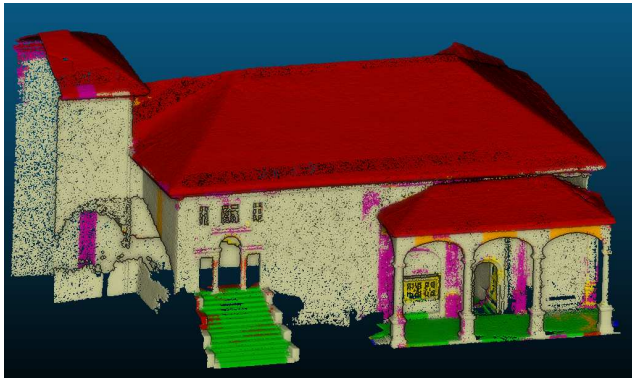
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_30

Overall Accuracy: **0.8409**

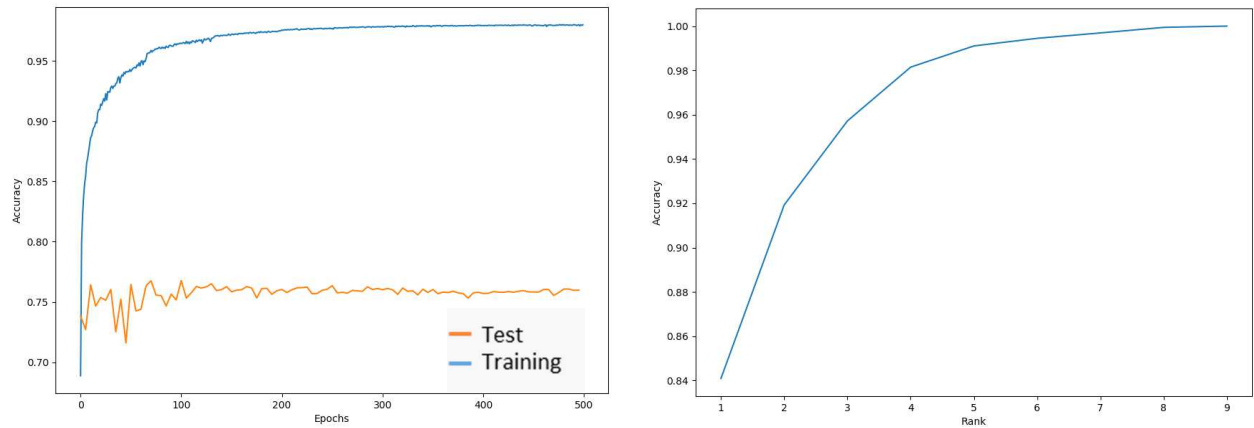
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 834.284829
eval accuracy: 0.840968

Accuracy:
0.8409678700206044

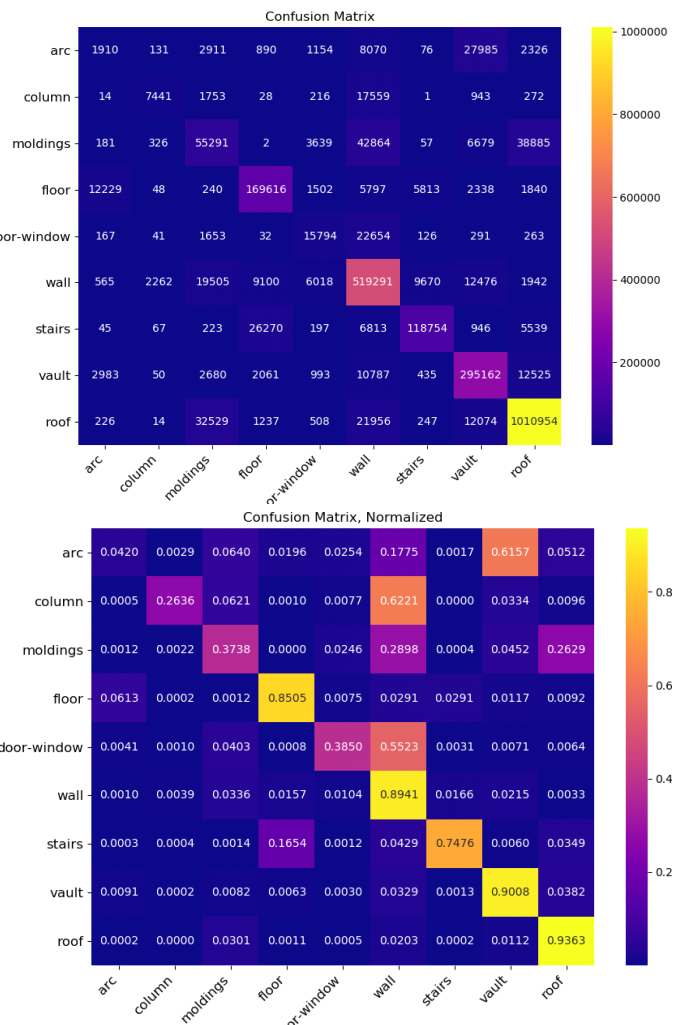
report:

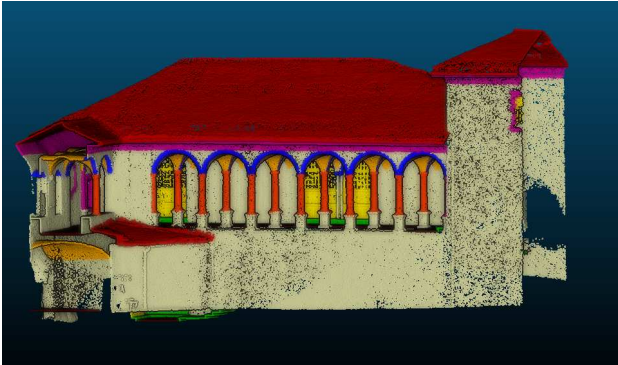
	precision	recall	f1-score	support
arc	0.1043	0.0420	0.0599	45453
column	0.7169	0.2636	0.3855	28227
moldings	0.4734	0.3738	0.4177	147924
floor	0.8106	0.8505	0.8301	199423
door-window	0.5261	0.3850	0.4446	41021
wall	0.7919	0.8941	0.8399	580829
stairs	0.8785	0.7476	0.8078	158854
vault	0.8224	0.9008	0.8598	327676
roof	0.9408	0.9363	0.9385	1079745
accuracy			0.8410	2609152
macro avg	0.6739	0.5993	0.6204	2609152
weighted avg	0.8290	0.8410	0.8319	2609152

Mean Jaccard (Mean_IoU):
0.5076490855968214

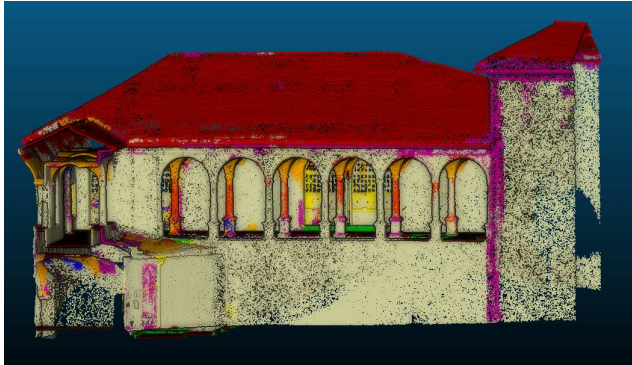
Jaccard:

- arc: 0.030874674684383235
- column: 0.23875377013412052
- moldings: 0.26402219484476025
- floor: 0.7095627146580322
- door-window: 0.2858746017955401
- wall: 0.7239230534385198
- stairs: 0.6775141346082532
- vault: 0.7541031353472591
- roof: 0.8842134908605249

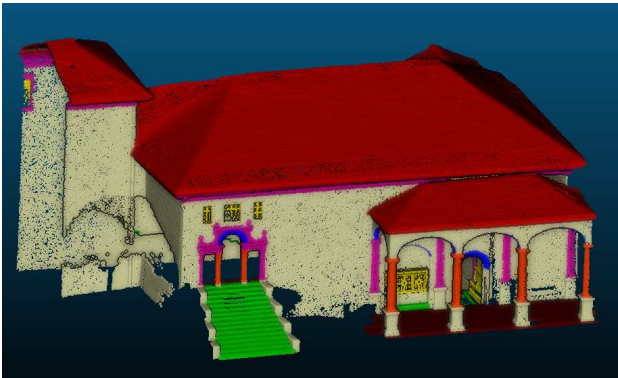




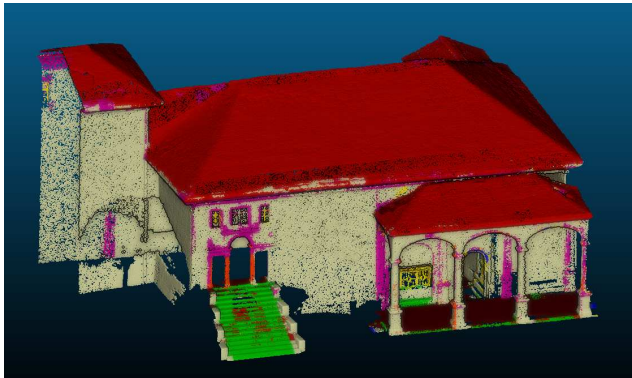
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_31

Overall Accuracy: **0.8469**

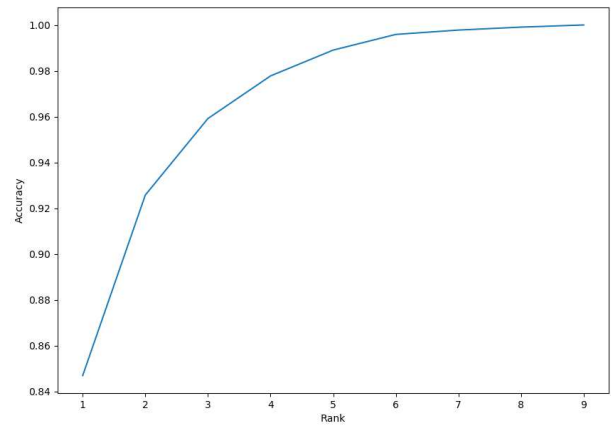
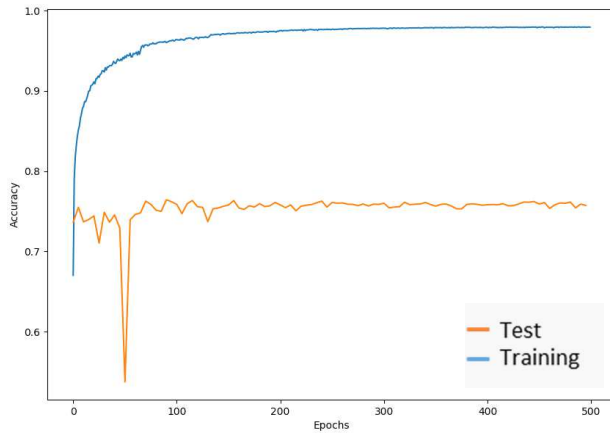
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 849.505518

eval accuracy: 0.846962

Accuracy:

0.8469621547537284

report:

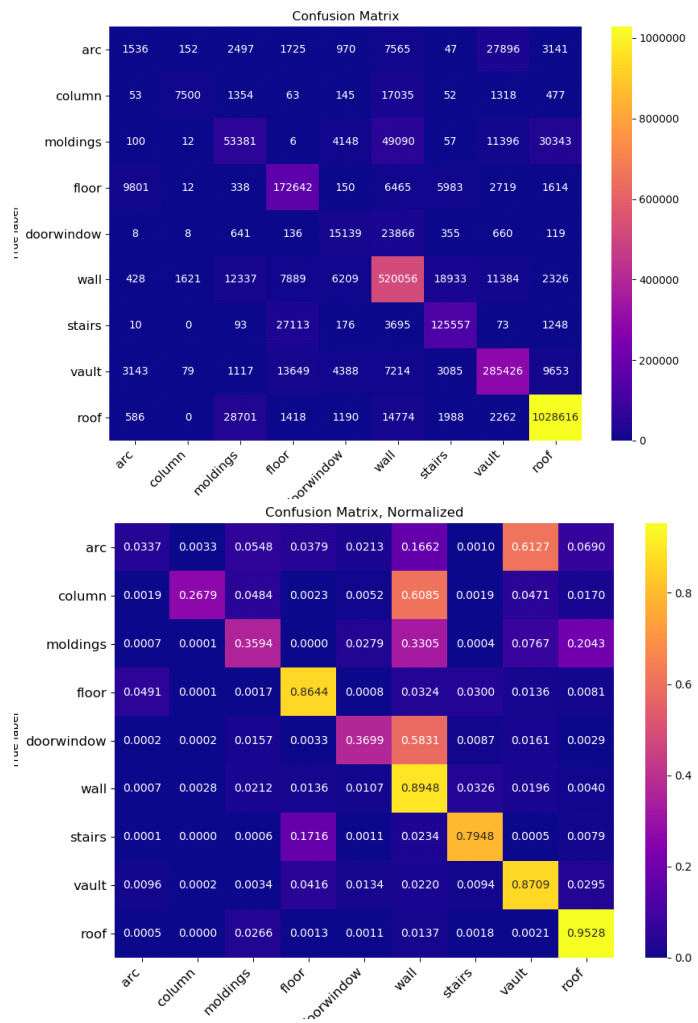
	precision	recall	f1-score	support
arc	0.0981	0.0337	0.0502	45529
column	0.7992	0.2679	0.4013	27997
moldings	0.5314	0.3594	0.4288	148533
floor	0.7685	0.8644	0.8136	199724
doorwindow	0.4656	0.3699	0.4122	40932
wall	0.8004	0.8948	0.8450	581183
stairs	0.8046	0.7948	0.7997	157965
vault	0.8318	0.8709	0.8509	327754
roof	0.9546	0.9528	0.9537	1079535
accuracy			0.8470	2609152
macro avg	0.6727	0.6010	0.6173	2609152
weighted avg	0.8331	0.8470	0.8365	2609152

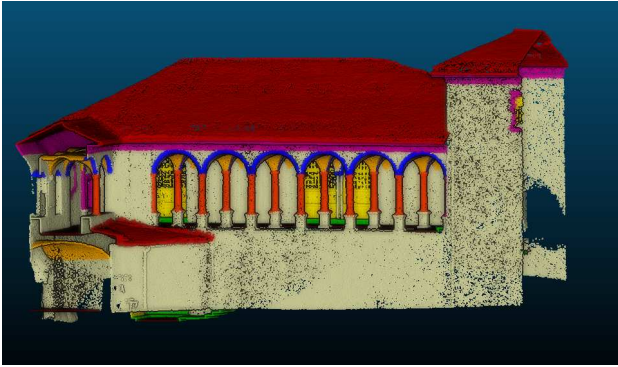
Mean Jaccard (Mean_IoU):

0.5049873724231039

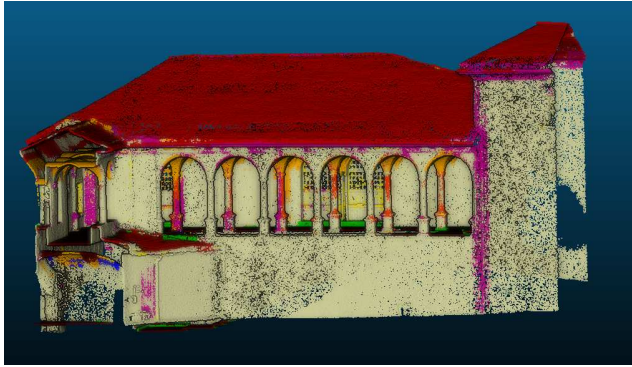
Jaccard:

- arc: 0.02574675651211908
- column: 0.25099561594324155
- moldings: 0.27289365117503617
- floor: 0.6858411825697295
- doorwindow: 0.25963847156479386
- wall: 0.73155930548737
- stairs: 0.6662085798424111
- vault: 0.7404776605735455
- roof: 0.9115251281396882

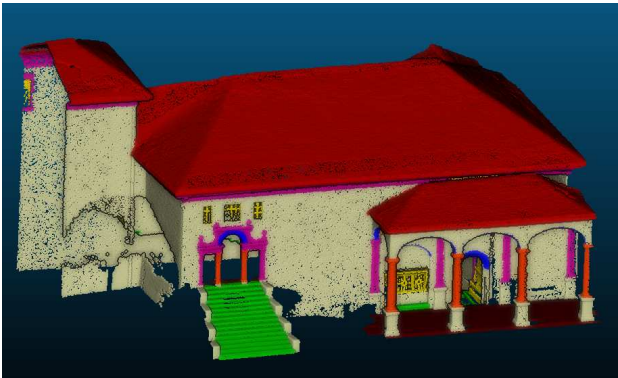




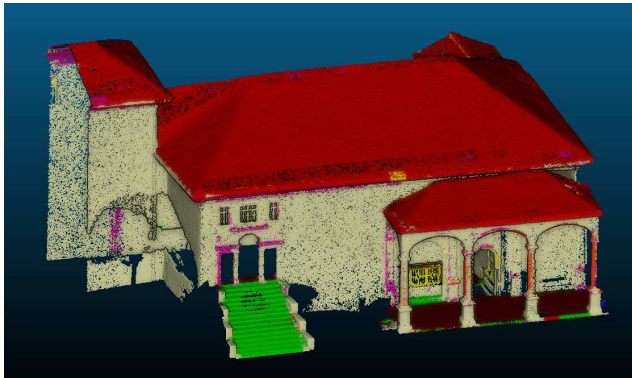
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_32

Overall Accuracy: **0.8491**

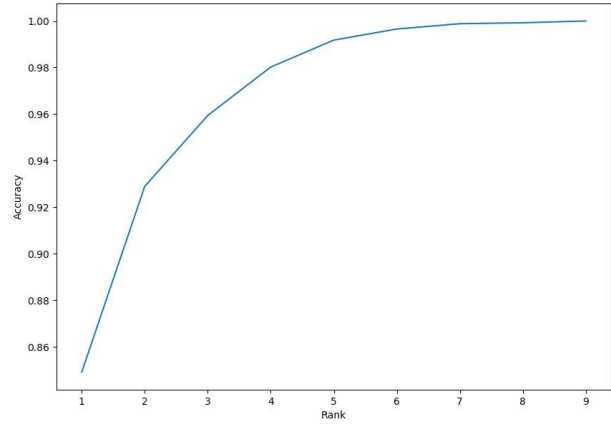
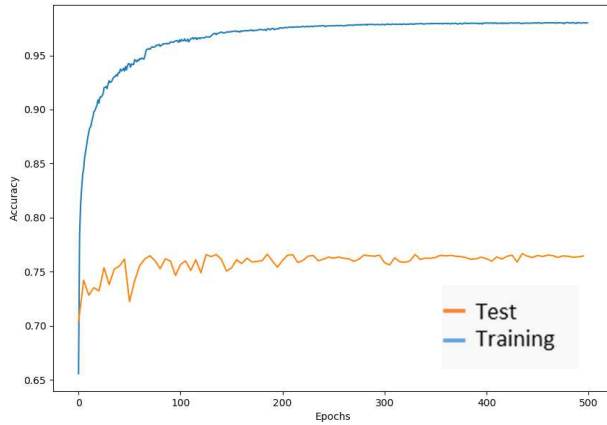
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

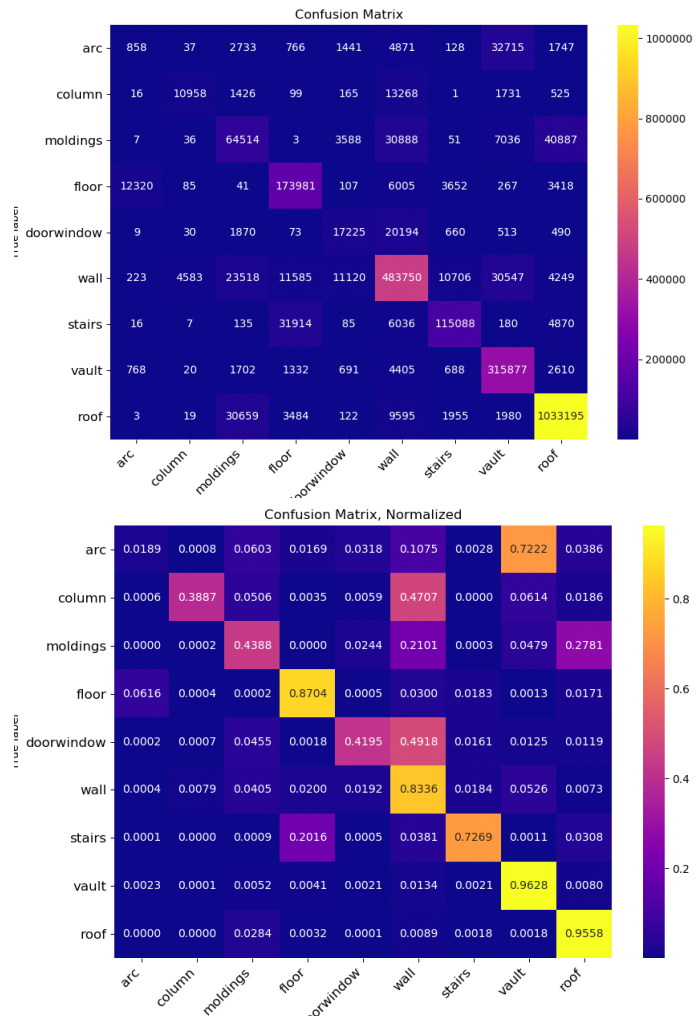
eval mean loss: 1132.364260
eval accuracy: 0.849106

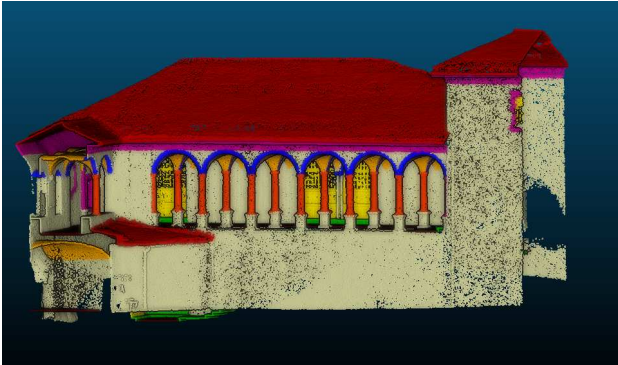
Accuracy:
0.8491057630985086

report:	precision	recall	f1-score	support
arc	0.0603	0.0189	0.0288	45296
column	0.6946	0.3887	0.4985	28189
moldings	0.5096	0.4388	0.4716	147010
floor	0.7794	0.8704	0.8224	199876
doorwindow	0.4986	0.4195	0.4556	41064
wall	0.8355	0.8336	0.8346	580281
stairs	0.8658	0.7269	0.7903	158331
vault	0.8082	0.9628	0.8787	328093
roof	0.9462	0.9558	0.9509	1081012
accuracy			0.8491	2609152
macro avg	0.6665	0.6239	0.6368	2609152
weighted avg	0.8368	0.8491	0.8407	2609152

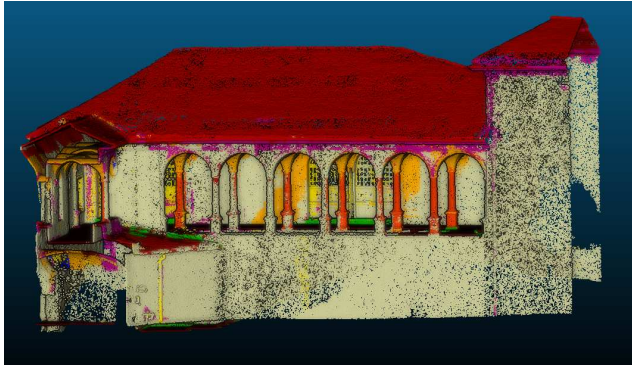
Mean Jaccard (Mean_IoU):
0.5231188796868977

Jaccard:
- arc: 0.014627160830577244
- column: 0.3320002423801733
- moldings: 0.30854065635551475
- floor: 0.6983486665703322
- doorwindow: 0.2950345134713872
- wall: 0.7160906115524844
- stairs: 0.653270667302409
- vault: 0.7836933275773951
- roof: 0.9064640711418064

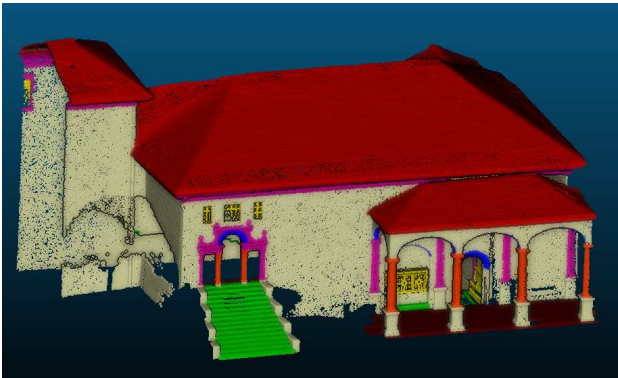




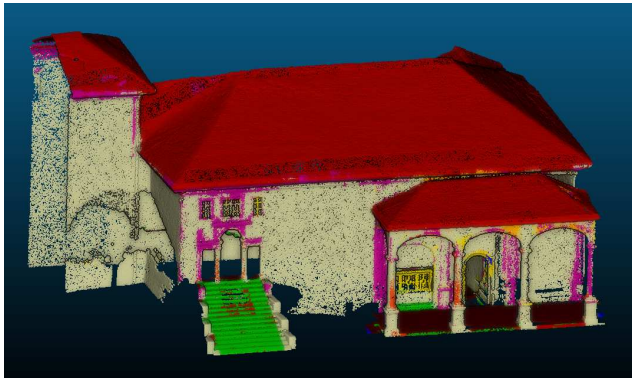
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_33

Overall Accuracy: **0.8403**

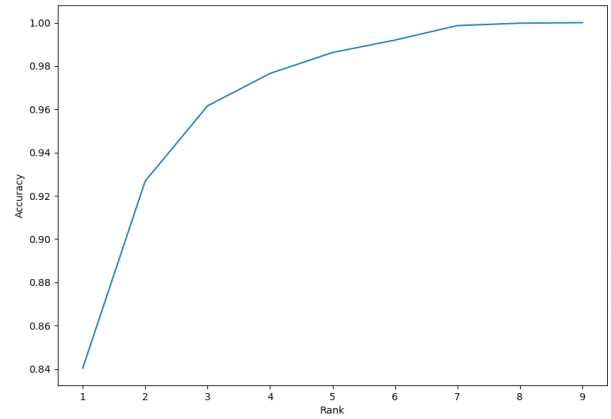
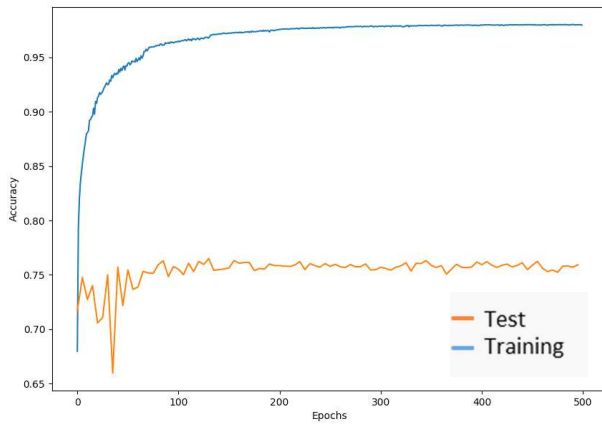
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z H S V Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

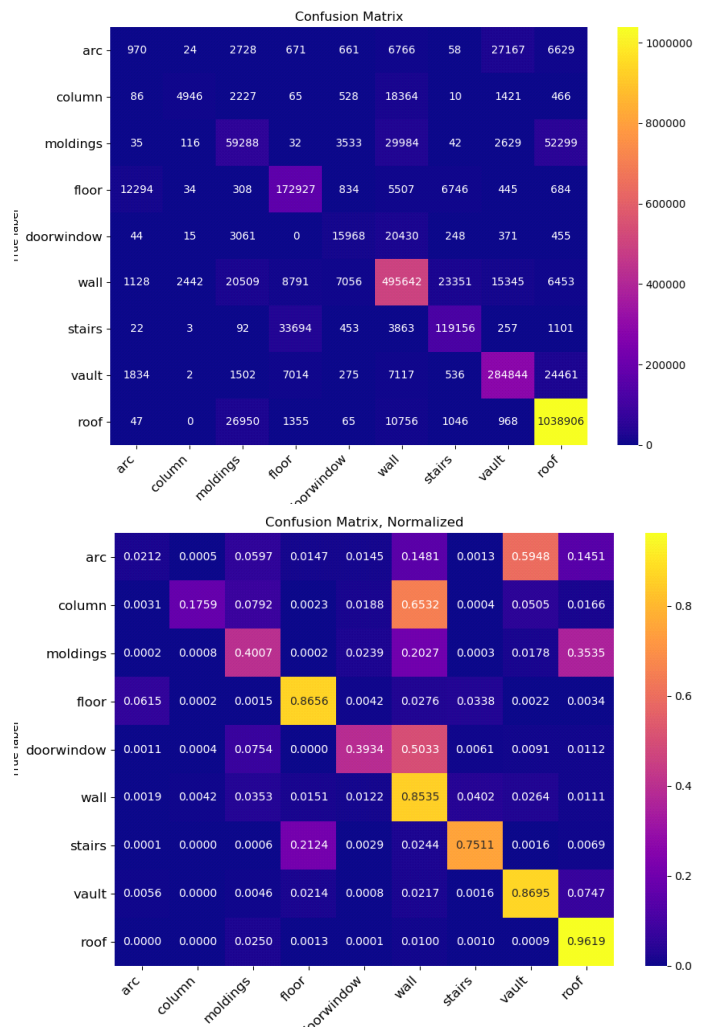
eval mean loss: 913.304535
eval accuracy: 0.840368

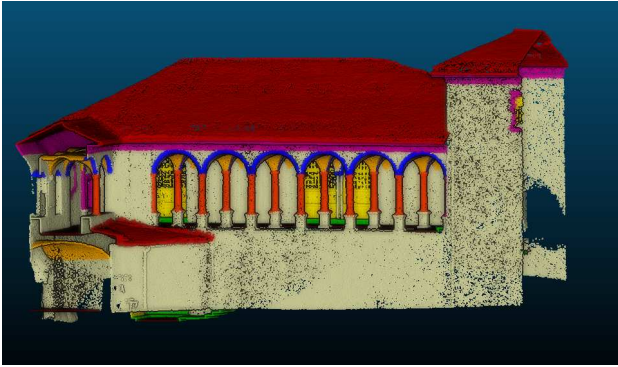
Accuracy:
0.8403676750147174

report:	precision	recall	f1-score	support
arc	0.0589	0.0212	0.0312	45674
column	0.6523	0.1759	0.2771	28113
moldings	0.5082	0.4007	0.4481	147958
floor	0.7701	0.8656	0.8151	199779
doorwindow	0.5436	0.3934	0.4565	40592
wall	0.8282	0.8535	0.8407	580717
stairs	0.7881	0.7511	0.7692	158641
vault	0.8542	0.8695	0.8618	327585
roof	0.9182	0.9619	0.9395	1080093
accuracy			0.8404	2609152
macro avg	0.6580	0.5881	0.6043	2609152
weighted avg	0.8239	0.8404	0.8295	2609152

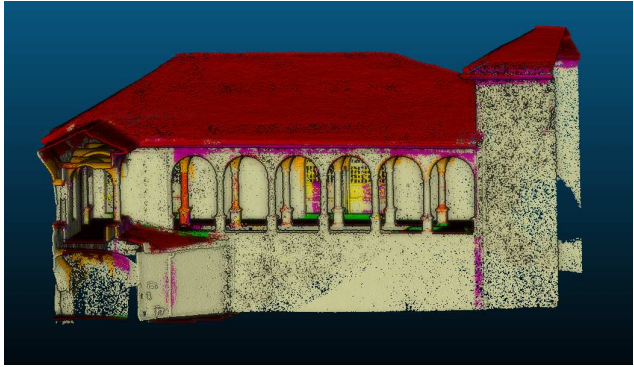
Mean Jaccard (Mean_IoU):
0.49357954307414975

Jaccard:
- arc: 0.015859002027336342
- column: 0.16085075937428858
- moldings: 0.2887379160883434
- floor: 0.6878532702733879
- doorwindow: 0.2957201325999593
- wall: 0.725148645801634
- stairs: 0.6249069111276603
- vault: 0.7571852371686497
- roof: 0.8859540132060878





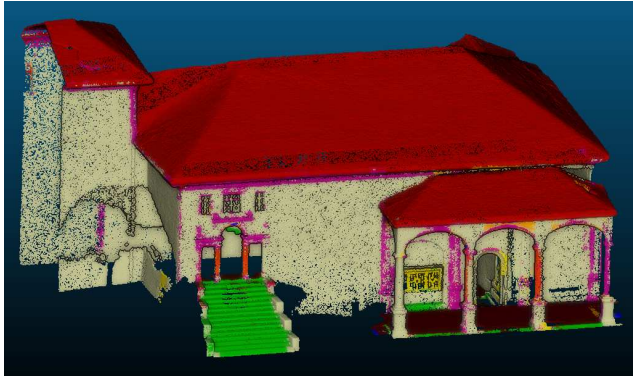
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMV_34

Overall Accuracy: **0.8628**

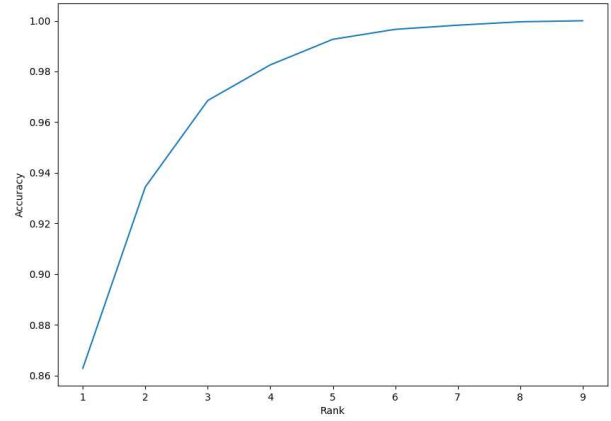
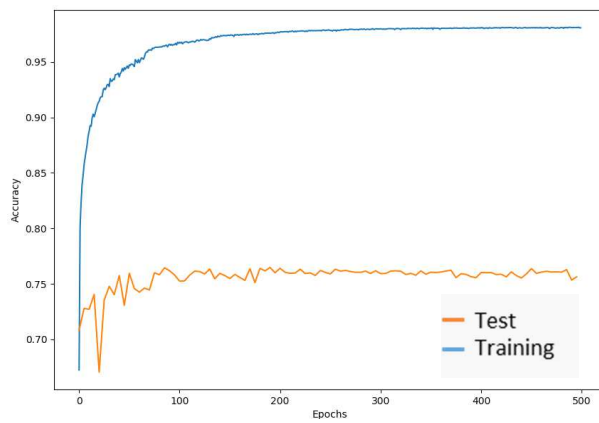
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z L A B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

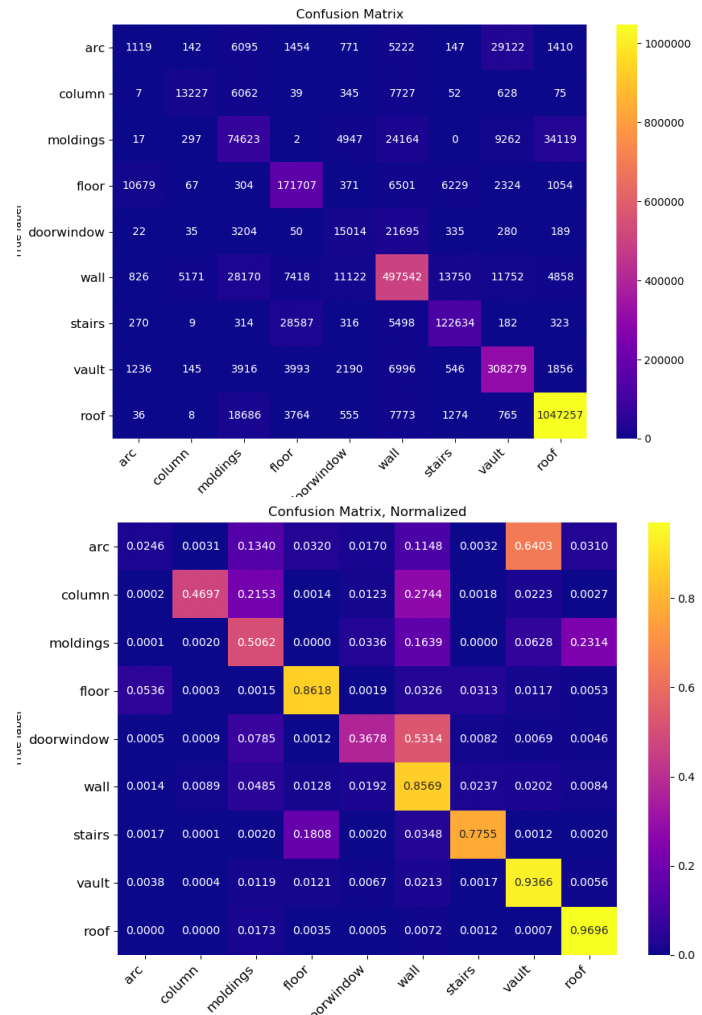
eval mean loss: 737.585571
eval accuracy: 0.862886

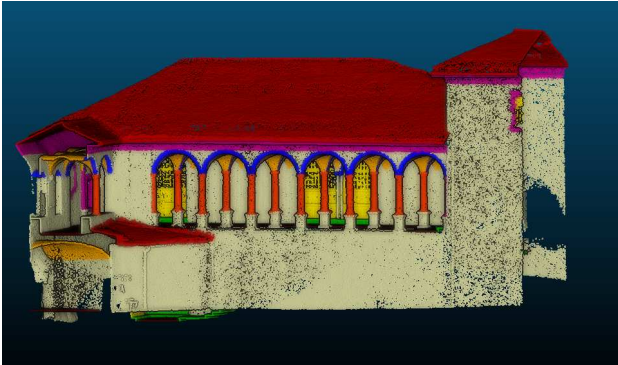
Accuracy:
0.8628864857240973

report:	precision	recall	f1-score	support
arc	0.0787	0.0246	0.0375	45482
column	0.6925	0.4697	0.5597	28162
moldings	0.5278	0.5062	0.5168	147431
floor	0.7912	0.8618	0.8250	199236
doorwindow	0.4214	0.3678	0.3928	40824
wall	0.8532	0.8569	0.8551	580609
stairs	0.8459	0.7755	0.8092	158133
vault	0.8502	0.9366	0.8913	329157
roof	0.9598	0.9696	0.9647	1080118
accuracy			0.8629	2609152
macro avg	0.6690	0.6410	0.6502	2609152
weighted avg	0.8514	0.8629	0.8561	2609152

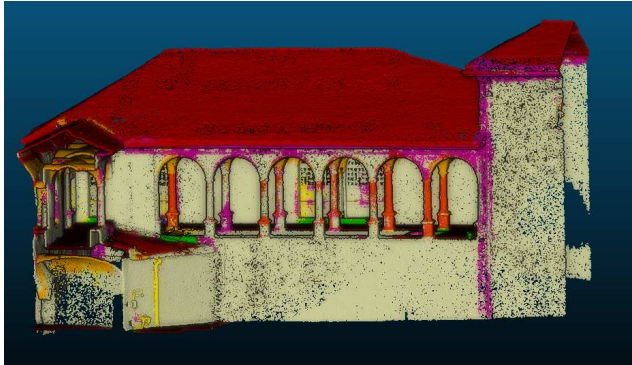
Mean Jaccard (Mean_IoU):
0.5405200404554952

Jaccard:
- arc: 0.01910371318822023
- column: 0.38861793395228583
- moldings: 0.34840929676630156
- floor: 0.7021546312918382
- doorwindow: 0.24436451229634934
- wall: 0.7468526010042256
- stairs: 0.6795407445169728
- vault: 0.8039152793424291
- roof: 0.9317216517408332

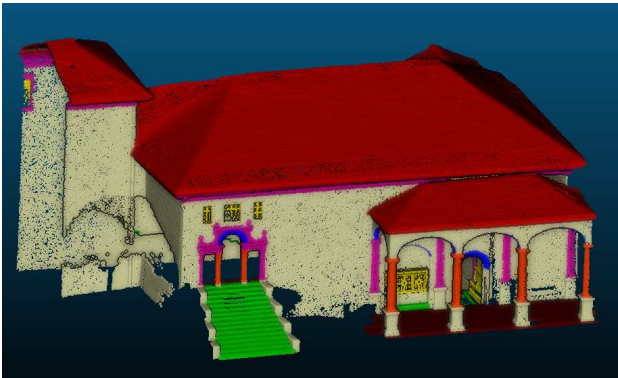




Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Tests with the whole ArCH benchmark on the Pilato's building from the SMV

TEST: B_SMV_1

Overall Accuracy: **0.8368**

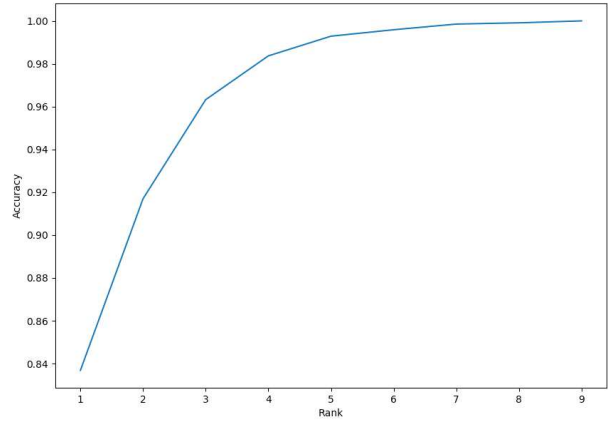
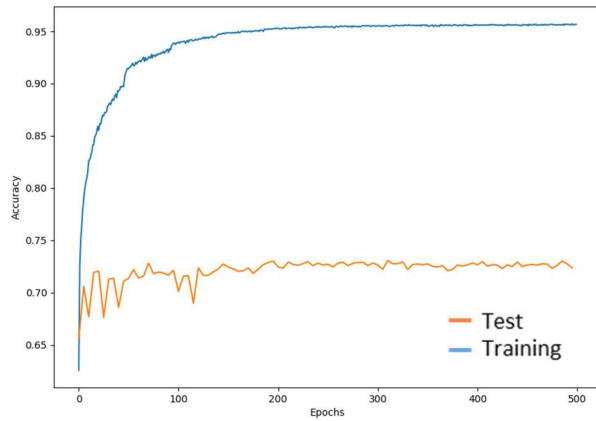
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 0.800134
eval accuracy: 0.836875

Accuracy:
0.8368753526049842

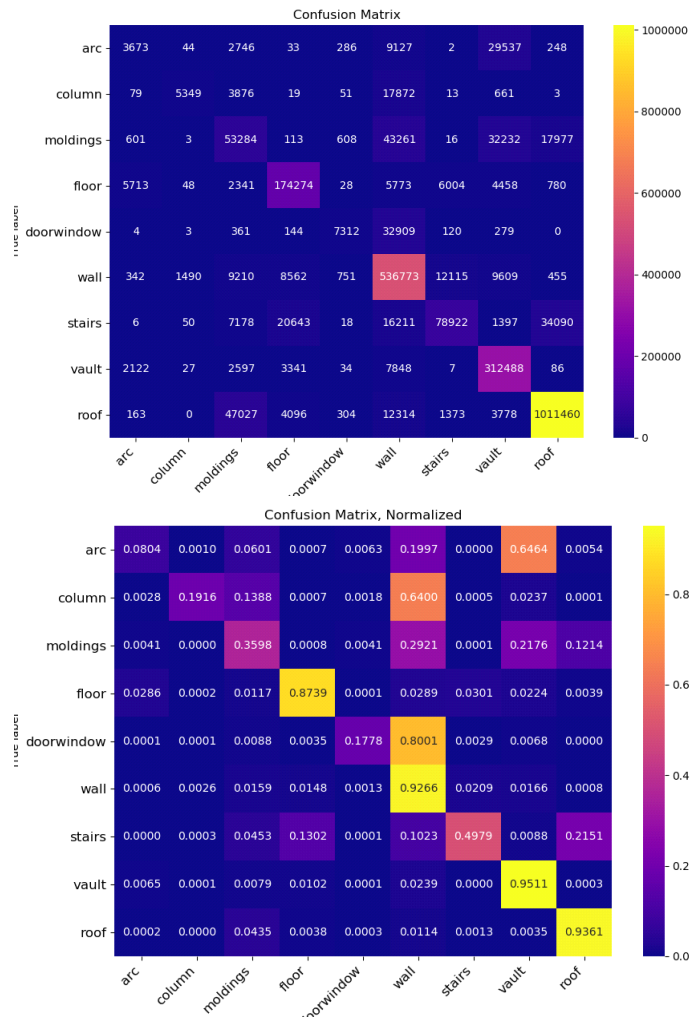
report:

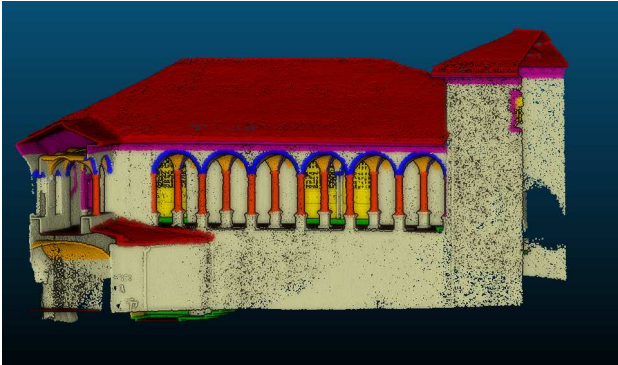
	precision	recall	f1-score	support
arc	0.2891	0.0804	0.1258	45696
column	0.7626	0.1916	0.3062	27923
moldings	0.4143	0.3598	0.3851	148095
floor	0.8251	0.8739	0.8488	199419
doorwindow	0.7785	0.1778	0.2894	41132
wall	0.7870	0.9266	0.8511	579307
stairs	0.8007	0.4979	0.6140	158515
vault	0.7922	0.9511	0.8644	328550
roof	0.9496	0.9361	0.9428	1080515
accuracy			0.8369	2609152
macro avg	0.7110	0.5550	0.5808	2609152
weighted avg	0.8285	0.8369	0.8223	2609152

Mean Jaccard (Mean_IoU):
0.4699637725325119

Jaccard:

- arc: 0.06711617878156635
- column: 0.1807827497634176
- moldings: 0.23848078377664692
- floor: 0.7372932267208191
- doorwindow: 0.16921225585485514
- wall: 0.7407627701063451
- stairs: 0.44297140291303005
- vault: 0.7612356608144681
- roof: 0.891818924061459

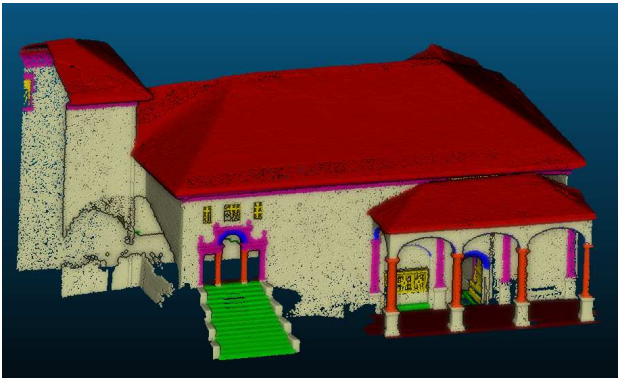




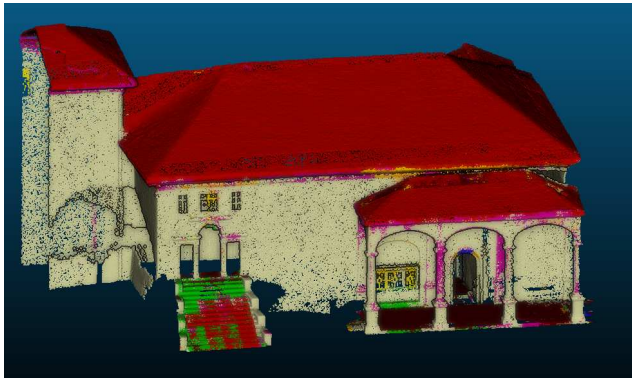
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMV_2

Overall Accuracy: **0.8318**

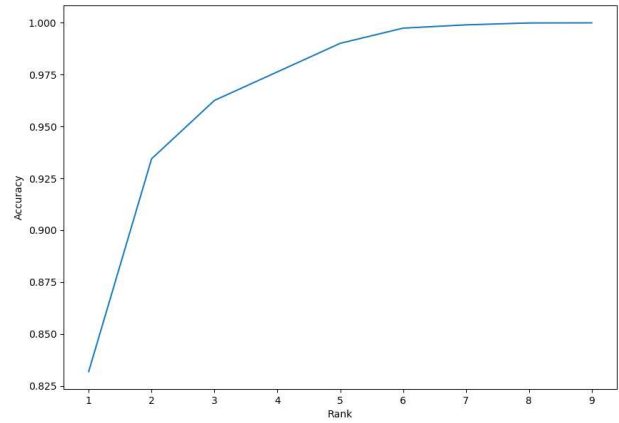
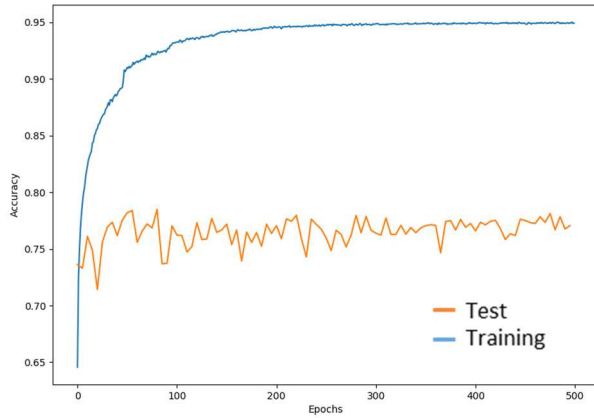
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 0.887864
eval accuracy: 0.831896

Accuracy:
0.8318959570005887

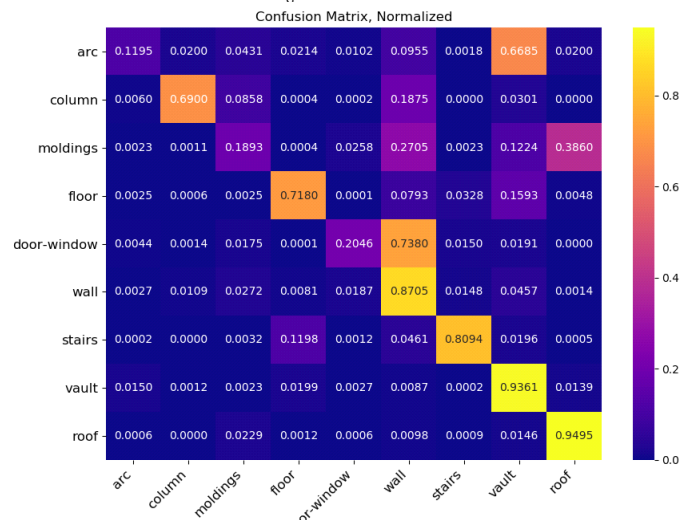
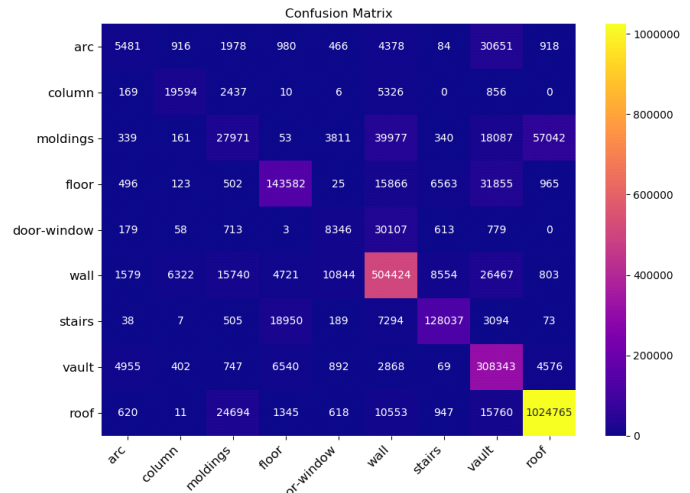
report:

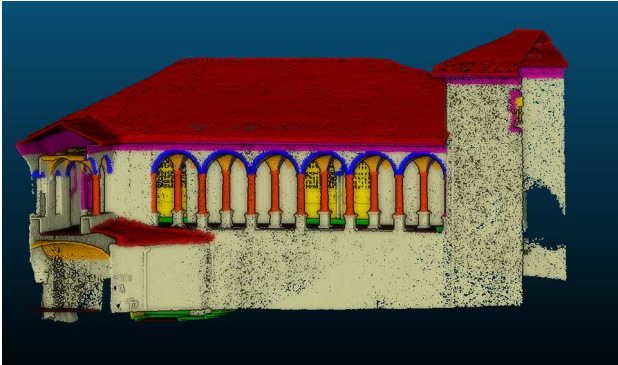
	precision	recall	f1-score	support
arc	0.3956	0.1195	0.1836	45852
column	0.7101	0.6900	0.6999	28398
moldings	0.3715	0.1893	0.2508	147781
floor	0.8150	0.7180	0.7634	199977
door-window	0.3312	0.2046	0.2529	40798
wall	0.8125	0.8705	0.8405	579454
stairs	0.8818	0.8094	0.8440	158187
vault	0.7074	0.9361	0.8058	329392
roof	0.9409	0.9495	0.9452	1079313
accuracy			0.8319	2609152
macro avg	0.6629	0.6096	0.6207	2609152
weighted avg	0.8158	0.8319	0.8181	2609152

Mean Jaccard (Mean_IoU):
0.507865295377123

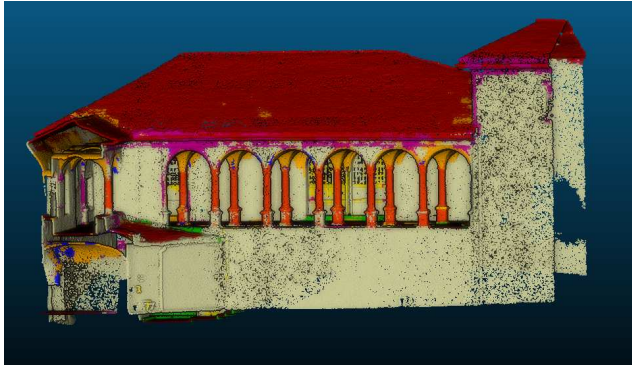
Jaccard:

- arc: 0.10107511018496321
- column: 0.5383262816638277
- moldings: 0.14336970840146185
- floor: 0.6173472239540113
- door-window: 0.14477267602213395
- wall: 0.7249314840124572
- stairs: 0.7301504929942917
- vault: 0.67479827811468
- roof: 0.89601640304628

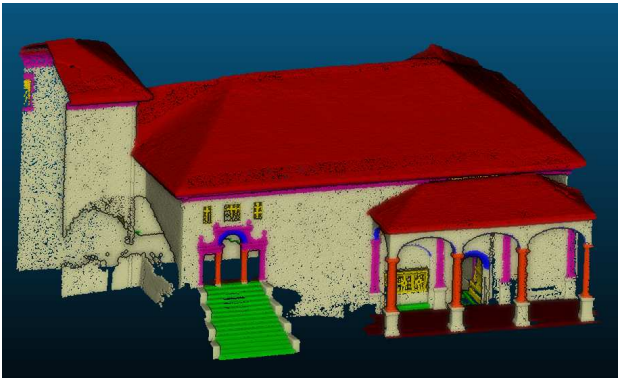




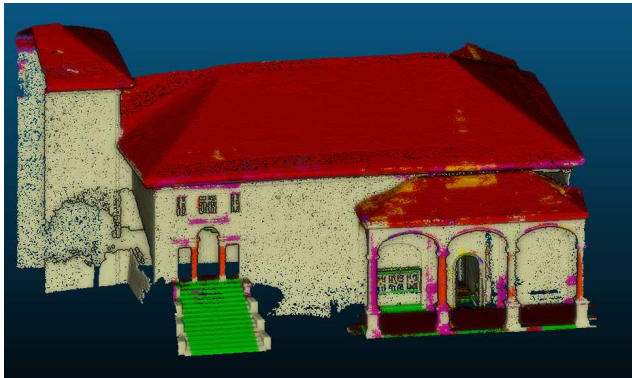
Ground truth



Predicted



Ground truth



Predicted

■ Wall ■ Floor ■ Roof ■ Column ■ Moldings ■ Vault ■ Arch ■ Stair ■ Window/Door

TEST: B_SMV_3

Overall Accuracy: **0.8535**

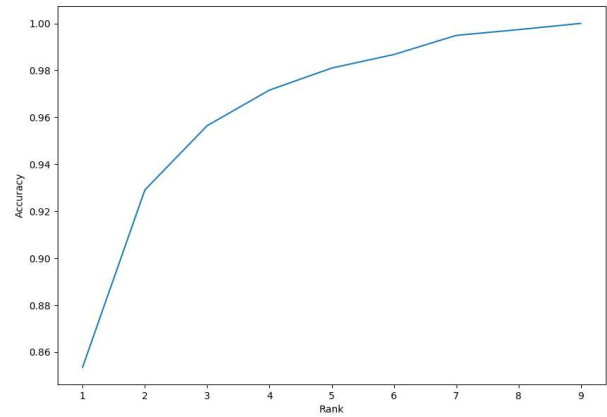
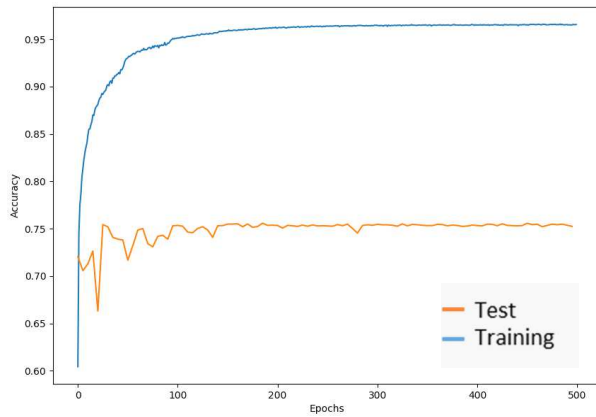
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

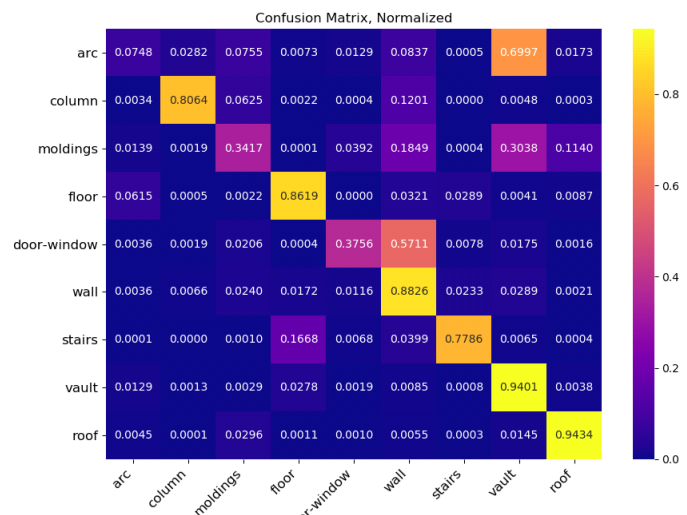
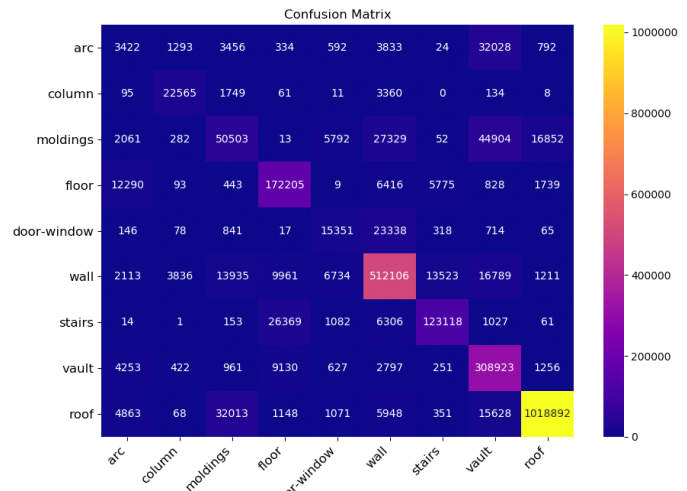
eval mean loss: 721.637469
eval accuracy: 0.853567

Accuracy:
0.8535665994162088

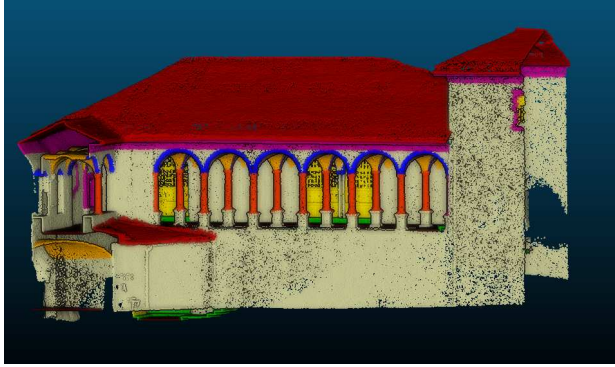
report:	precision	recall	f1-score	support
arc	0.1170	0.0748	0.0912	45774
column	0.7879	0.8064	0.7971	27983
moldings	0.4854	0.3417	0.4011	147788
floor	0.7855	0.8619	0.8219	199798
door-window	0.4909	0.3756	0.4256	40868
wall	0.8659	0.8826	0.8742	580208
stairs	0.8585	0.7786	0.8166	158131
vault	0.7338	0.9401	0.8242	328620
roof	0.9789	0.9434	0.9608	1079982
accuracy			0.8536	2609152
macro avg	0.6782	0.6672	0.6681	2609152
weighted avg	0.8480	0.8536	0.8479	2609152

Mean Jaccard (Mean_IoU):
0.5579260269895833

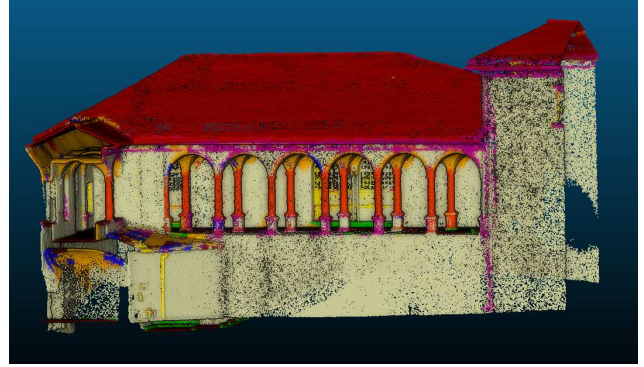
Jaccard:
- arc: 0.04778728930720999
- column: 0.6625851538642237
- moldings: 0.25083565528784785
- floor: 0.6976635835855302
- door-window: 0.27033071531715563
- wall: 0.7764652368714321
- stairs: 0.6900266218299005
- vault: 0.701027067751071
- roof: 0.9246129190918776



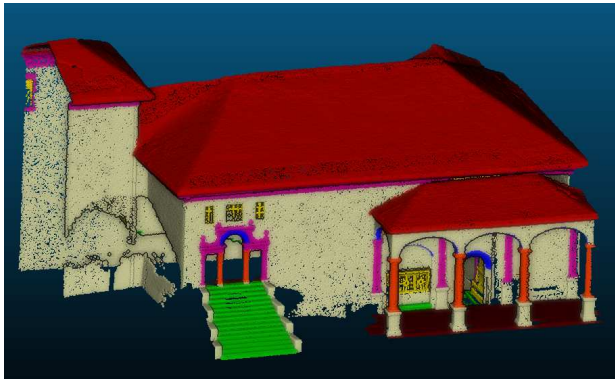
VISUAL INSPECTION



Ground truth



Predicted



Ground truth



Predicted

Wall
 Floor
 Roof
 Column
 Moldings
 Vault
 Arch
 Stair
 Window/Door

TEST: B_SMV_4

Overall Accuracy: **0.8656**

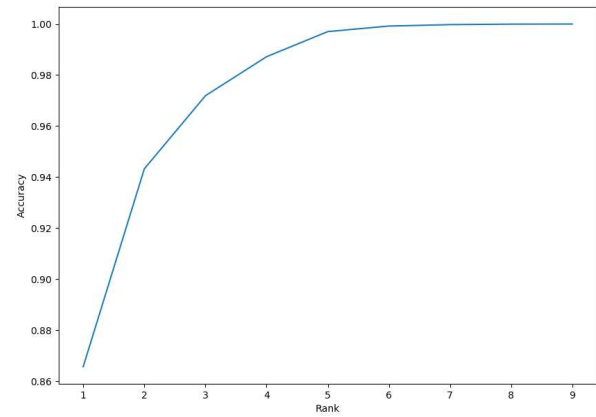
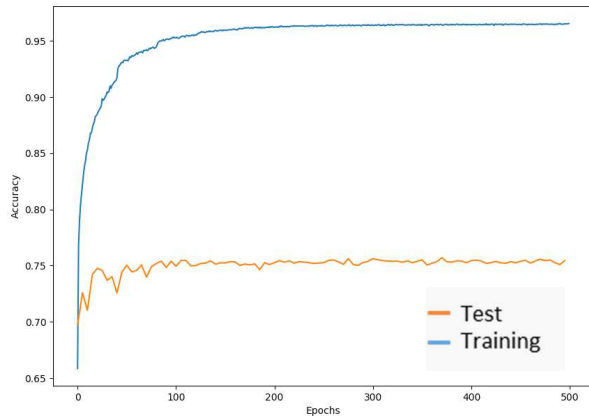
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

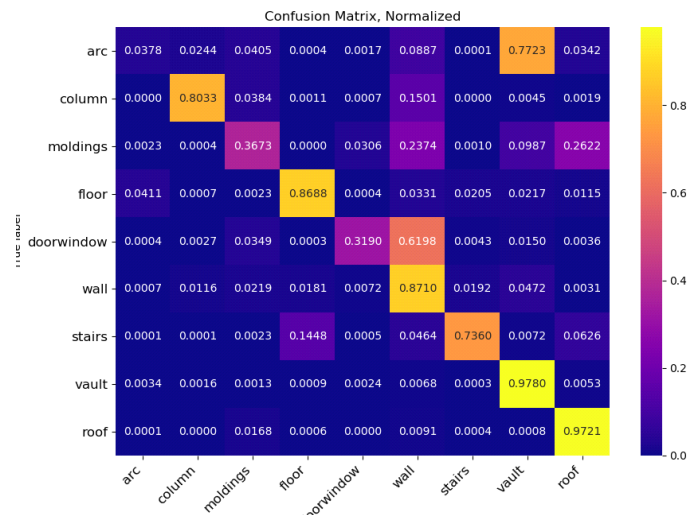
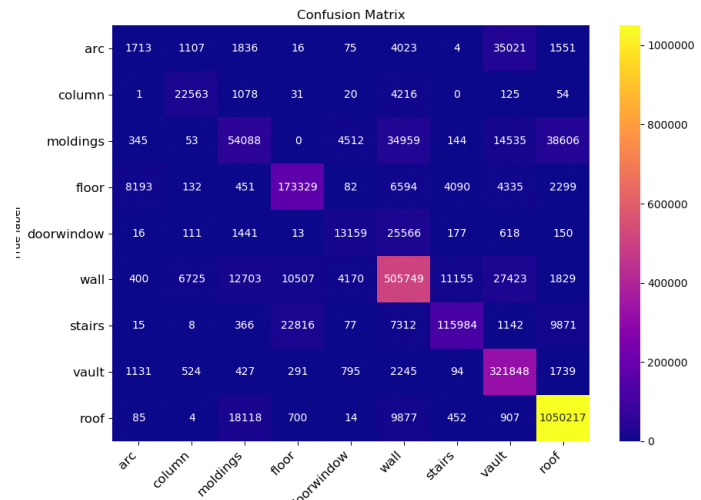
eval mean loss: 586.624341
eval accuracy: 0.865664

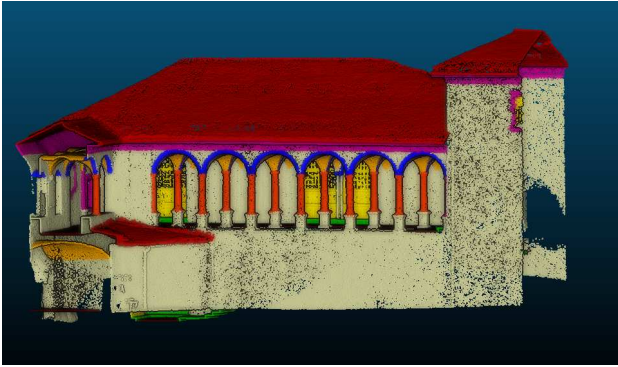
Accuracy:
0.8656643997743328

report:	precision	recall	f1-score	support
arc	0.1440	0.0378	0.0598	45346
column	0.7225	0.8033	0.7608	28088
moldings	0.5976	0.3673	0.4550	147242
floor	0.8345	0.8688	0.8513	199505
doorwindow	0.5745	0.3190	0.4102	41251
wall	0.8422	0.8710	0.8563	580661
stairs	0.8780	0.7360	0.8007	157591
vault	0.7928	0.9780	0.8757	329094
roof	0.9493	0.9721	0.9606	1080374
accuracy			0.8657	2609152
macro avg	0.7039	0.6615	0.6701	2609152
weighted avg	0.8504	0.8657	0.8536	2609152

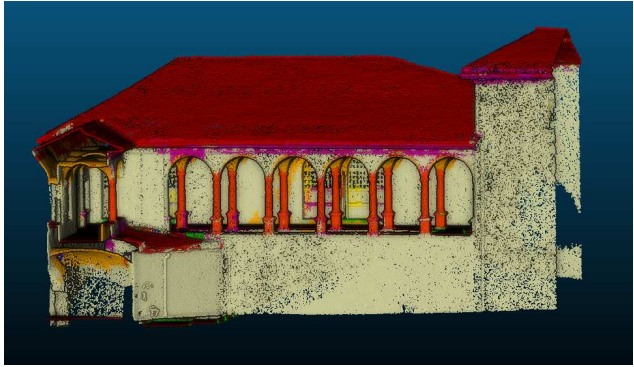
Mean Jaccard (Mean_IoU):
0.5619875313755578

Jaccard:
- arc: 0.030847079161564504
- column: 0.6139257727470614
- moldings: 0.2944975008439416
- floor: 0.741105443413047
- doorwindow: 0.25803984626245197
- wall: 0.7487552797900076
- stairs: 0.6676990564571376
- vault: 0.7789157792836399
- roof: 0.9241020244211697

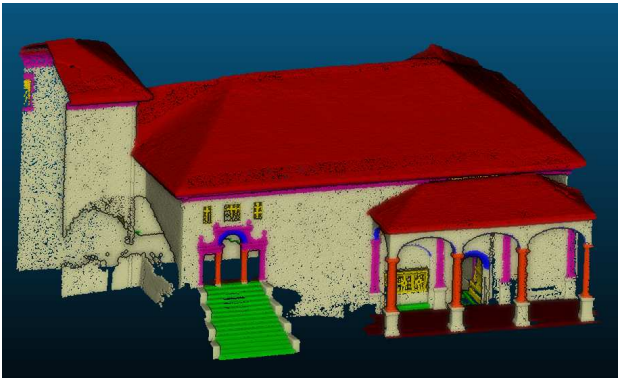




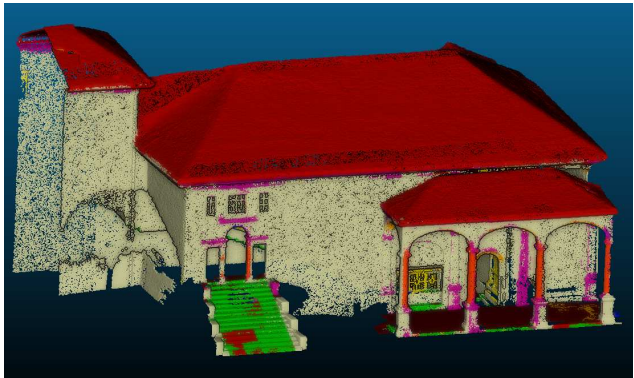
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMV_5

Overall Accuracy: **0.8587**

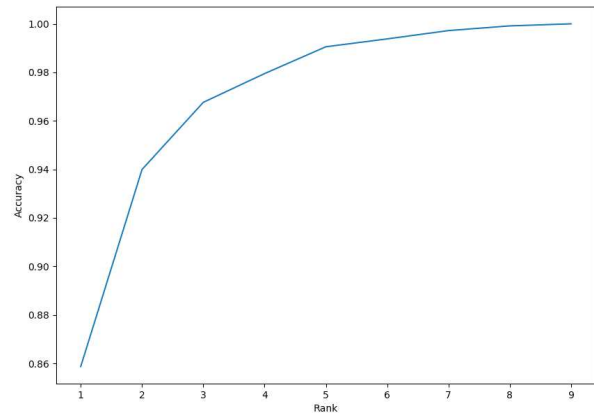
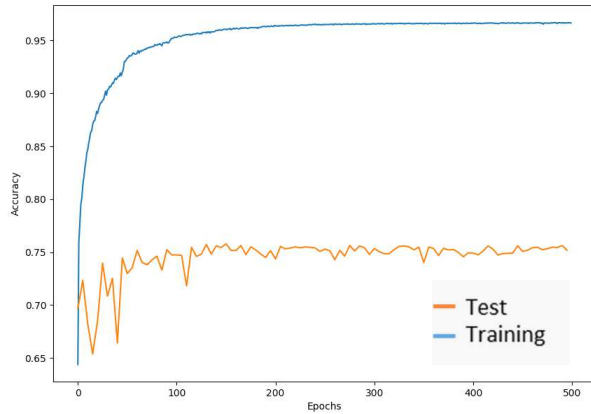
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z H S V Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

eval mean loss: 691.327302
eval accuracy: 0.858703

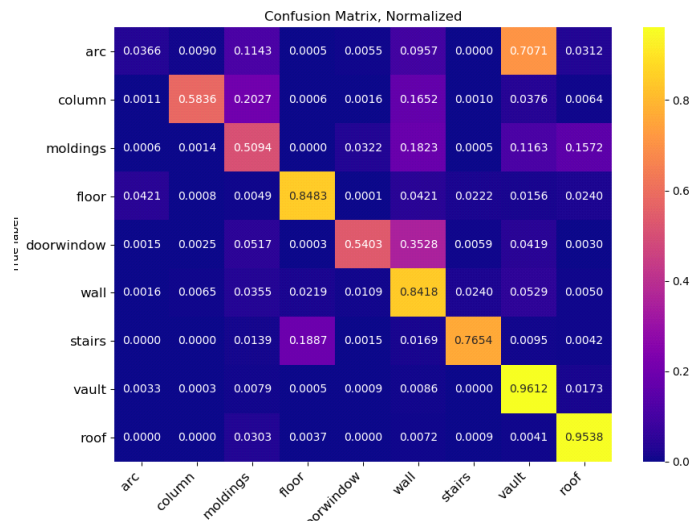
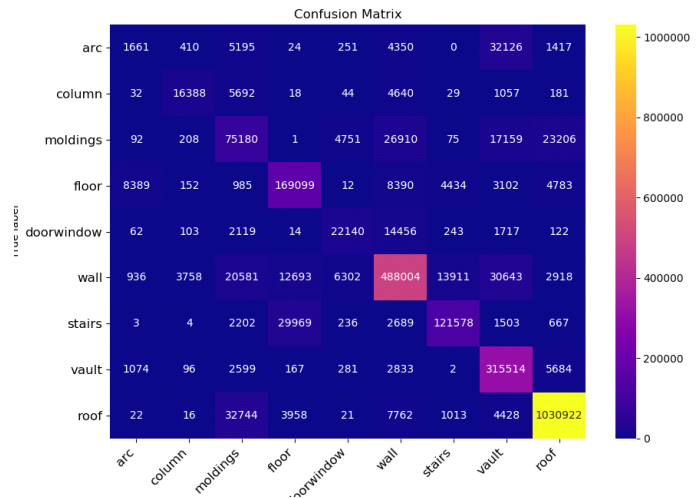
Accuracy:
0.8587027509321036

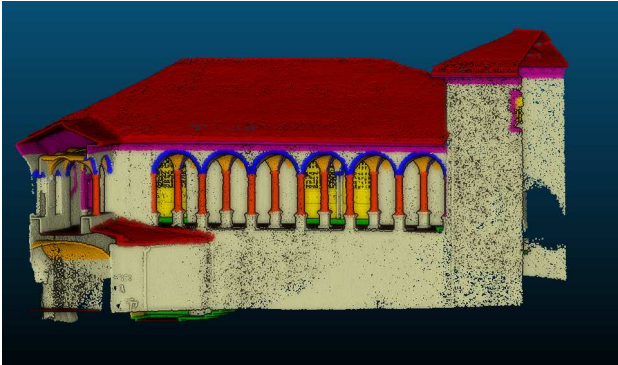
report:	precision	recall	f1-score	support
arc	0.1354	0.0366	0.0576	45434
column	0.7754	0.5836	0.6660	28081
moldings	0.5104	0.5094	0.5099	147582
floor	0.7831	0.8483	0.8144	199346
doorwindow	0.6504	0.5403	0.5903	40976
wall	0.8714	0.8418	0.8563	579746
stairs	0.8605	0.7654	0.8102	158851
vault	0.7747	0.9612	0.8580	328250
roof	0.9636	0.9538	0.9586	1080886
accuracy			0.8587	2609152
macro avg	0.7028	0.6711	0.6801	2609152
weighted avg	0.8523	0.8587	0.8532	2609152

Mean Jaccard (Mean_IoU):
0.5642313478457818

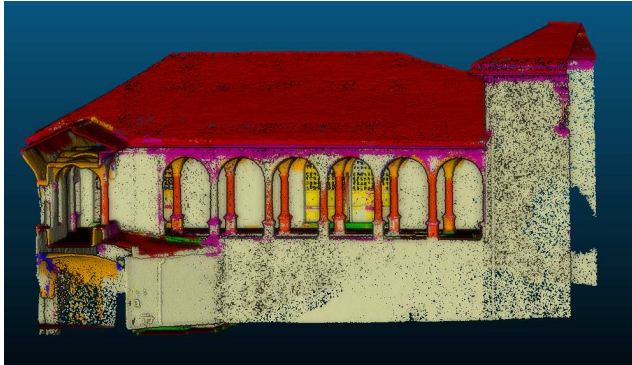
Jaccard:

- arc: 0.029637427735350795
- column: 0.4992079931765566
- moldings: 0.34219545833162646
- floor: 0.6868638043787318
- doorwindow: 0.4187313235238492
- wall: 0.7487296249018067
- stairs: 0.6808880027778089
- vault: 0.7512506399038061
- roof: 0.9205778558825

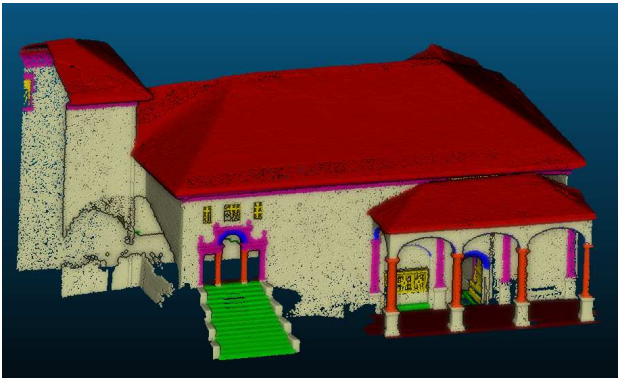




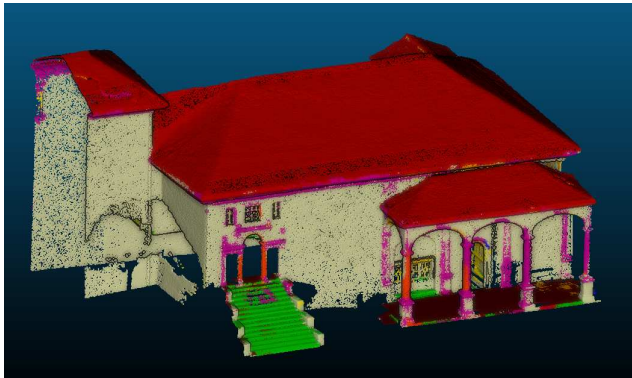
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMV_6

Overall Accuracy: **0.8647**

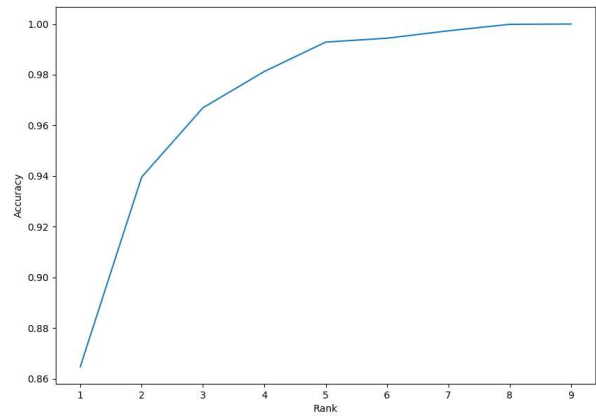
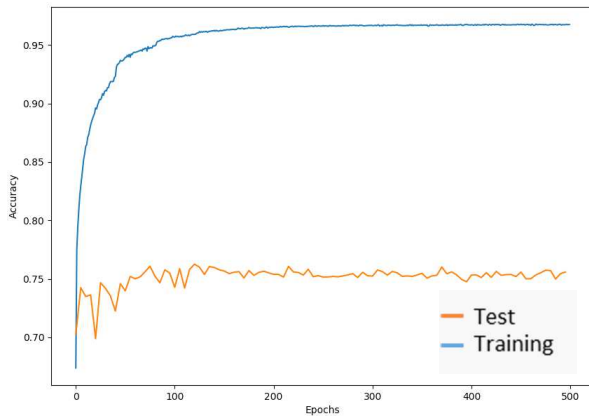
Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z L A B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

TRAINING EVALUATION and CUMULATIVE MATCH CHARACTERISTICS (CMC) CURVE



METRICS and CONFUSION MATRIX

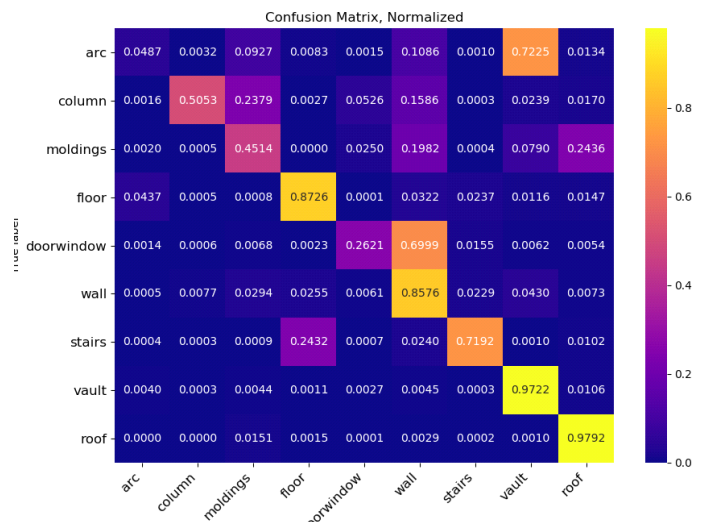
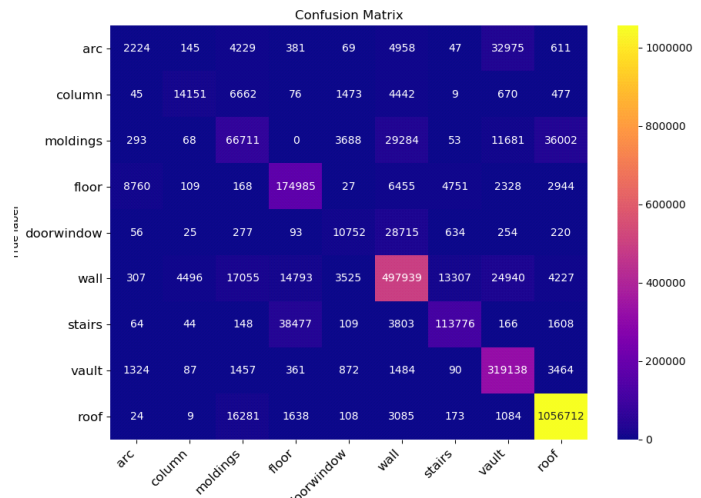
eval mean loss: 701.302755
eval accuracy: 0.864797

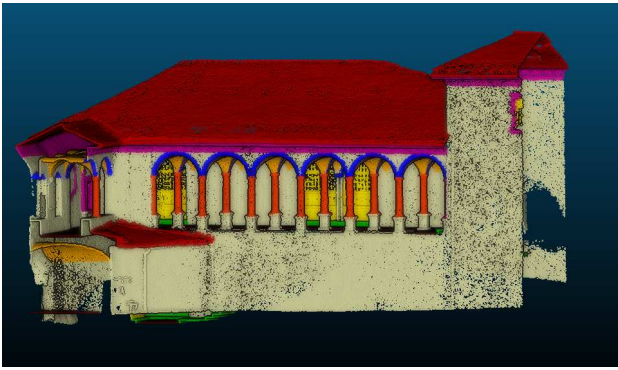
Accuracy:
0.8647974514324961

report:	precision	recall	f1-score	support
arc	0.1698	0.0487	0.0757	45639
column	0.7396	0.5053	0.6004	28005
moldings	0.5904	0.4514	0.5117	147780
floor	0.7582	0.8726	0.8114	200527
doorwindow	0.5214	0.2621	0.3488	41026
wall	0.8583	0.8576	0.8580	580589
stairs	0.8565	0.7192	0.7819	158195
vault	0.8116	0.9722	0.8846	328277
roof	0.9552	0.9792	0.9671	1079114
accuracy			0.8648	2609152
macro avg	0.6957	0.6298	0.6488	2609152
weighted avg	0.8509	0.8648	0.8542	2609152

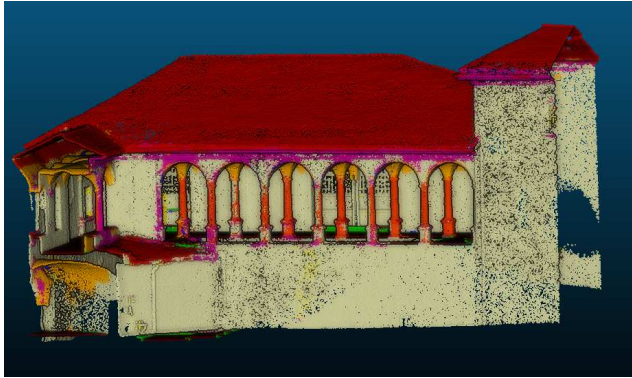
Mean Jaccard (Mean_IoU):
0.5364952163167295

Jaccard:
- arc: 0.03935447338618347
- column: 0.4289741724263684
- moldings: 0.3437701293949716
- floor: 0.6826125627082147
- doorwindow: 0.21125017191583
- wall: 0.7512488401741059
- stairs: 0.6418630365736013
- vault: 0.7931357564461012
- roof: 0.9362478038252203

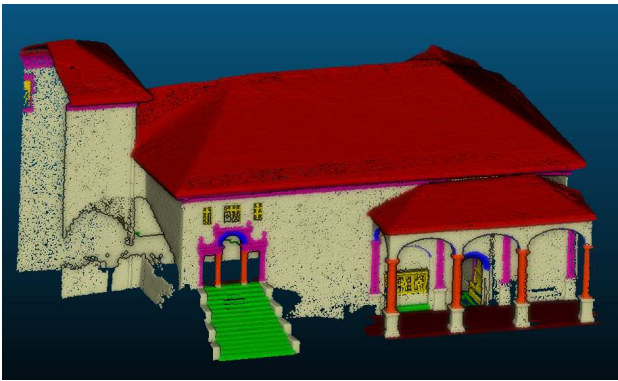




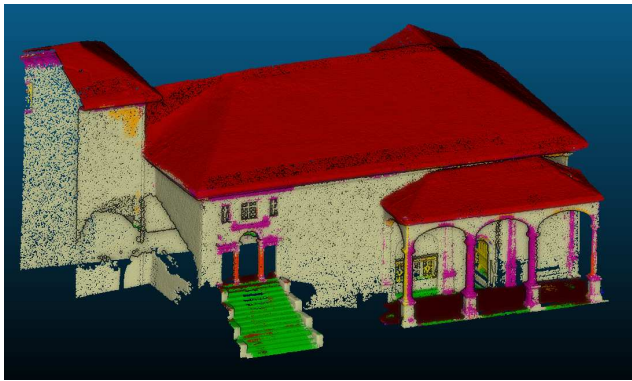
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Tests on the SMG scene

TEST: SMG_4

Overall Accuracy: **0.8860**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.583092
eval accuracy: 0.886088

Accuracy:

0.886087530551676

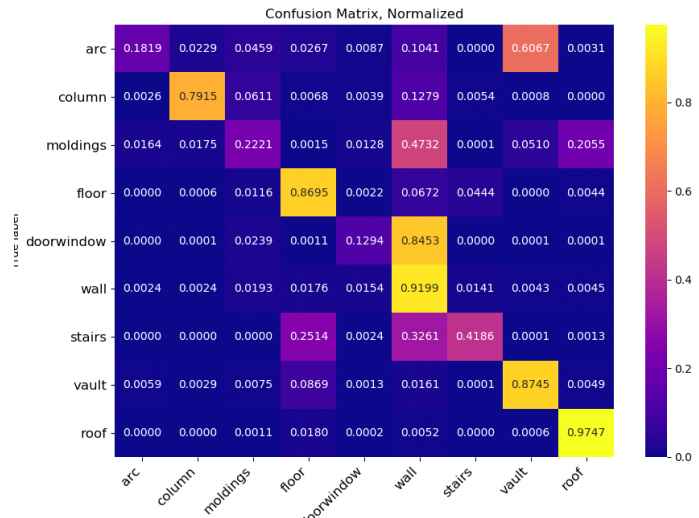
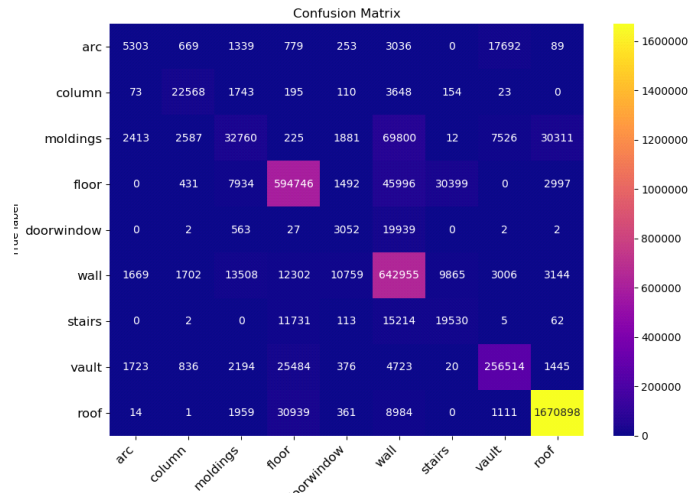
report:

	precision	recall	f1-score	support
arc	0.4737	0.1819	0.2628	29160
column	0.7837	0.7915	0.7875	28514
moldings	0.5284	0.2221	0.3127	147515
floor	0.8792	0.8695	0.8744	683995
doorwindow	0.1659	0.1294	0.1454	23587
wall	0.7896	0.9199	0.8498	698910
stairs	0.3256	0.4186	0.3663	46657
vault	0.8973	0.8745	0.8858	293315
roof	0.9777	0.9747	0.9762	1714267
accuracy			0.8861	3665920
macro avg	0.6468	0.5980	0.6068	3665920
weighted avg	0.8799	0.8861	0.8789	3665920

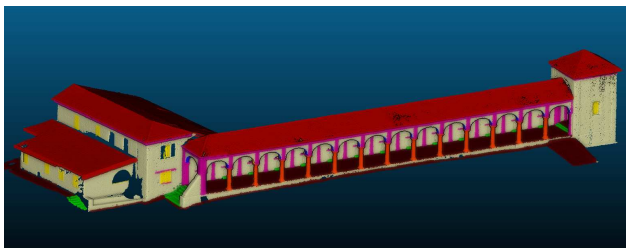
Mean Jaccard (Mean_IoU):
0.5058712911274125

Jaccard:

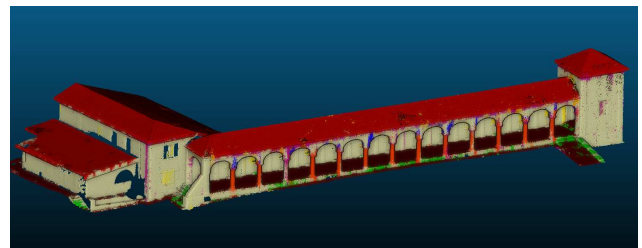
- arc: 0.151289512723953
- column: 0.6495510016117891
- moldings: 0.18534129161834179
- floor: 0.7767583458821409
- doorwindow: 0.07839309565396076
- wall: 0.7388164320597529
- stairs: 0.2242070097695937
- vault: 0.7949485558447998
- roof: 0.9535363749823804



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_5

Overall Accuracy: **0.8562**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.862078
eval accuracy: 0.856265

Accuracy:
0.8562650030551676

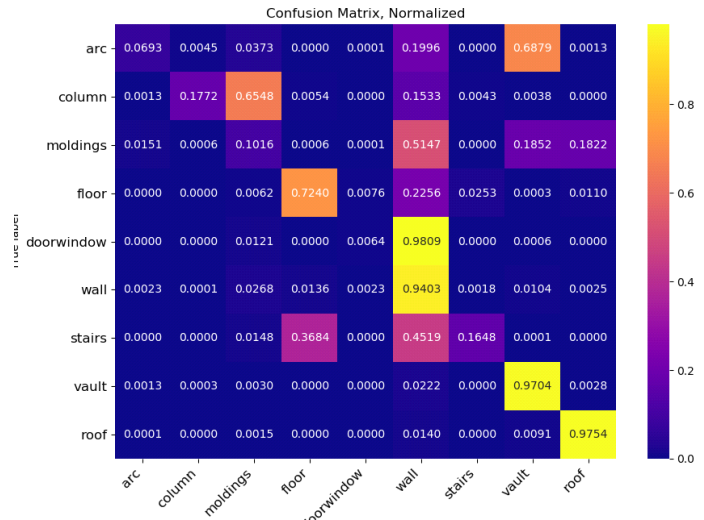
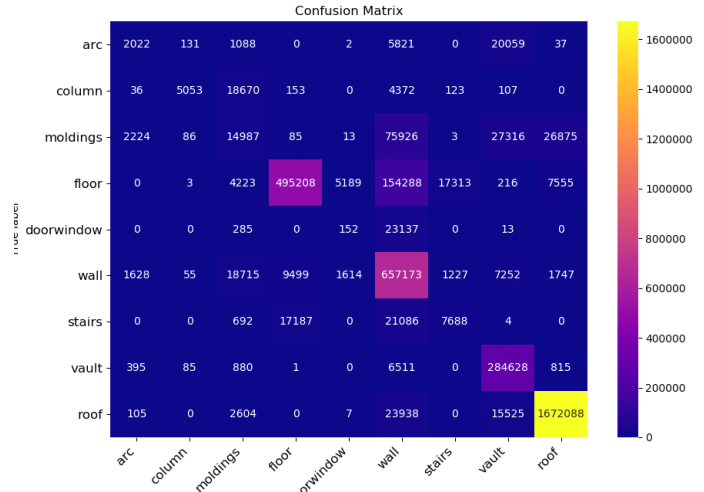
report:

	precision	recall	f1-score	support
arc	0.3154	0.0693	0.1137	29160
column	0.9335	0.1772	0.2979	28514
moldings	0.2412	0.1016	0.1430	147515
floor	0.9484	0.7240	0.8212	683995
doorwindow	0.0218	0.0064	0.0099	23587
wall	0.6759	0.9403	0.7865	698910
stairs	0.2917	0.1648	0.2106	46657
vault	0.8015	0.9704	0.8779	293315
roof	0.9783	0.9754	0.9769	1714267
accuracy			0.8563	3665920
macro avg	0.5786	0.4588	0.4708	3665920
weighted avg	0.8508	0.8563	0.8419	3665920

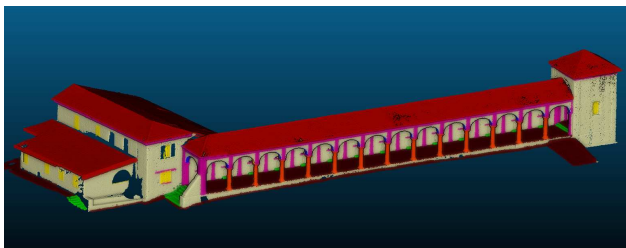
Mean Jaccard (Mean_IoU):
0.390751260549402

Jaccard:

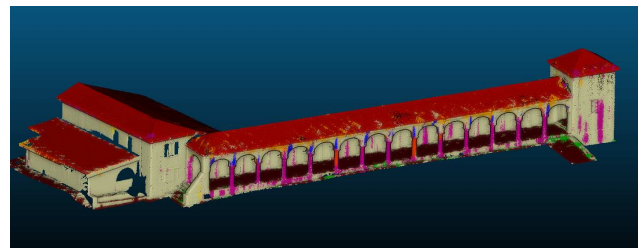
- arc: 0.06027184929056874
- column: 0.17500173166170258
- moldings: 0.07698590449576724
- floor: 0.6965734541157936
- doorwindow: 0.004998027094567934
- wall: 0.648106636265285
- stairs: 0.11769208395205365
- vault: 0.7823598776274233
- roof: 0.9547717804414559



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_6

Overall Accuracy: **0.7386**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.700810

eval accuracy: 0.738678

Accuracy:

0.7386776034392458

report:

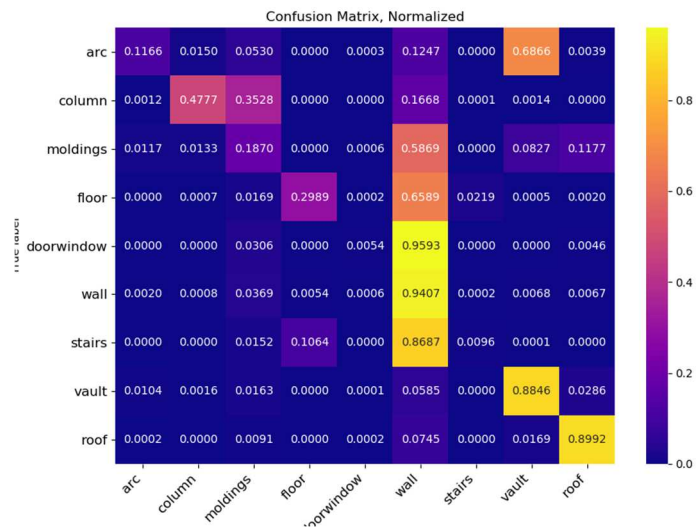
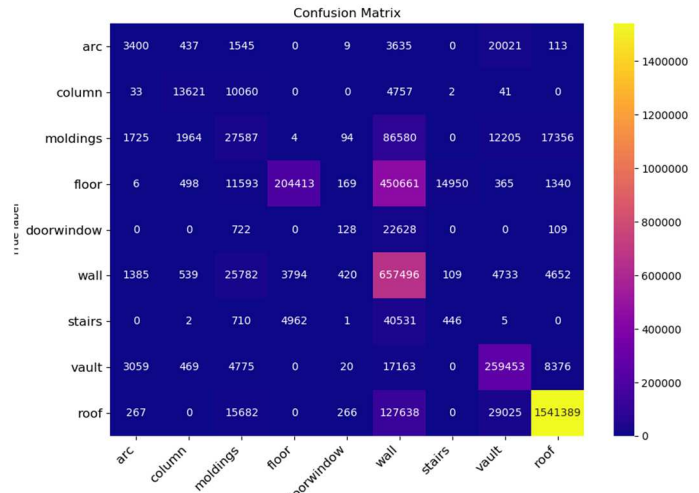
	precision	recall	f1-score	support
arc	0.3443	0.1166	0.1742	29160
column	0.7770	0.4777	0.5917	28514
moldings	0.2802	0.1870	0.2243	147515
floor	0.9589	0.2989	0.4557	683995
doorwindow	0.1156	0.0054	0.0104	23587
wall	0.4659	0.9407	0.6232	698910
stairs	0.0288	0.0096	0.0143	46657
vault	0.7962	0.8846	0.8381	293315
roof	0.9797	0.8992	0.9377	1714267
accuracy			0.7387	3665920
macro avg	0.5274	0.4244	0.4300	3665920
weighted avg	0.8108	0.7387	0.7246	3665920

Mean Jaccard (Mean_IoU):

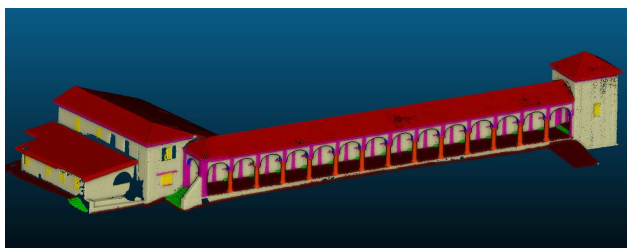
0.3339999389176136

Jaccard:

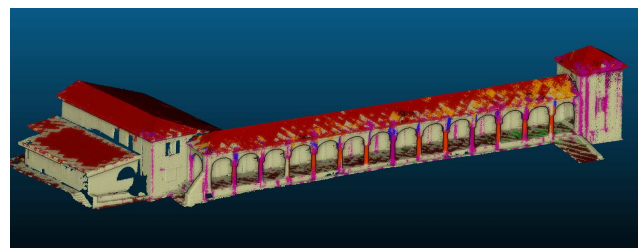
- arc: 0.09541181422758524
- column: 0.42010301329303273
- moldings: 0.12632335702249248
- floor: 0.29507257255451064
- doorwindow: 0.005210453472278759
- wall: 0.4526641253064538
- stairs: 0.007226416928610778
- vault: 0.7212838119596342
- roof: 0.8827038854939231



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_7

Overall Accuracy: **0.8951**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 398.032326
eval accuracy: 0.895143

Accuracy:

0.8951425563023743

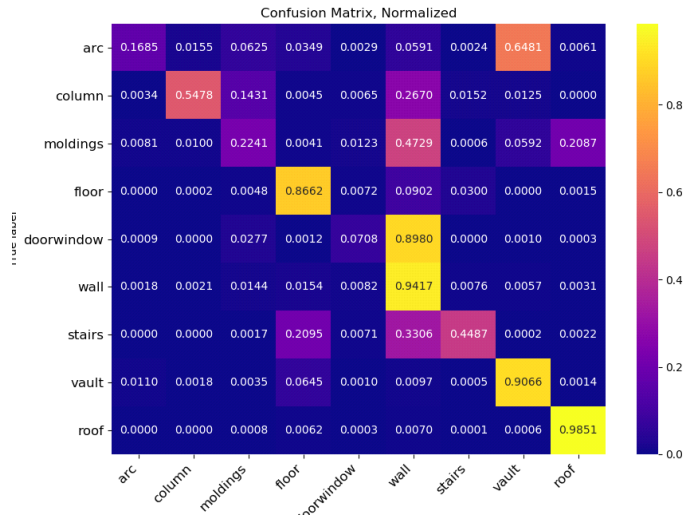
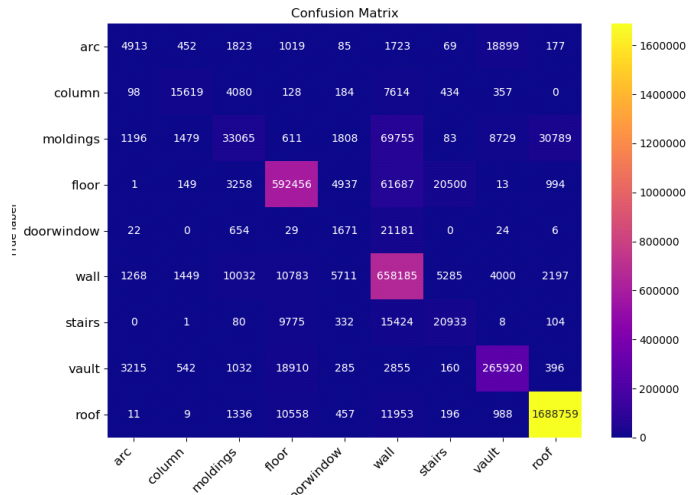
report:

	precision	recall	f1-score	support
arc	0.4581	0.1685	0.2464	29160
column	0.7928	0.5478	0.6479	28514
moldings	0.5973	0.2241	0.3260	147515
floor	0.9196	0.8662	0.8921	683995
doorwindow	0.1080	0.0708	0.0856	23587
wall	0.7740	0.9417	0.8497	698910
stairs	0.4392	0.4487	0.4439	46657
vault	0.8895	0.9066	0.8980	293315
roof	0.9799	0.9851	0.9825	1714267
accuracy			0.8951	3665920
macro avg	0.6621	0.5733	0.5969	3665920
weighted avg	0.8887	0.8951	0.8860	3665920

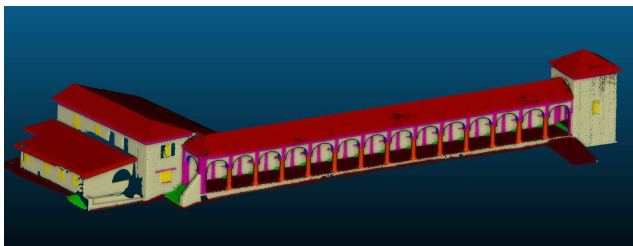
Mean Jaccard (Mean_IoU):
0.49651149400780564

Jaccard:

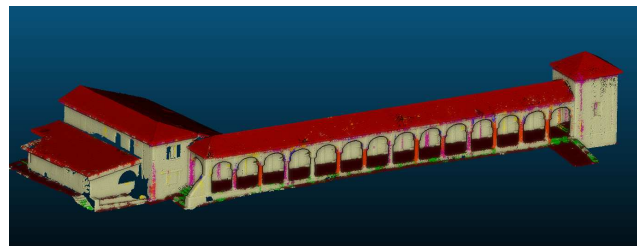
- arc: 0.14048783277572846
- column: 0.4791839239147108
- moldings: 0.1947176255815323
- floor: 0.8051774375924154
- doorwindow: 0.04469587546140266
- wall: 0.738619147976326
- stairs: 0.28525291616701187
- vault: 0.814873151045098
- roof: 0.9655955355560257



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_8

Overall Accuracy: **0.8887**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

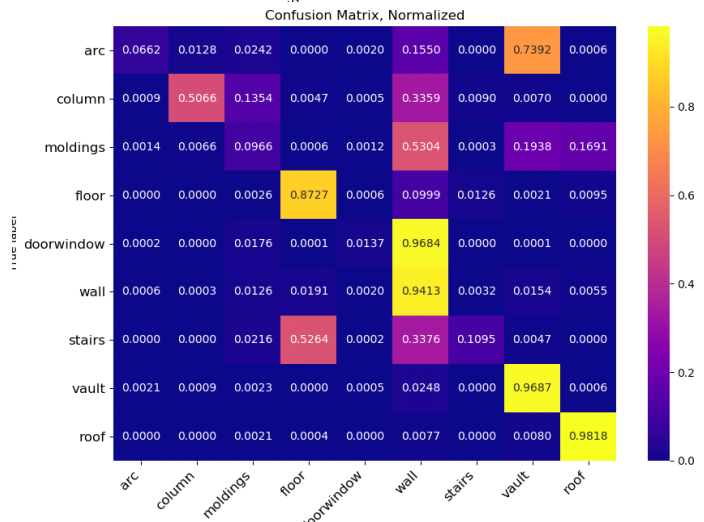
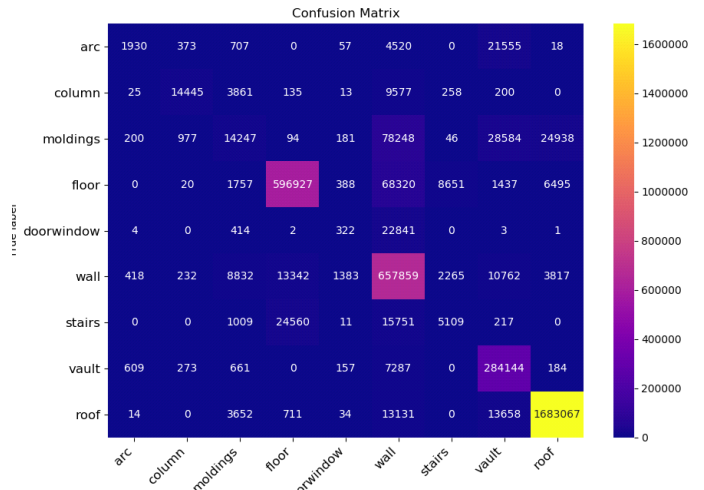
eval mean loss: 546.997199
eval accuracy: 0.888740

Accuracy:
0.88874007053073

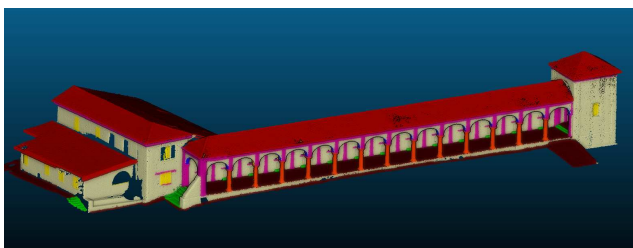
report:	precision	recall	f1-score	support
arc	0.6031	0.0662	0.1193	29160
column	0.8851	0.5066	0.6444	28514
moldings	0.4054	0.0966	0.1560	147515
floor	0.9389	0.8727	0.9046	683995
doorwindow	0.1265	0.0137	0.0246	23587
wall	0.7497	0.9413	0.8346	698910
stairs	0.3129	0.1095	0.1622	46657
vault	0.7881	0.9687	0.8691	293315
roof	0.9794	0.9818	0.9806	1714267
accuracy			0.8887	3665920
macro avg	0.6432	0.5063	0.5217	3665920
weighted avg	0.8719	0.8887	0.8704	3665920

Mean Jaccard (Mean_IoU):
0.44405602290009466

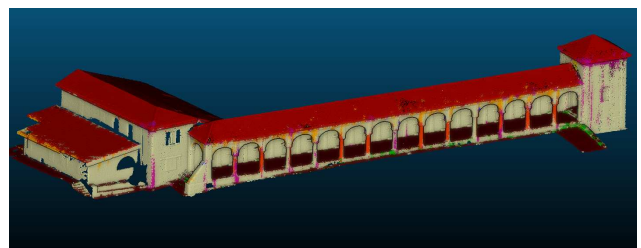
Jaccard:
- arc: 0.06342425238251725
- column: 0.4753364704333805
- moldings: 0.0845981188542112
- floor: 0.8258090667493038
- doorwindow: 0.012475301228158537
- wall: 0.7161656243025959
- stairs: 0.08827340739844844
- vault: 0.7685154882874305
- roof: 0.9619064764648058



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_9

Overall Accuracy: **0.7813**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 881.344720

eval accuracy: 0.781382

Accuracy:

0.7813822996682961

report:

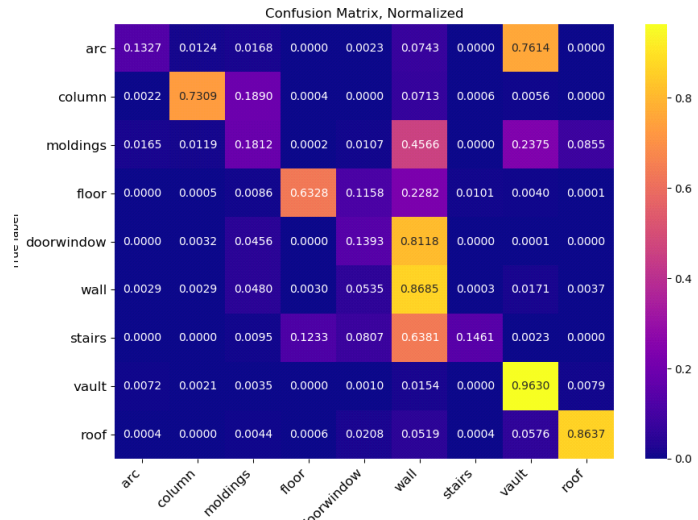
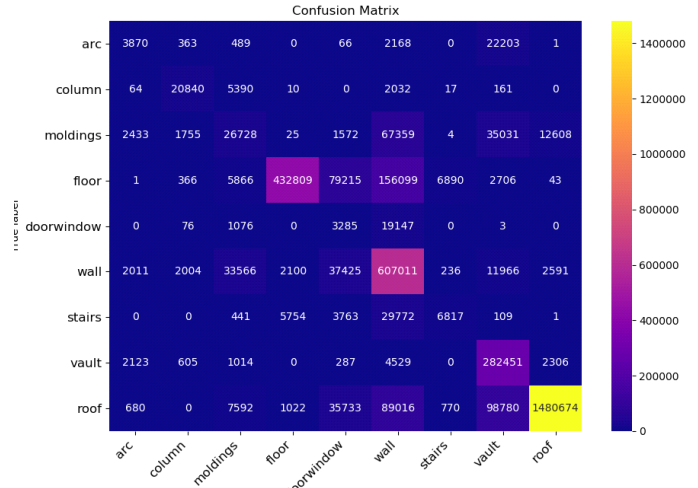
	precision	recall	f1-score	support
arc	0.3461	0.1327	0.1919	29160
column	0.8013	0.7309	0.7644	28514
moldings	0.3253	0.1812	0.2327	147515
floor	0.9798	0.6328	0.7689	683995
doorwindow	0.0204	0.1393	0.0355	23587
wall	0.6212	0.8685	0.7243	698910
stairs	0.4627	0.1461	0.2221	46657
vault	0.6229	0.9630	0.7565	293315
roof	0.9883	0.8637	0.9218	1714267
accuracy			0.7814	3665920
macro avg	0.5742	0.5176	0.5131	3665920
weighted avg	0.8413	0.7814	0.7931	3665920

Mean Jaccard (Mean_IoU):

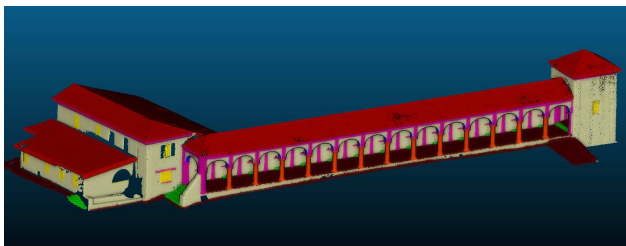
0.40614563886275057

Jaccard:

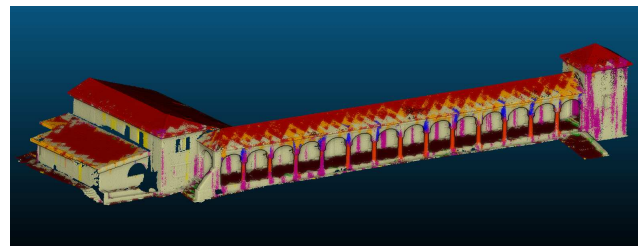
- arc: 0.10610879578855012
- column: 0.6187097348810973
- moldings: 0.13169811134817122
- floor: 0.6246287375199522
- doorwindow: 0.01808442702369418
- wall: 0.5678136856520666
- stairs: 0.12491296221644006
- vault: 0.6083713496771304
- roof: 0.8549829456576532



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_10

Overall Accuracy: **0.8736**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

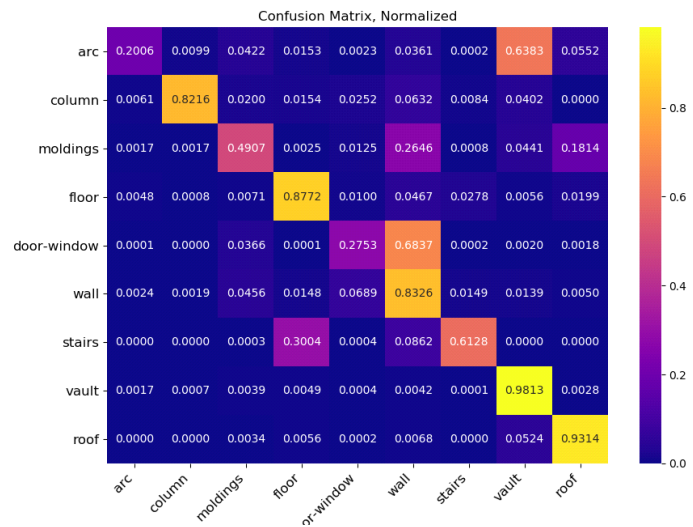
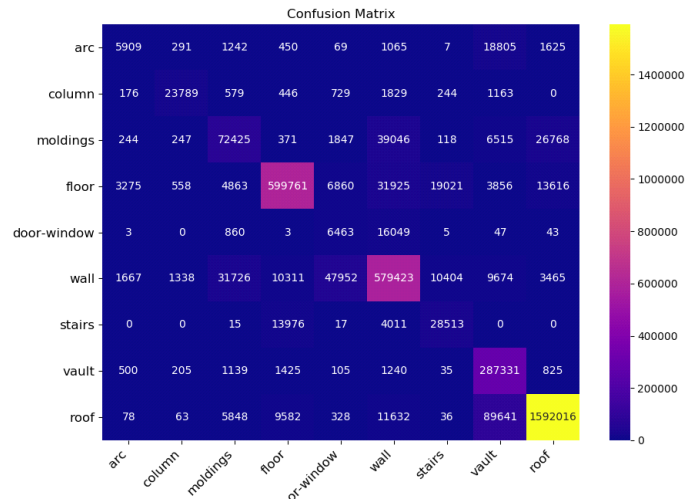
eval mean loss: 0.635961
eval accuracy: 0.873665

Accuracy:
0.8736652916783315

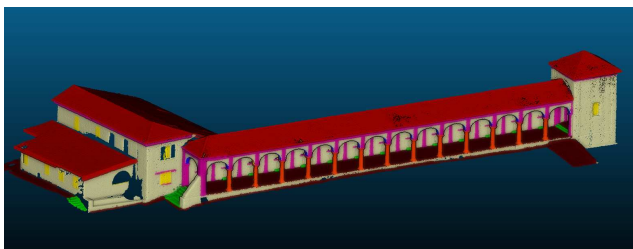
report:	precision	recall	f1-score	support
arc	0.4986	0.2006	0.2860	29463
column	0.8980	0.8216	0.8581	28955
moldings	0.6102	0.4907	0.5440	147581
floor	0.9425	0.8772	0.9087	683735
door-window	0.1004	0.2753	0.1471	23473
wall	0.8444	0.8326	0.8384	695960
stairs	0.4884	0.6128	0.5435	46532
vault	0.6890	0.9813	0.8096	292805
roof	0.9717	0.9314	0.9511	1709224
accuracy			0.8737	3657728
macro avg	0.6715	0.6693	0.6541	3657728
weighted avg	0.8887	0.8737	0.8776	3657728

Mean Jaccard (Mean_IoU):
0.5428806410572523

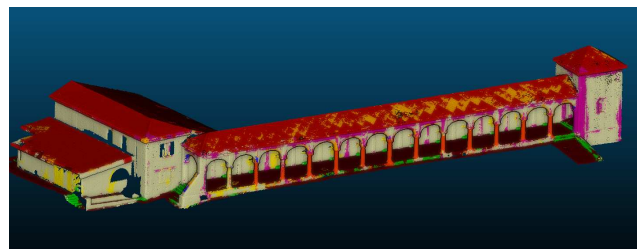
Jaccard:
- arc: 0.166892617070553
- column: 0.7514609722968064
- moldings: 0.37360783686607896
- floor: 0.8326556055193746
- door-window: 0.07941754730892112
- wall: 0.7217912768122856
- stairs: 0.3731970367267873
- vault: 0.680063715071502
- roof: 0.9068391618429612



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_11

Overall Accuracy: **0.9092**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

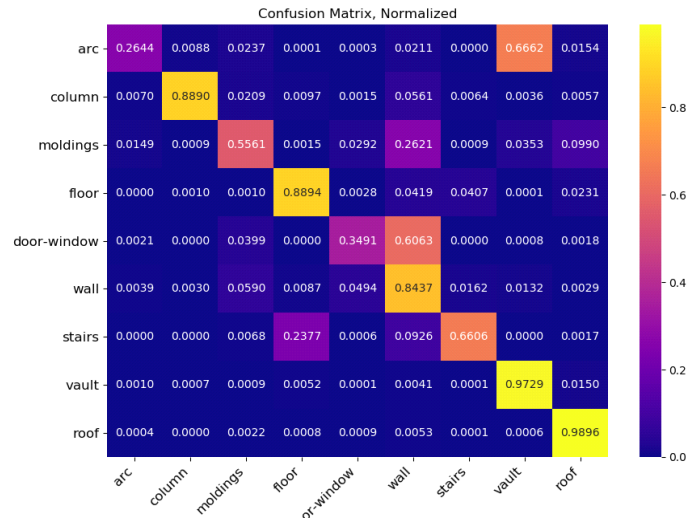
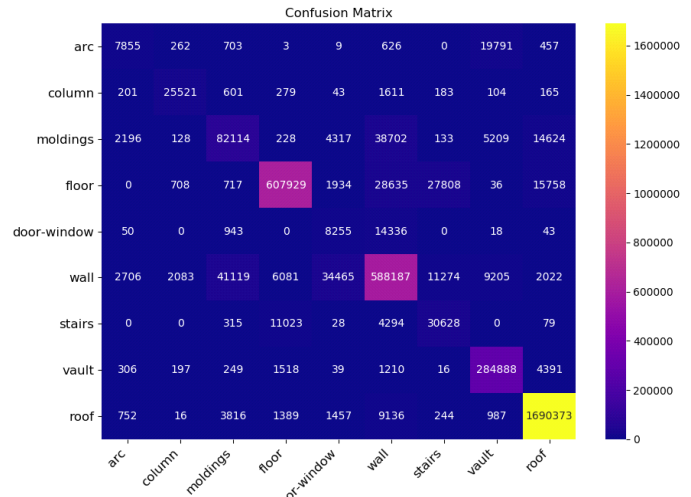
eval mean loss: 0.463988
eval accuracy: 0.909239

Accuracy:
0.9092392873390257

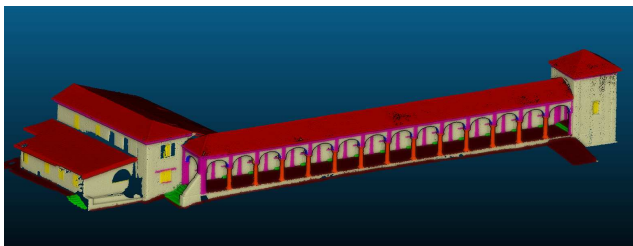
report:	precision	recall	f1-score	support
arc	0.5584	0.2644	0.3589	29706
column	0.8826	0.8890	0.8858	28708
moldings	0.6289	0.5561	0.5903	147651
floor	0.9673	0.8894	0.9267	683525
door-window	0.1633	0.3491	0.2225	23645
wall	0.8565	0.8437	0.8501	697142
stairs	0.4358	0.6606	0.5251	46367
vault	0.8896	0.9729	0.9294	292814
roof	0.9783	0.9896	0.9839	1708170
accuracy			0.9092	3657728
macro avg	0.7067	0.7128	0.6970	3657728
weighted avg	0.9155	0.9092	0.9109	3657728

Mean Jaccard (Mean_IoU):
0.5947505260918935

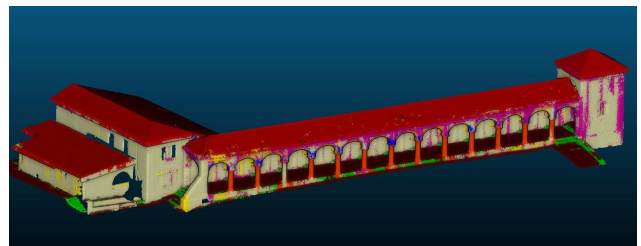
Jaccard:
- arc: 0.21869866636968566
- column: 0.7949971964363591
- moldings: 0.41870544683194466
- floor: 0.863479090854859
- door-window: 0.12519526214416793
- wall: 0.7392144196498143
- stairs: 0.35603603603603606
- vault: 0.8681269121536792
- roof: 0.968301704350496



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_12

Overall Accuracy: **0.9121**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

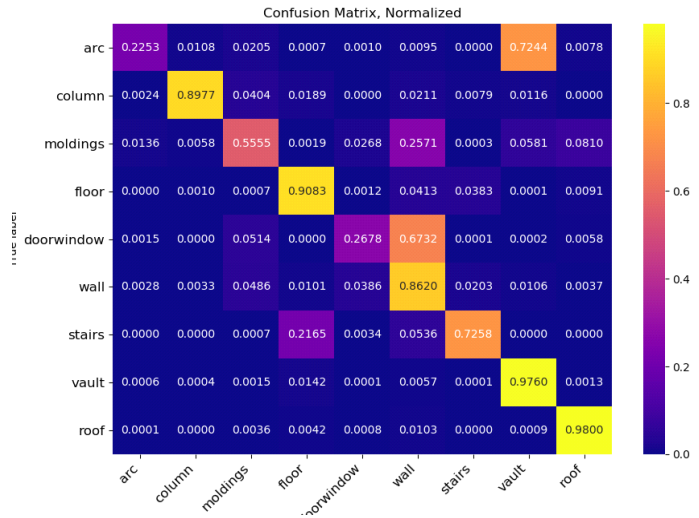
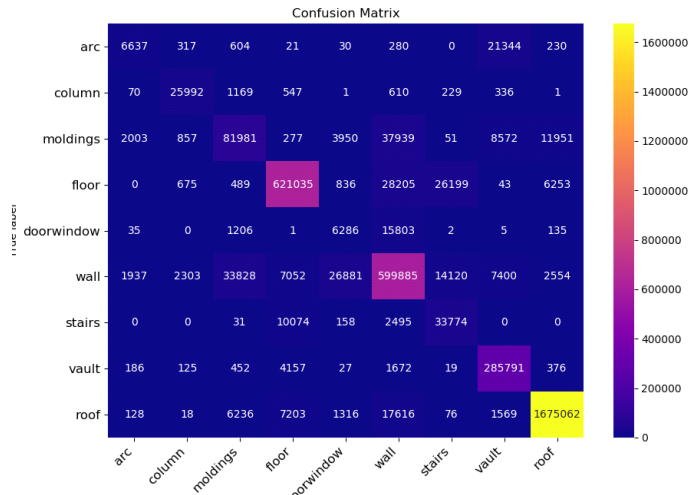
eval mean loss: 344.354613
eval accuracy: 0.912163

Accuracy:
0.9121626867826148

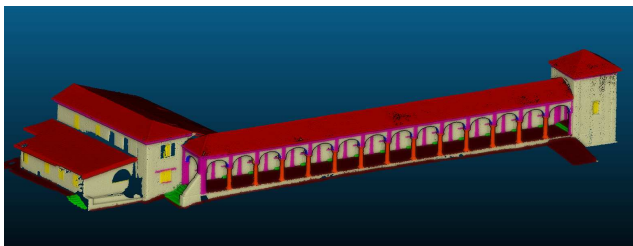
report:	precision	recall	f1-score	support
arc	0.6036	0.2253	0.3281	29463
column	0.8582	0.8977	0.8775	28955
moldings	0.6507	0.5555	0.5993	147581
floor	0.9549	0.9083	0.9310	683735
doorwindow	0.1592	0.2678	0.1997	23473
wall	0.8515	0.8620	0.8567	695960
stairs	0.4535	0.7258	0.5582	46532
vault	0.8792	0.9760	0.9251	292805
roof	0.9873	0.9800	0.9837	1709224
accuracy			0.9122	3657728
macro avg	0.7109	0.7109	0.6955	3657728
weighted avg	0.9170	0.9122	0.9129	3657728

Mean Jaccard (Mean_IoU):
0.5947394111245178

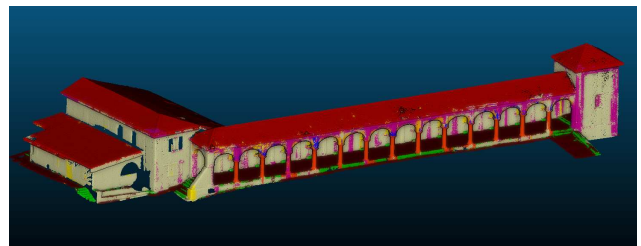
Jaccard:
- arc: 0.19623322098042695
- column: 0.7817142857142857
- moldings: 0.42788471575607007
- floor: 0.8709349892787074
- doorwindow: 0.11091897233201581
- wall: 0.7493129980763946
- stairs: 0.3871921859953226
- vault: 0.860624439131037
- roof: 0.9678388928564



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_13

Overall Accuracy: **0.9135**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

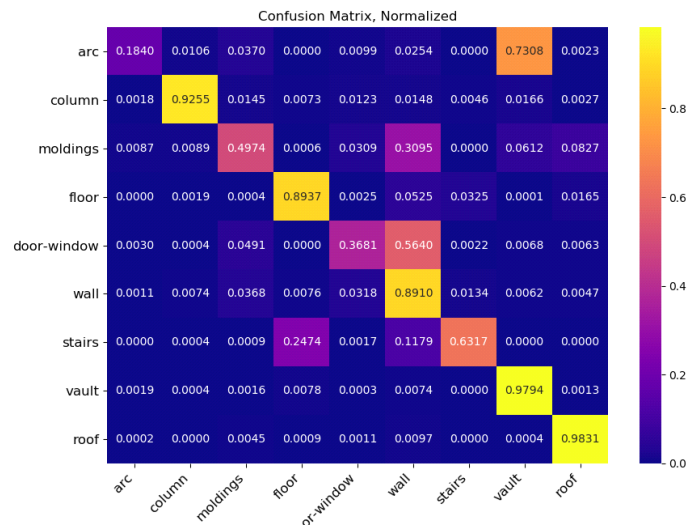
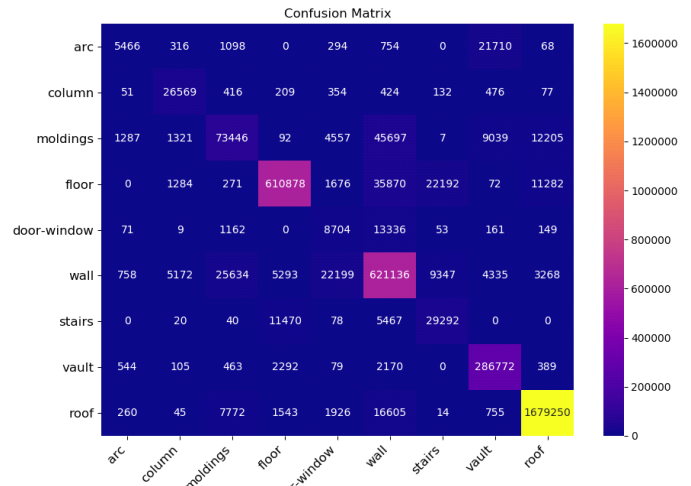
eval mean loss: 350.261853
eval accuracy: 0.913549

Accuracy:
0.9135487931305991

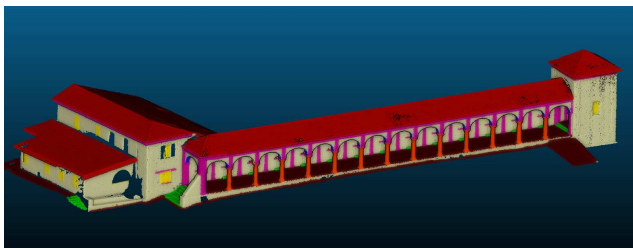
report:	precision	recall	f1-score	support
arc	0.6479	0.1840	0.2866	29706
column	0.7626	0.9255	0.8362	28708
moldings	0.6659	0.4974	0.5695	147651
floor	0.9669	0.8937	0.9289	683525
door-window	0.2183	0.3681	0.2741	23645
wall	0.8377	0.8910	0.8635	697142
stairs	0.4799	0.6317	0.5455	46367
vault	0.8870	0.9794	0.9309	292814
roof	0.9839	0.9831	0.9835	1708170
accuracy			0.9135	3657728
macro avg	0.7167	0.7060	0.6910	3657728
weighted avg	0.9165	0.9135	0.9125	3657728

Mean Jaccard (Mean_IoU):
0.5869855584391416

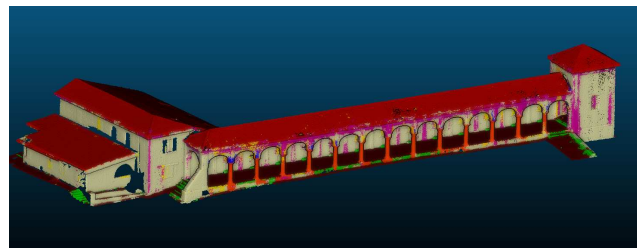
Jaccard:
- arc: 0.16727361752914893
- column: 0.7184694429421309
- moldings: 0.39806619803042703
- floor: 0.8672021396204559
- door-window: 0.1588089330024814
- wall: 0.7598319194093937
- stairs: 0.375
- vault: 0.8706893934333652
- roof: 0.9675283819848721



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: SMG_14

Overall Accuracy: **0.9161**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 353.044514
eval accuracy: 0.916147

Accuracy:

0.9161474007908734

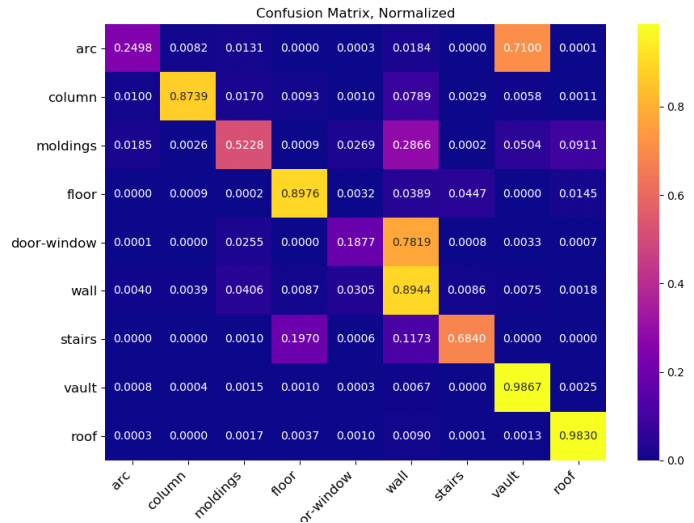
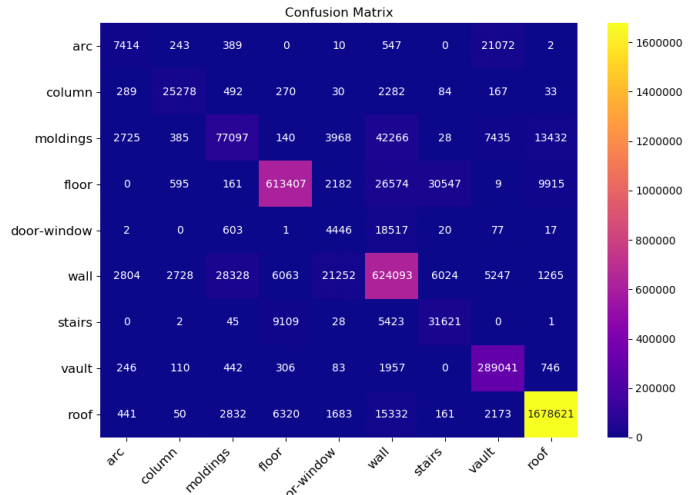
report:

	precision	recall	f1-score	support
arc	0.5326	0.2498	0.3401	29677
column	0.8601	0.8739	0.8669	28925
moldings	0.6984	0.5228	0.5980	147476
floor	0.9651	0.8976	0.9301	683390
door-window	0.1320	0.1877	0.1550	23683
wall	0.8468	0.8944	0.8699	697804
stairs	0.4617	0.6840	0.5513	46229
vault	0.8888	0.9867	0.9352	292931
roof	0.9851	0.9830	0.9841	1707613
accuracy			0.9161	3657728
macro avg	0.7078	0.6978	0.6923	3657728
weighted avg	0.9189	0.9161	0.9157	3657728

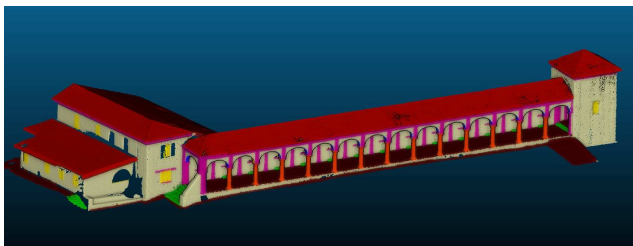
Mean Jaccard (Mean_IoU):
0.5941215371423311

Jaccard:

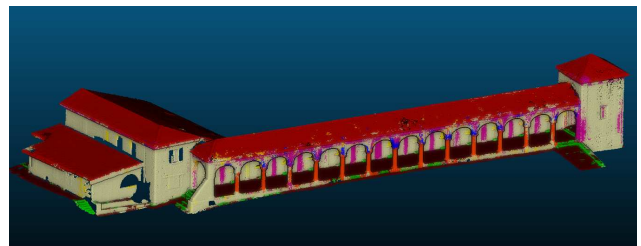
- arc: 0.20489719212911783
- column: 0.765118953931836
- moldings: 0.426496946362188
- floor: 0.8693422184555251
- door-window: 0.08401519303085848
- wall: 0.7698180095768852
- stairs: 0.38054950477176175
- vault: 0.8782477644320609
- roof: 0.9686080515907455



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Tests with the whole ArCH benchmark on the SMG scene

TEST: B_SMG_1

Overall Accuracy: **0.8958**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.411544

eval accuracy: 0.895828

Accuracy:

0.8958277867493016

report:

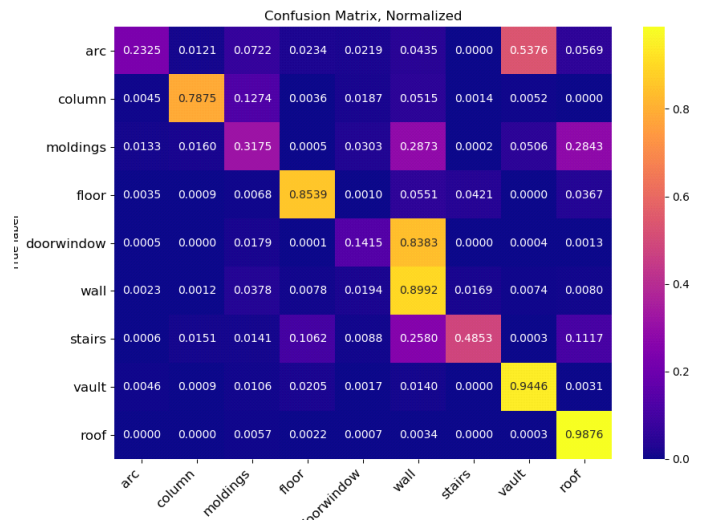
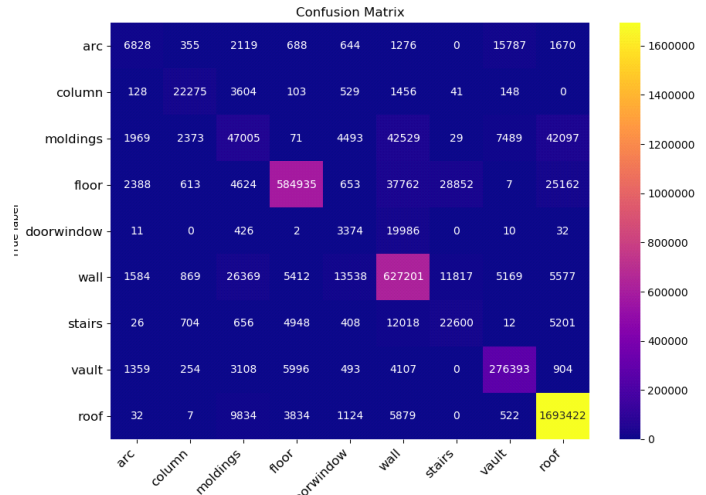
	precision	recall	f1-score	support
arc	0.4766	0.2325	0.3126	29367
column	0.8115	0.7875	0.7993	28284
moldings	0.4809	0.3175	0.3825	148055
floor	0.9653	0.8539	0.9062	684996
doorwindow	0.1336	0.1415	0.1374	23841
wall	0.8338	0.8992	0.8653	697536
stairs	0.3568	0.4853	0.4112	46573
vault	0.9046	0.9446	0.9242	292614
roof	0.9545	0.9876	0.9708	1714654
accuracy			0.8958	3665920
macro avg	0.6575	0.6277	0.6344	3665920
weighted avg	0.8926	0.8958	0.8920	3665920

Mean Jaccard (MeanIoU):

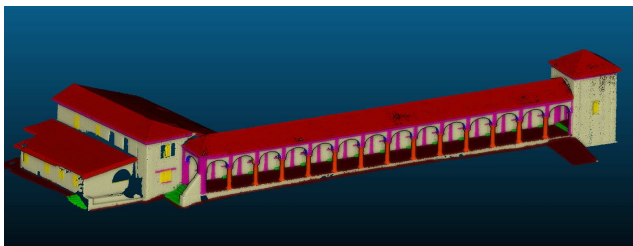
0.5348087508818643

Jaccard:

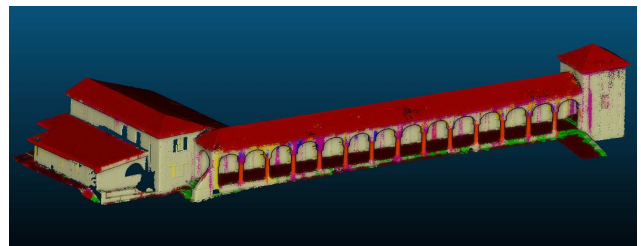
- arc: 0.18522135416666666
- column: 0.6657401595983143
- moldings: 0.23644960889358385
- floor: 0.8284611571418454
- doorwindow: 0.07379218336504603
- wall: 0.762508981227866
- stairs: 0.25884185449880887
- vault: 0.8590089446105458
- roof: 0.943254514434102



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMG_2

Overall Accuracy: **0.8719**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.625519
eval accuracy: 0.871936

Accuracy:

0.8719355293777995

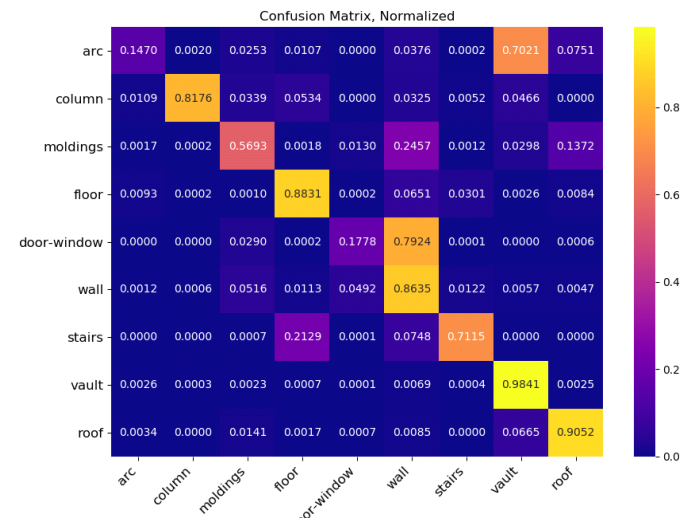
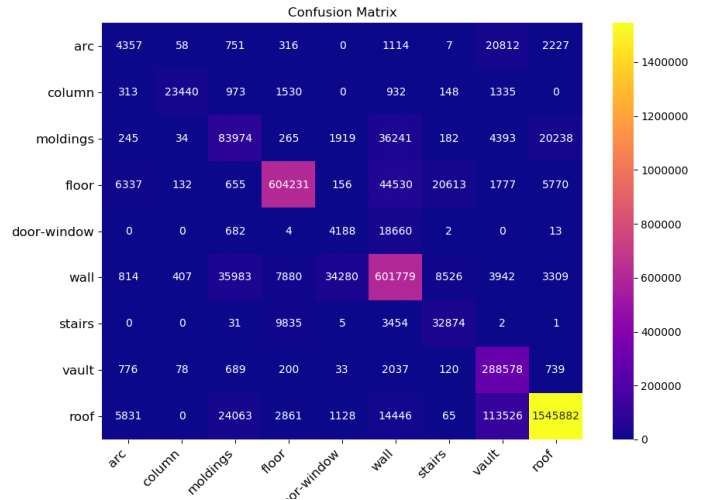
report:

	precision	recall	f1-score	support
arc	0.2333	0.1470	0.1804	29642
column	0.9706	0.8176	0.8875	28671
moldings	0.5682	0.5693	0.5688	147491
floor	0.9635	0.8831	0.9216	684201
door-window	0.1004	0.1778	0.1284	23549
wall	0.8321	0.8635	0.8475	696920
stairs	0.5257	0.7115	0.6046	46202
vault	0.6644	0.9841	0.7932	293250
roof	0.9795	0.9052	0.9409	1707802
accuracy			0.8719	3657728
macro avg	0.6486	0.6732	0.6525	3657728
weighted avg	0.8891	0.8719	0.8766	3657728

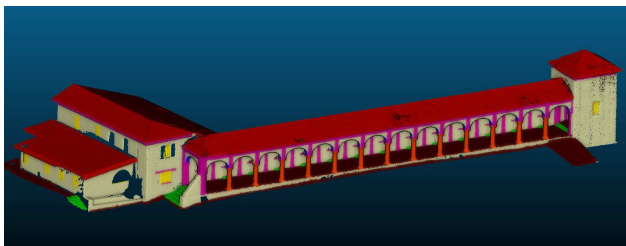
Mean Jaccard (Mean_IoU):
0.5479784455194734

Jaccard:

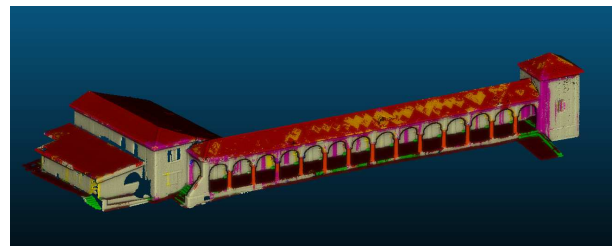
- arc: 0.0991173392784021
- column: 0.7978216473791695
- moldings: 0.39738214444581155
- floor: 0.8545295378819163
- door-window: 0.06857704273784182
- wall: 0.7353708876815579
- stairs: 0.4333223489092467
- vault: 0.6572976765056248
- roof: 0.8883873848556892



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMG_3

Overall Accuracy: **0.9144**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 313.865690
eval accuracy: 0.914474

Accuracy:

0.9144742309980403

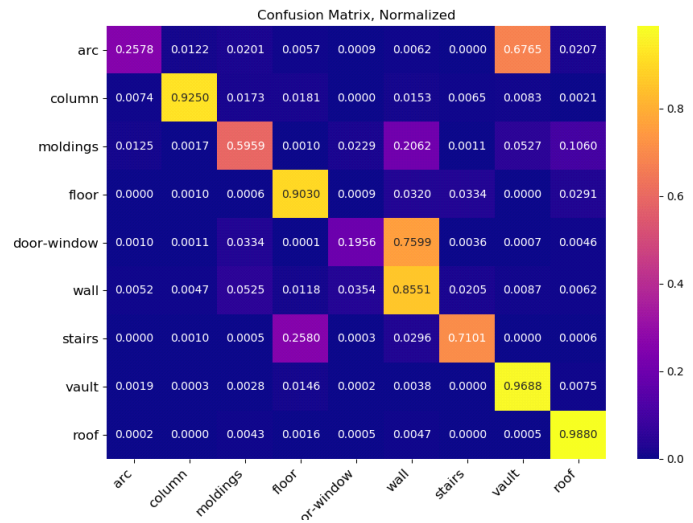
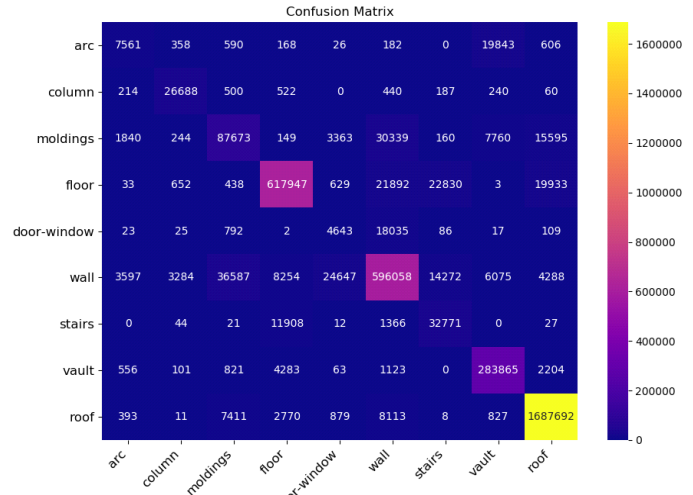
report:

	precision	recall	f1-score	support
arc	0.5318	0.2578	0.3472	29334
column	0.8497	0.9250	0.8858	28851
moldings	0.6502	0.5959	0.6219	147123
floor	0.9566	0.9030	0.9290	684357
door-window	0.1355	0.1956	0.1601	23732
wall	0.8797	0.8551	0.8672	697062
stairs	0.4661	0.7101	0.5628	46149
vault	0.8909	0.9688	0.9282	293016
roof	0.9753	0.9880	0.9816	1708104
accuracy			0.9145	3657728
macro avg	0.7040	0.7110	0.6982	3657728
weighted avg	0.9173	0.9145	0.9148	3657728

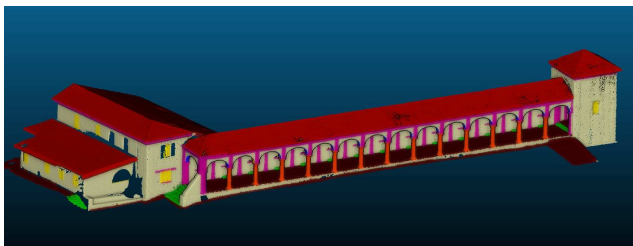
Mean Jaccard (Mean_IoU):
0.599760445639908

Jaccard:

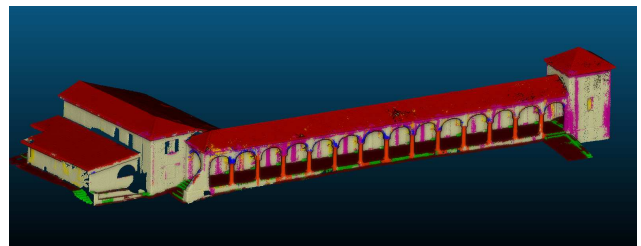
- arc: 0.21008613503751042
- column: 0.7949955317247542
- moldings: 0.4512643926643093
- floor: 0.8673999491867779
- door-window: 0.08702742216640738
- wall: 0.7655981874043095
- stairs: 0.3915666969363858
- vault: 0.8660203001394223
- roof: 0.9638853954992957



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: B_SMG_4

Overall Accuracy: **0.9157**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 287.740481
eval accuracy: 0.915795

Accuracy:

0.9157952696318589

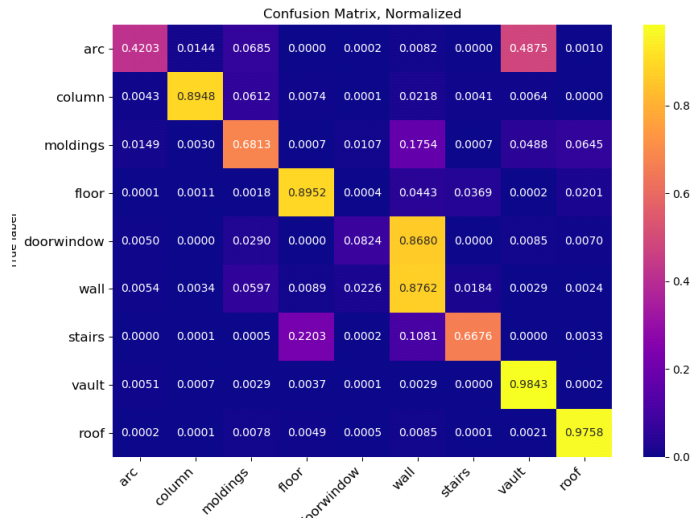
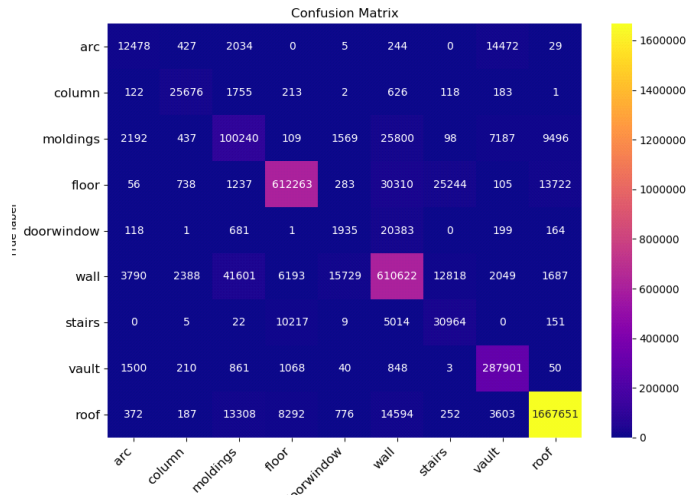
report:

	precision	recall	f1-score	support
arc	0.6049	0.4203	0.4960	29689
column	0.8539	0.8948	0.8739	28696
moldings	0.6198	0.6813	0.6491	147128
floor	0.9591	0.8952	0.9260	683958
doorwindow	0.0951	0.0824	0.0883	23482
wall	0.8619	0.8762	0.8690	696877
stairs	0.4455	0.6676	0.5344	46382
vault	0.9119	0.9843	0.9468	292481
roof	0.9851	0.9758	0.9804	1709035
accuracy			0.9158	3657728
macro avg	0.7041	0.7198	0.7071	3657728
weighted avg	0.9195	0.9158	0.9168	3657728

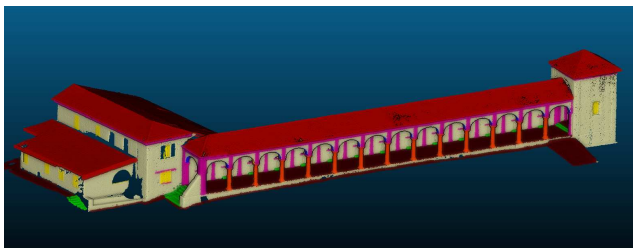
Mean Jaccard (Mean_IoU):
0.6097946377955138

Jaccard:

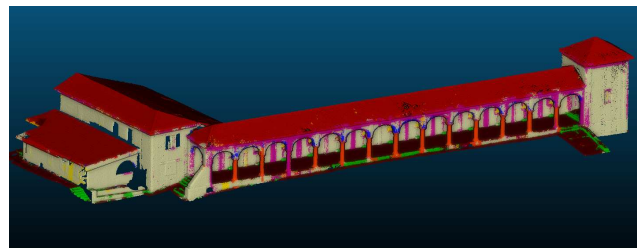
- arc: 0.32976558577129417
- column: 0.7759678442987096
- moldings: 0.48047472283069786
- floor: 0.8622803150759594
- doorwindow: 0.04618689581095596
- wall: 0.7683718050675982
- stairs: 0.3646469999411176
- vault: 0.8989068905547976
- roof: 0.9615506880884944



VISUAL INSPECTION



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Random Forest trained with multiple scenes

TEST: RF_1

Overall Accuracy: 0.6630

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: -
Impurity: Gini
N. of trees: 200

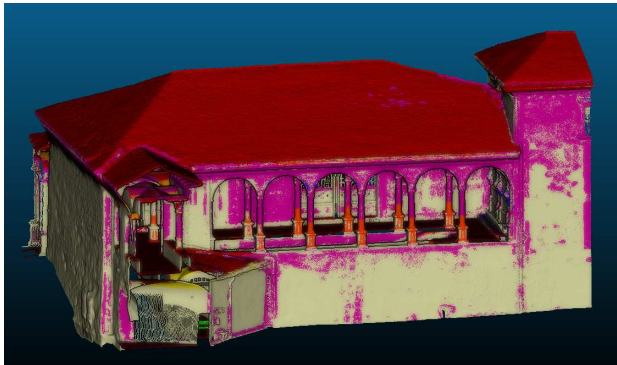
METRICS

MAX score_test: 0.6630026127155574				
	precision	recall	f1-score	support
0	0.18	0.02	0.04	478397
1	0.62	0.39	0.48	427107
2	0.22	0.55	0.32	1112471
3	0.69	0.95	0.80	1147659
4	0.02	0.00	0.01	484550
5	0.78	0.77	0.77	6457975
6	0.90	0.33	0.49	768890
7	0.85	0.48	0.62	2233582
8	0.74	0.87	0.80	2499947
accuracy			0.66	15610578
macro avg	0.56	0.49	0.48	15610578
weighted avg	0.70	0.66	0.66	15610578
Iperparametri: [True, 'gini', 200, None]				

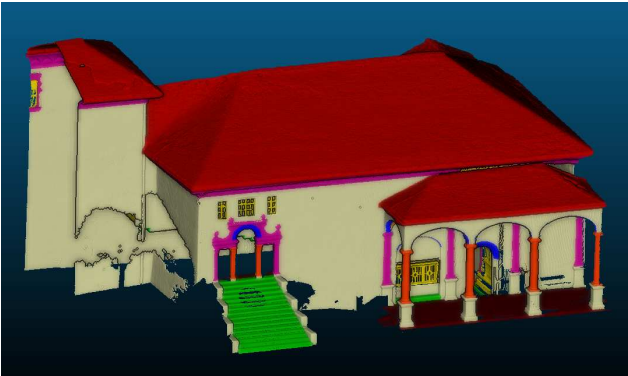
VISUAL INSPECTION



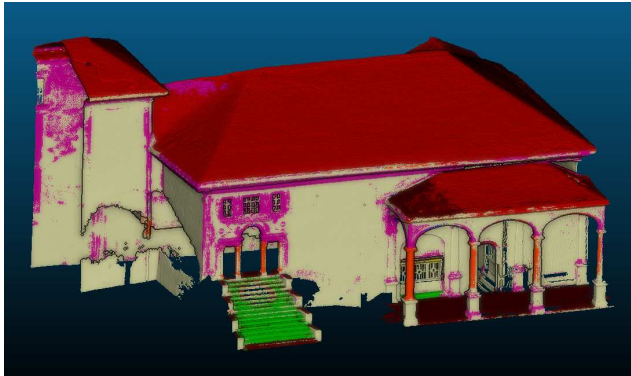
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: RF_2

Overall Accuracy: 0.6782

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: -
Impurity: Entropy
N. of trees: 200

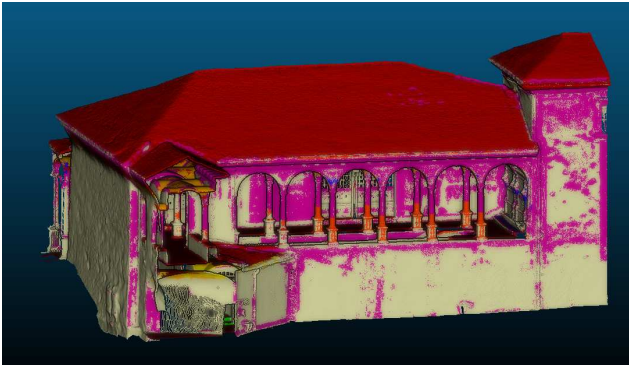
METRICS

MAX score_test: 0.678217936581208				
	precision	recall	f1-score	support
0	0.20	0.02	0.04	478397
1	0.60	0.31	0.41	427107
2	0.24	0.60	0.34	1112471
3	0.68	0.93	0.78	1147659
4	0.03	0.01	0.01	484550
5	0.78	0.75	0.76	6457975
6	0.87	0.32	0.47	768890
7	0.87	0.64	0.74	2233582
8	0.81	0.87	0.84	2499947
accuracy			0.68	15610578
macro avg	0.56	0.50	0.49	15610578
weighted avg	0.71	0.68	0.67	15610578
Iperparametri: [True, 'entropy', 200, None]				

VISUAL INSPECTION



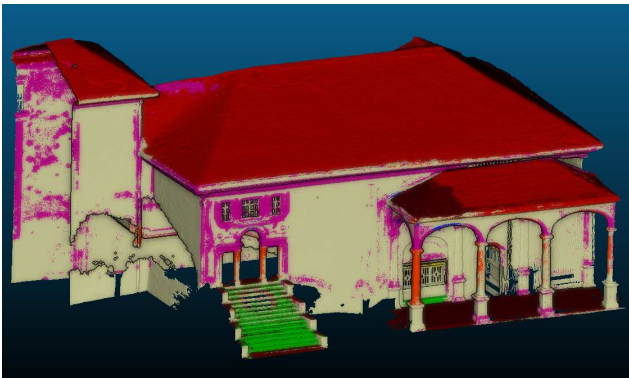
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: RF_3

Overall Accuracy: 0.3665

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: 1
Impurity: Gini
N. of trees: 150

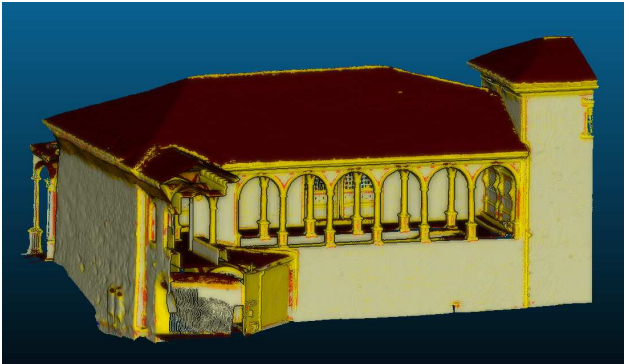
METRICS

MAX score_test: 0.36652255925437227				
	precision	recall	f1-score	support
0	0.19	0.00	0.00	478397
1	0.07	0.09	0.08	427107
2	0.02	0.00	0.00	1112471
3	0.21	0.94	0.35	1147659
4	0.05	0.51	0.09	484550
5	0.89	0.57	0.69	6457975
6	0.00	0.00	0.00	768890
7	0.85	0.31	0.46	2233582
8	0.00	0.00	0.00	2499947
accuracy			0.37	15610578
macro avg	0.25	0.27	0.19	15610578
weighted avg	0.51	0.37	0.38	15610578
Iperparametri: [True, 'gini', 150, None]				

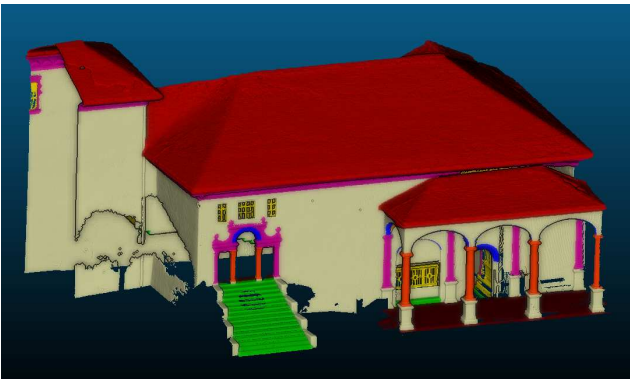
VISUAL INSPECTION



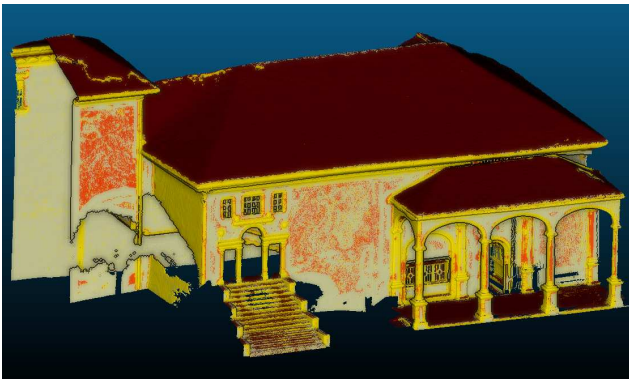
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: RF_4

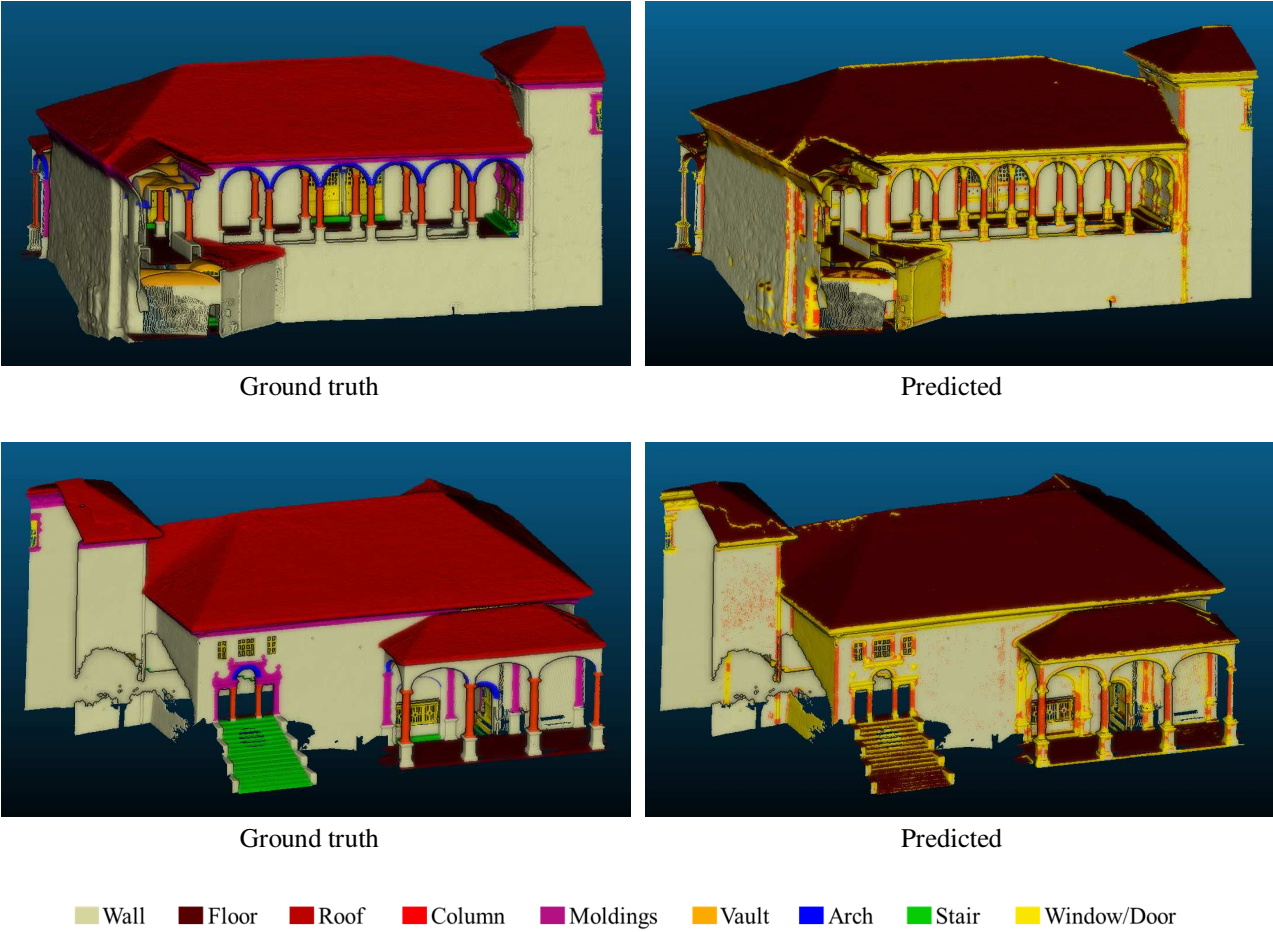
Overall Accuracy: 0.3966

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: 1
Impurity: Entropy
N. of trees: 150

METRICS

MAX score_test: 0.39663784390302526				
	precision	recall	f1-score	support
0	0.00	0.00	0.00	478397
1	0.27	0.63	0.38	427107
2	0.00	0.00	0.00	1112471
3	0.21	0.98	0.35	1147659
4	0.05	0.47	0.09	484550
5	0.94	0.61	0.74	6457975
6	0.00	0.00	0.00	768890
7	0.85	0.28	0.43	2233582
8	0.00	0.00	0.00	2499947
accuracy			0.40	15610578
macro avg	0.26	0.33	0.22	15610578
weighted avg	0.53	0.40	0.41	15610578
Iperparametri: [True, 'entropy', 150, None]				

VISUAL INSPECTION



TEST: RF_5

Overall Accuracy: 0.1760

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: 2
Impurity: Gini
N. of trees: 150

METRICS

MAX score_test: 0.17600020960146384

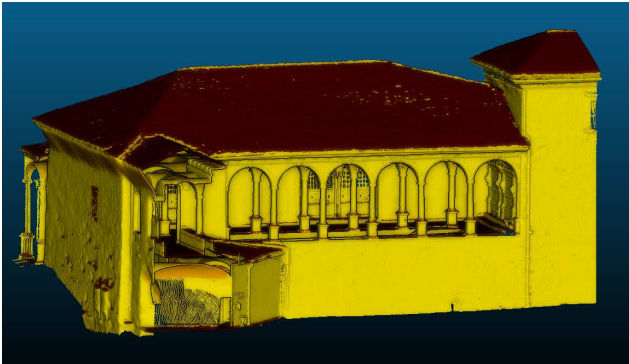
	precision	recall	f1-score	support
0	0.00	0.00	0.00	478397
1	0.00	0.00	0.00	427107
2	0.00	0.00	0.00	1112471
3	0.26	0.98	0.42	1147659
4	0.05	0.92	0.09	484550
5	0.81	0.00	0.00	6457975
6	0.00	0.00	0.00	768890
7	0.79	0.53	0.63	2233582
8	0.11	0.00	0.00	2499947
accuracy			0.18	15610578
macro avg	0.23	0.27	0.13	15610578
weighted avg	0.49	0.18	0.12	15610578

Iperparametri: [True, 'gini', 150, None]

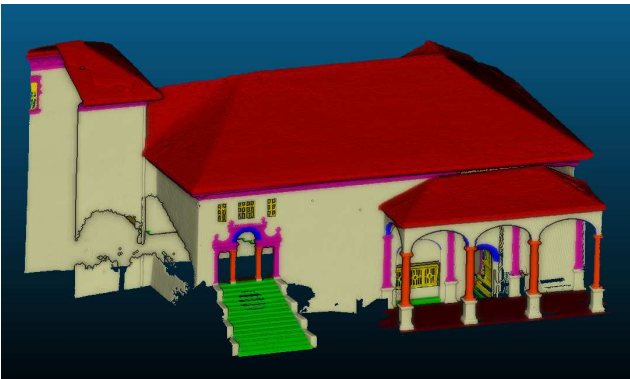
VISUAL INSPECTION



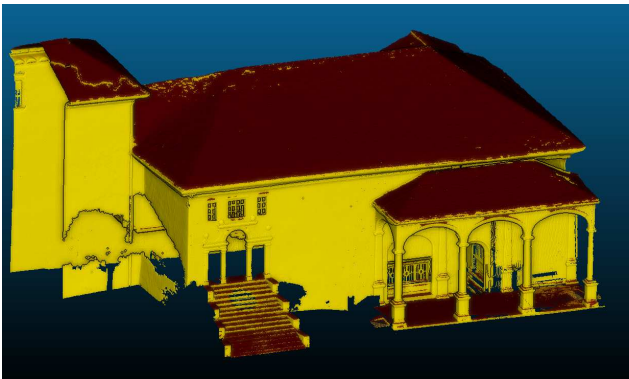
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: RF_6

Overall Accuracy: 0.1840

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
Scaler: 2
Impurity: Entropy
N. of trees: 150

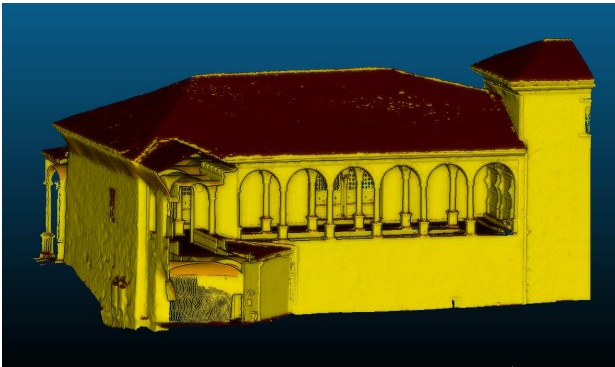
METRICS

MAX score_test: 0.1840699940770931				
	precision	recall	f1-score	support
0	0.00	0.00	0.00	478397
1	0.00	0.00	0.00	427107
2	0.00	0.00	0.00	1112471
3	0.27	0.98	0.42	1147659
4	0.05	0.93	0.09	484550
5	0.85	0.00	0.00	6457975
6	0.00	0.00	0.00	768890
7	0.80	0.58	0.68	2233582
8	0.03	0.00	0.00	2499947
accuracy			0.18	15610578
macro avg	0.22	0.28	0.13	15610578
weighted avg	0.49	0.18	0.13	15610578
Iperparametri: [True, 'entropy', 150, None]				

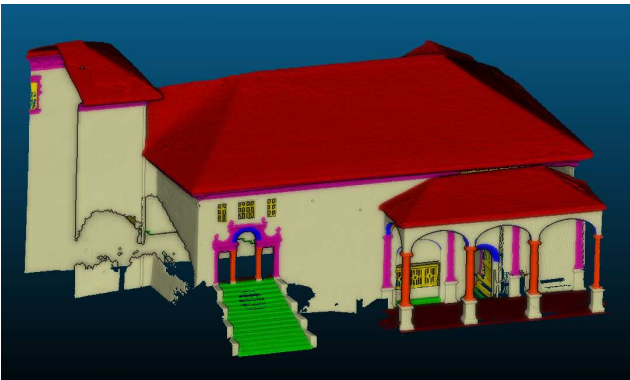
VISUAL INSPECTION



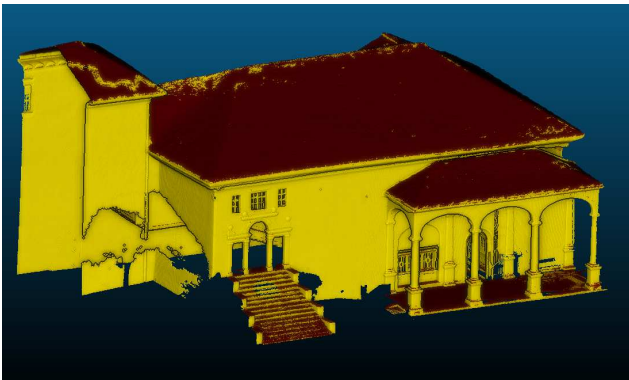
Ground truth



Predicted



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

DGCNN used as Feature extractor for the Random Forest

TEST: FE_pieces_1

Overall Accuracy: **0.6912**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: -

Impurity: Entropy

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.06	0.28	0.10	41684
1	0.60	0.69	0.64	19660
2	0.21	0.25	0.23	171203
3	0.89	0.73	0.80	212136
4	0.13	0.00	0.01	6162
5	0.96	0.35	0.51	622917
6	0.71	0.89	0.79	152094
7	0.71	0.80	0.75	359297
8	0.80	0.96	0.87	847871
accuracy			0.69	2433024
macro avg	0.56	0.55	0.52	2433024
weighted avg	0.77	0.69	0.69	2433024

- 0.6915015811011904 - 0.6912714383417509

TEST: FE_pieces_2

Overall Accuracy: **0.6904**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: -

Impurity: Gini

N. of trees: 150

METRICS

	precision	recall	f1-score	support
0	0.06	0.27	0.10	41684
1	0.60	0.66	0.63	19660
2	0.21	0.24	0.22	171203
3	0.87	0.72	0.79	212136
4	0.13	0.01	0.01	6162
5	0.96	0.36	0.52	622917
6	0.71	0.89	0.79	152094
7	0.71	0.79	0.75	359297
8	0.79	0.97	0.87	847871
accuracy			0.69	2433024
macro avg	0.56	0.54	0.52	2433024
weighted avg	0.77	0.69	0.69	2433024

- 0.6939104352678571 - 0.6904535261468855

TEST: FE_pieces_3

Overall Accuracy: **0.6833**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 1

Impurity: Entropy

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.05	0.18	0.08	41684
1	0.69	0.59	0.64	19660
2	0.15	0.11	0.13	171203
3	0.86	0.65	0.74	212136
4	0.16	0.00	0.00	6162
5	0.94	0.34	0.49	622917
6	0.76	0.86	0.80	152094
7	0.53	0.88	0.66	359297
8	0.82	0.95	0.88	847871
accuracy			0.67	2433024
macro avg	0.55	0.51	0.49	2433024
weighted avg	0.74	0.67	0.66	2433024

- 0.6934000651041666 - 0.6739062171191077

TEST: FE_pieces_4

Overall Accuracy: **0.6739**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 1

Impurity: Gini

N. of trees: 150

METRICS

	precision	recall	f1-score	support
0	0.05	0.18	0.08	41684
1	0.71	0.55	0.62	19660
2	0.18	0.12	0.15	171203
3	0.87	0.69	0.77	212136
4	0.14	0.00	0.01	6162
5	0.94	0.35	0.51	622917
6	0.75	0.86	0.80	152094
7	0.51	0.90	0.65	359297
8	0.85	0.95	0.89	847871
accuracy			0.68	2433024
macro avg	0.56	0.51	0.50	2433024
weighted avg	0.75	0.68	0.67	2433024

- 0.6996012369791667 - 0.6833072752262206

TEST: FE_pieces_5

Overall Accuracy: **0.6947**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 2

Impurity: Entropy

N. of trees: 150

METRICS

	precision	recall	f1-score	support
0	0.06	0.25	0.09	41684
1	0.57	0.71	0.63	19660
2	0.17	0.11	0.13	171203
3	0.72	0.84	0.78	212136
4	0.12	0.00	0.01	6162
5	0.96	0.37	0.53	622917
6	0.70	0.86	0.77	152094
7	0.64	0.83	0.72	359297
8	0.83	0.96	0.89	847871
accuracy			0.69	2433024
macro avg	0.53	0.55	0.51	2433024
weighted avg	0.75	0.69	0.68	2433024

- 0.7069638206845238 - 0.6947547578651094

TEST: FE_pieces_6

Overall Accuracy: **0.6968**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 2

Impurity: Gini

N. of trees: 150

METRICS

	precision	recall	f1-score	support
0	0.06	0.25	0.10	41684
1	0.63	0.74	0.68	19660
2	0.22	0.14	0.17	171203
3	0.67	0.86	0.75	212136
4	0.06	0.01	0.01	6162
5	0.95	0.36	0.52	622917
6	0.69	0.87	0.77	152094
7	0.66	0.82	0.73	359297
8	0.83	0.96	0.89	847871
accuracy			0.70	2433024
macro avg	0.53	0.56	0.51	2433024
weighted avg	0.75	0.70	0.68	2433024

- 0.7022809709821428 - 0.696847626657197

TEST: FE_slice_1

Overall Accuracy: **0.8152**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: -

Impurity: Entropy

N. of trees: 100

METRICS

	precision	recall	f1-score	support
0	0.39	0.21	0.27	30141
1	0.96	0.18	0.31	18696
2	0.76	0.53	0.63	88458
3	0.39	0.99	0.56	113972
4	0.50	0.27	0.35	22412
5	0.82	0.79	0.81	398109
6	0.68	0.04	0.08	149711
7	0.86	0.94	0.90	230315
8	0.95	0.97	0.96	938842
accuracy			0.82	1990656
macro avg	0.70	0.55	0.54	1990656
weighted avg	0.84	0.82	0.79	1990656

- 0.678276134672619 - 0.8152257346322016

TEST: FE_slice_2

Overall Accuracy: **0.8130**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: -

Impurity: Gini

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.40	0.21	0.28	30141
1	0.96	0.14	0.24	18696
2	0.76	0.51	0.61	88458
3	0.39	0.99	0.56	113972
4	0.47	0.24	0.32	22412
5	0.81	0.80	0.81	398109
6	0.67	0.04	0.07	149711
7	0.86	0.94	0.90	230315
8	0.94	0.97	0.95	938842
accuracy			0.81	1990656
macro avg	0.70	0.54	0.53	1990656
weighted avg	0.83	0.81	0.79	1990656

- 0.6675304594494048 - 0.8130736802340535

TEST: FE_slice_3

Overall Accuracy: **0.8063**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 1

Impurity: Entropy

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.21	0.27	0.24	30141
1	0.97	0.06	0.11	18696
2	0.67	0.55	0.60	88458
3	0.41	0.97	0.58	113972
4	0.43	0.30	0.36	22412
5	0.78	0.82	0.80	398109
6	0.79	0.13	0.22	149711
7	0.83	0.94	0.88	230315
8	0.98	0.93	0.95	938842
accuracy			0.81	1990656
macro avg	0.67	0.55	0.53	1990656
weighted avg	0.84	0.81	0.79	1990656

- 0.624336170014881 - 0.8063261557998971

TEST: FE_slice_4

Overall Accuracy: **0.8063**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: -

Impurity: Gini

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.22	0.28	0.24	30141
1	0.96	0.07	0.13	18696
2	0.66	0.54	0.59	88458
3	0.41	0.97	0.58	113972
4	0.41	0.28	0.33	22412
5	0.78	0.81	0.79	398109
6	0.76	0.12	0.21	149711
7	0.83	0.94	0.88	230315
8	0.98	0.93	0.95	938842
accuracy			0.81	1990656
macro avg	0.67	0.55	0.52	1990656
weighted avg	0.84	0.81	0.79	1990656

- 0.6271949404761905 - 0.8063703623328189

TEST: FE_slice_5

Overall Accuracy: **0.8098**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 2

Impurity: Entropy

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.25	0.24	0.24	30141
1	0.94	0.22	0.36	18696
2	0.70	0.53	0.60	88458
3	0.38	0.98	0.55	113972
4	0.39	0.37	0.38	22412
5	0.84	0.77	0.80	398109
6	0.71	0.09	0.15	149711
7	0.82	0.96	0.88	230315
8	0.97	0.95	0.96	938842
accuracy			0.81	1990656
macro avg	0.67	0.57	0.55	1990656
weighted avg	0.84	0.81	0.80	1990656

- 0.6628580729166667 - 0.8098054108796297

TEST: FE_slice_6

Overall Accuracy: **0.8089**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

Scaler: 2

Impurity: Gini

N. of trees: 200

METRICS

	precision	recall	f1-score	support
0	0.25	0.24	0.25	30141
1	0.94	0.21	0.35	18696
2	0.70	0.51	0.59	88458
3	0.38	0.98	0.55	113972
4	0.39	0.35	0.37	22412
5	0.84	0.77	0.80	398109
6	0.71	0.08	0.14	149711
7	0.82	0.96	0.88	230315
8	0.97	0.95	0.96	938842
accuracy			0.81	1990656
macro avg	0.67	0.56	0.54	1990656
weighted avg	0.84	0.81	0.79	1990656

- 0.6614966982886905 - 0.8089810595100309

Fine tuning

TEST: FT_pieces_1

Overall Accuracy: **0.6680**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.644528
eval accuracy: 0.668082

Accuracy:
0.6680821890782829

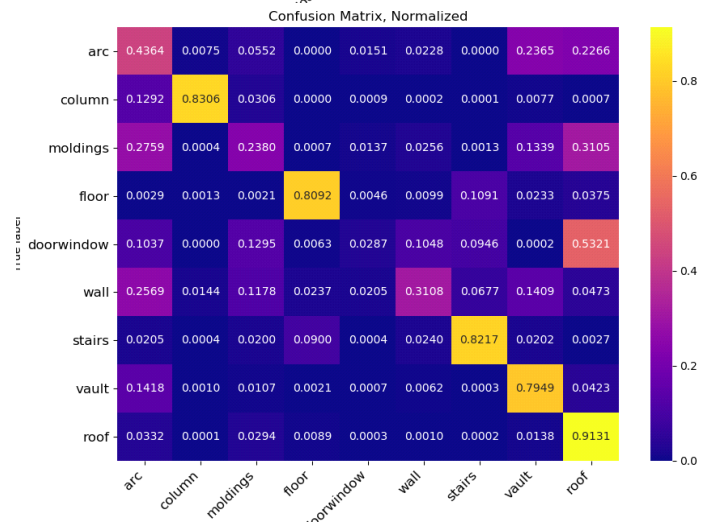
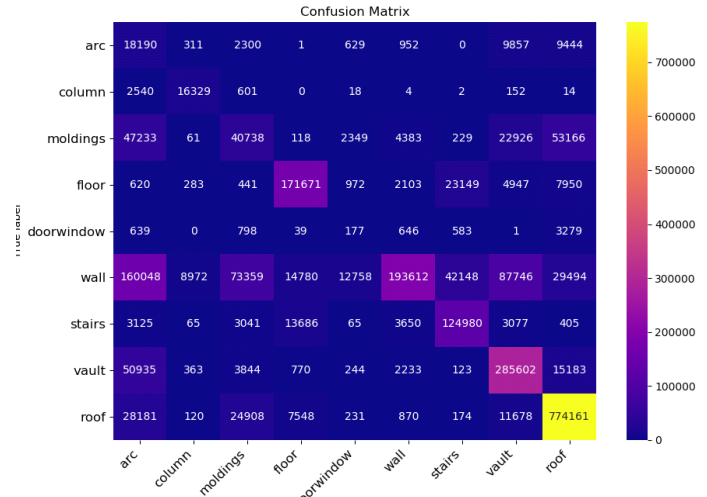
report:

	precision	recall	f1-score	support
arc	0.0584	0.4364	0.1030	41684
column	0.6161	0.8306	0.7074	19660
moldings	0.2715	0.2380	0.2536	171203
floor	0.8229	0.8092	0.8160	212136
doorwindow	0.0101	0.0287	0.0150	6162
wall	0.9288	0.3108	0.4658	622917
stairs	0.6530	0.8217	0.7277	152094
vault	0.6704	0.7949	0.7274	359297
roof	0.8668	0.9131	0.8893	847871
accuracy			0.6681	2433024
macro avg	0.5442	0.5759	0.5228	2433024
weighted avg	0.7766	0.6681	0.6786	2433024

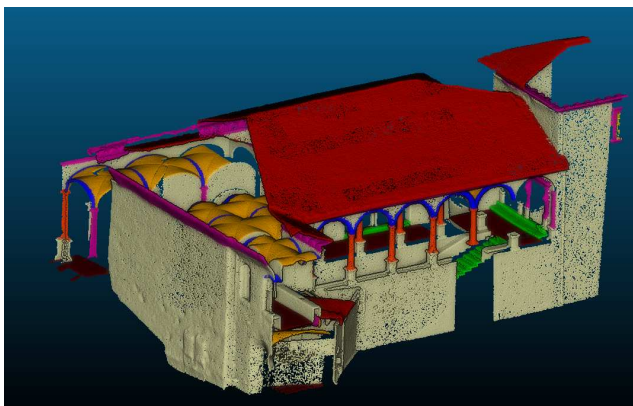
Mean Jaccard (Mean_IoU):
0.41016691435293073

Jaccard:

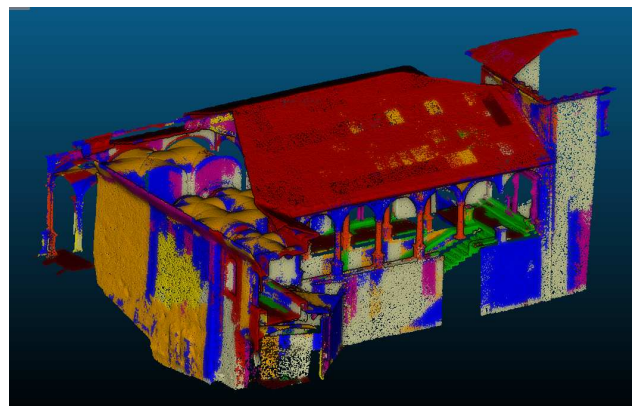
- arc: 0.05429769704929777
- column: 0.5473102061337356
- moldings: 0.14523610046524893
- floor: 0.6892258649900834
- doorwindow: 0.007555062318593137
- wall: 0.30358223652231725
- stairs: 0.5719856111156877
- vault: 0.571568660805594
- roof: 0.8007407897758185



VISUAL INSPECTION (the missing parts are those used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_pieces_2

Overall Accuracy: **0.7067**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1232.613546
 eval accuracy: 0.706747

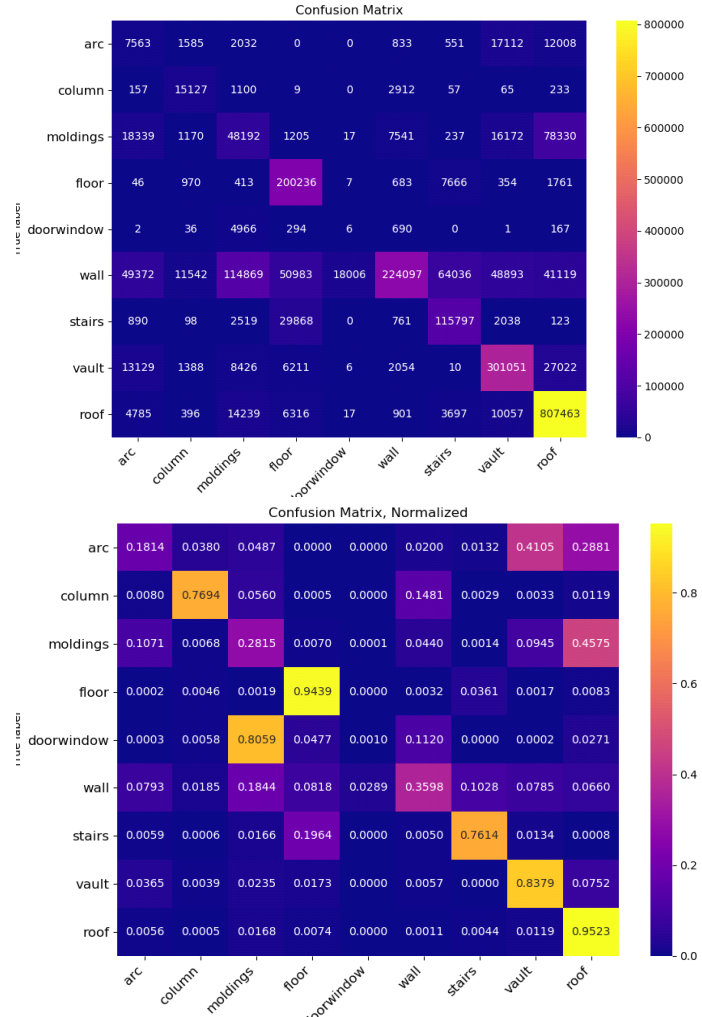
Accuracy:
 0.7067468302819865

report:	precision	recall	f1-score	support
arc	0.0802	0.1814	0.1112	41684
column	0.4682	0.7694	0.5821	19660
moldings	0.2449	0.2815	0.2619	171203
floor	0.6785	0.9439	0.7895	212136
doorwindow	0.0003	0.0010	0.0005	6162
wall	0.9319	0.3598	0.5191	622917
stairs	0.6029	0.7614	0.6730	152094
vault	0.7607	0.8379	0.7974	359297
roof	0.8340	0.9523	0.8892	847871
accuracy			0.7067	2433024
macro avg	0.5113	0.5654	0.5138	2433024
weighted avg	0.7608	0.7067	0.6965	2433024

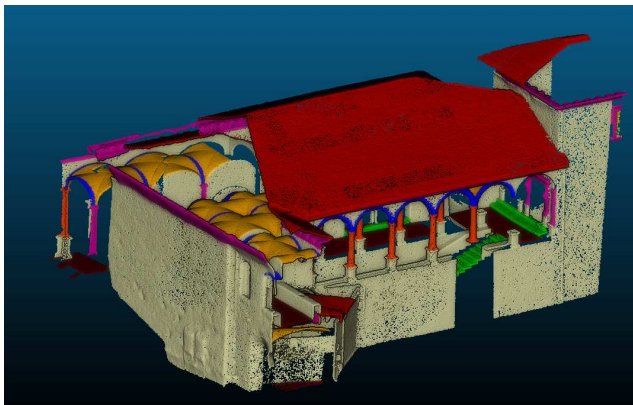
Mean Jaccard (Mean_IoU):
 0.3993250045656425

Jaccard:

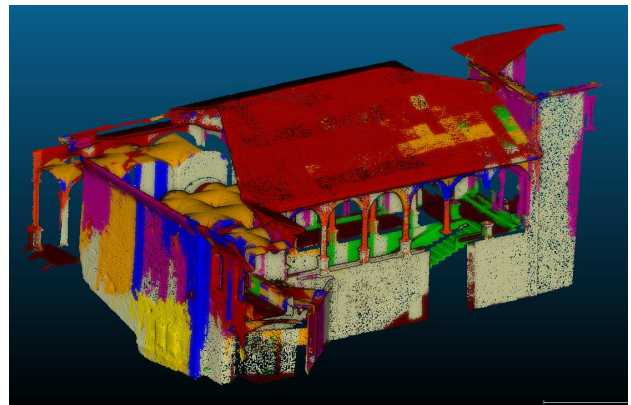
- arc: 0.05890003426684527
- column: 0.4105577418917085
- moldings: 0.15070973552618
- floor: 0.6521877911029177
- doorwindow: 0.00024778030146603347
- wall: 0.350539346652234
- stairs: 0.5071075726522676
- vault: 0.6631239963963884
- roof: 0.8005510423007751



VISUAL INSPECTION (the missing parts are those used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_pieces_3

Overall Accuracy: **0.7145**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1196.366017
eval accuracy: 0.714589

Accuracy:
0.7145889230850169

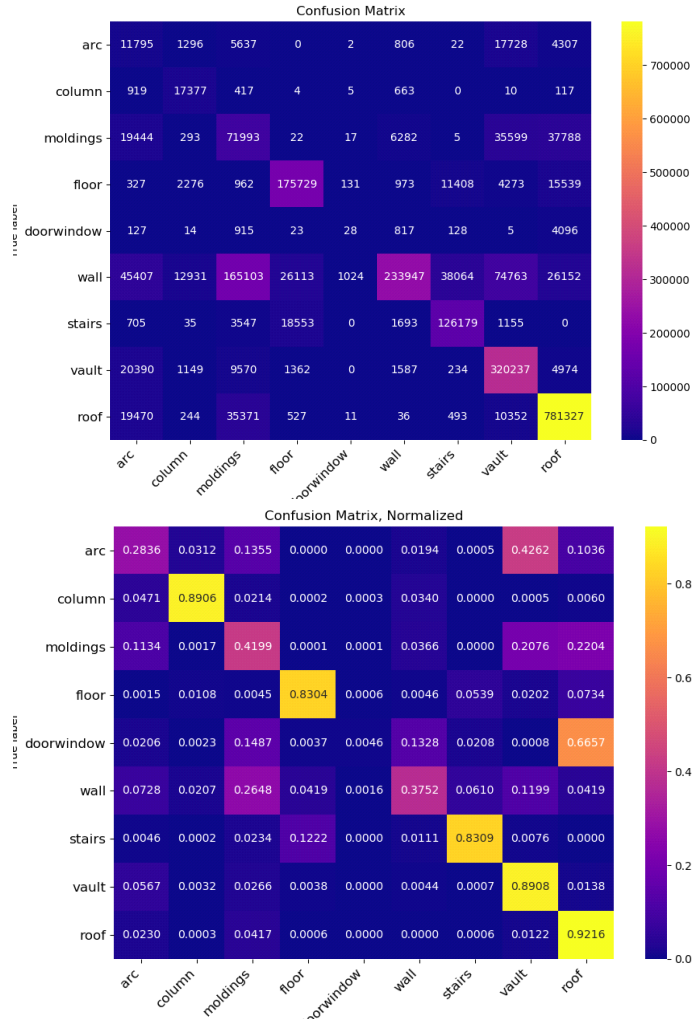
report:

	precision	recall	f1-score	support
arc	0.0995	0.2836	0.1473	41593
column	0.4879	0.8906	0.6304	19512
moldings	0.2453	0.4199	0.3097	171443
floor	0.7904	0.8304	0.8099	211618
doorwindow	0.0230	0.0046	0.0076	6153
wall	0.9479	0.3752	0.5376	623504
stairs	0.7148	0.8309	0.7684	151867
vault	0.6900	0.8908	0.7776	359503
roof	0.8937	0.9216	0.9074	847831
accuracy			0.7146	2433024
macro avg	0.5436	0.6053	0.5440	2433024
weighted avg	0.7926	0.7146	0.7167	2433024

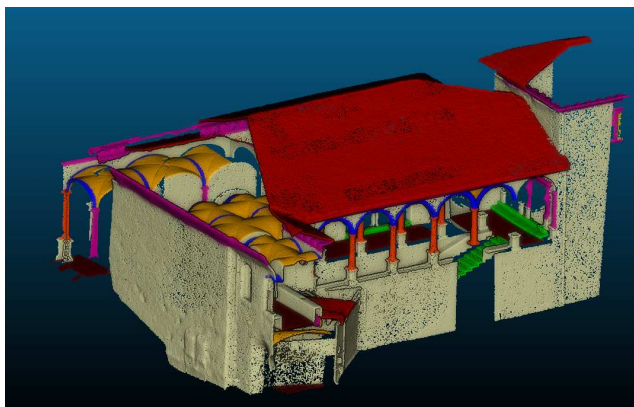
Mean Jaccard (Mean_IoU):
0.4295123713895294

Jaccard:

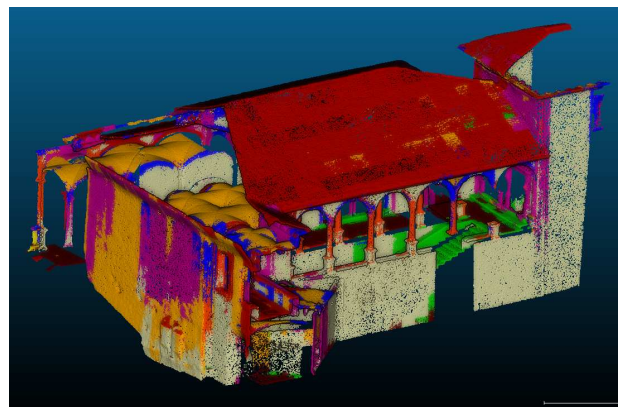
- arc: 0.07949077381353534
- column: 0.460317880794702
- moldings: 0.18320461109768046
- floor: 0.6805345787733036
- doorwindow: 0.0038131553860819827
- wall: 0.36763252304902405
- stairs: 0.6239658591343135
- vault: 0.6361633570923423
- roof: 0.8304886033647816



VISUAL INSPECTION (the missing parts are those used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_slice_1

Overall Accuracy: **0.8395**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.734454
eval accuracy: 0.839524

Accuracy:

0.8395242573302469

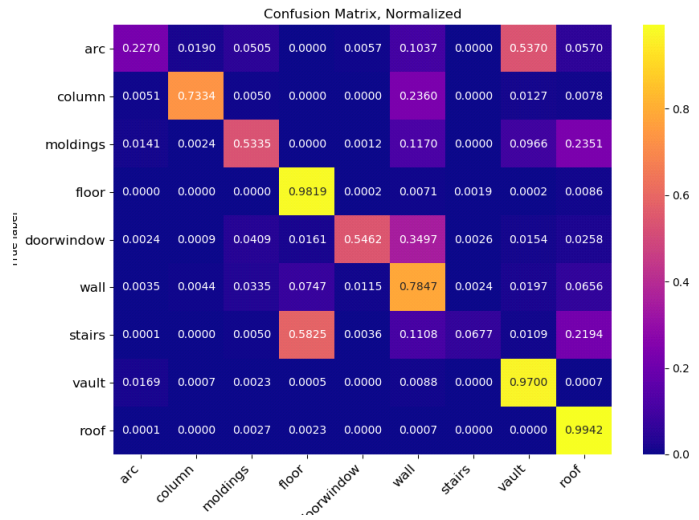
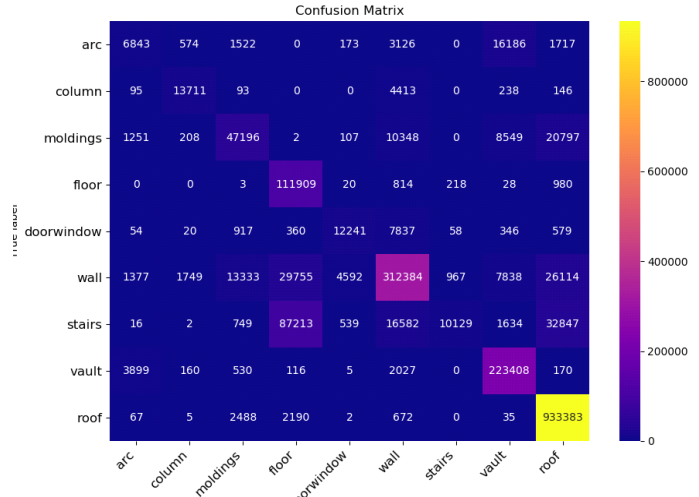
report:

	precision	recall	f1-score	support
arc	0.5031	0.2270	0.3129	30141
column	0.8346	0.7334	0.7807	18696
moldings	0.7062	0.5335	0.6078	88458
floor	0.4833	0.9819	0.6478	113972
doorwindow	0.6924	0.5462	0.6107	22412
wall	0.8721	0.7847	0.8261	398109
stairs	0.8907	0.0677	0.1258	149711
vault	0.8650	0.9700	0.9145	230315
roof	0.9180	0.9942	0.9546	938842
accuracy			0.8395	1990656
macro avg	0.7517	0.6487	0.6423	1990656
weighted avg	0.8567	0.8395	0.8137	1990656

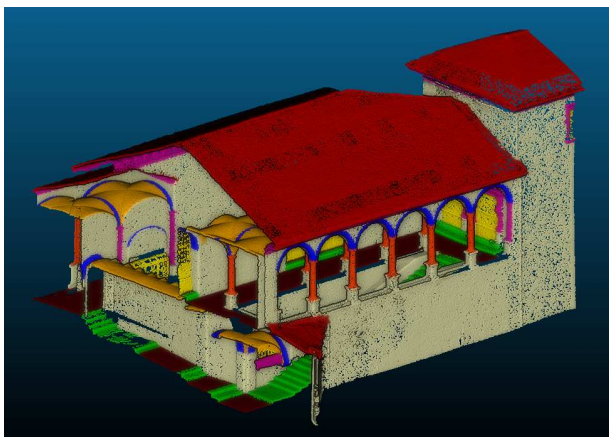
Mean Jaccard (Mean_IoU):
0.523038327430704

Jaccard:

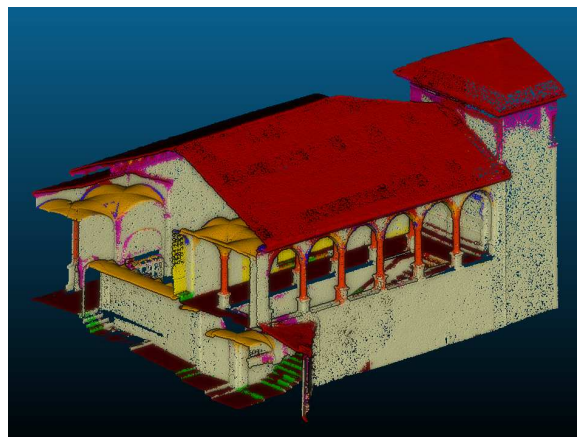
- arc: 0.18544715447154472
- column: 0.6402820584664238
- moldings: 0.43662401820654434
- floor: 0.47904609431183864
- doorwindow: 0.43953321364452425
- wall: 0.7036816781099637
- stairs: 0.067099911231236
- vault: 0.8425117566533041
- roof: 0.913119061780957



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_slice_2

Overall Accuracy: **0.8365**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1040.984327
eval accuracy: 0.836501

Accuracy:
0.836500630947788

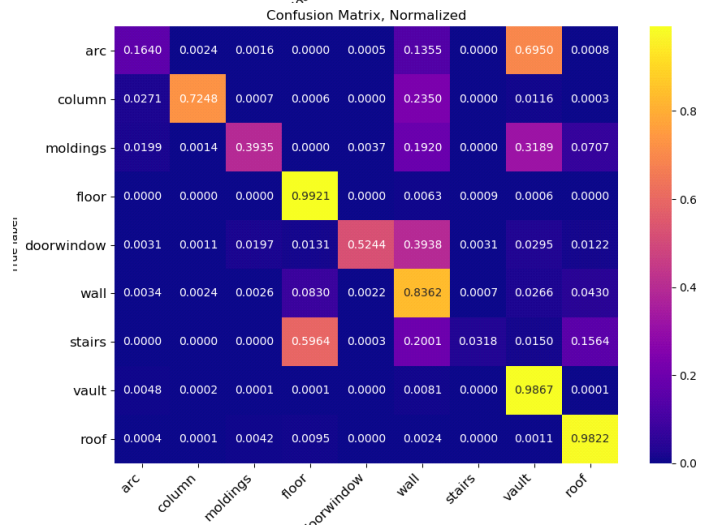
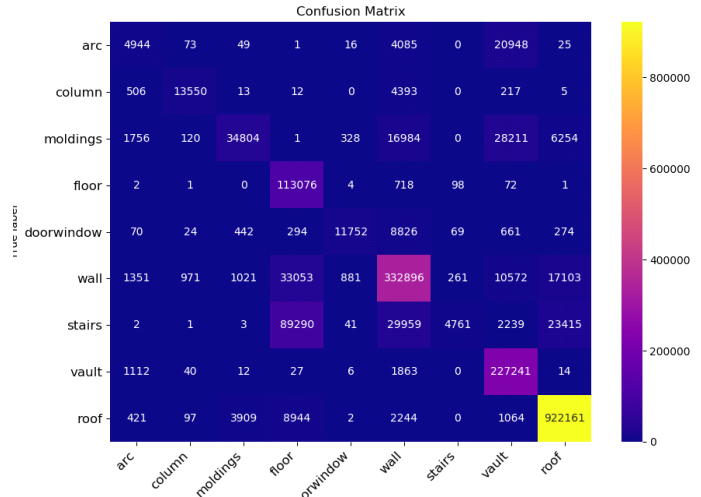
report:

	precision	recall	f1-score	support
arc	0.4864	0.1640	0.2453	30141
column	0.9108	0.7248	0.8072	18696
moldings	0.8646	0.3935	0.5408	88458
floor	0.4621	0.9921	0.6305	113972
doorwindow	0.9019	0.5244	0.6632	22412
wall	0.8282	0.8362	0.8322	398109
stairs	0.9175	0.0318	0.0615	149711
vault	0.7803	0.9867	0.8714	230315
roof	0.9514	0.9822	0.9666	938842
accuracy			0.8365	1990656
macro avg	0.7893	0.6262	0.6243	1990656
weighted avg	0.8646	0.8365	0.8066	1990656

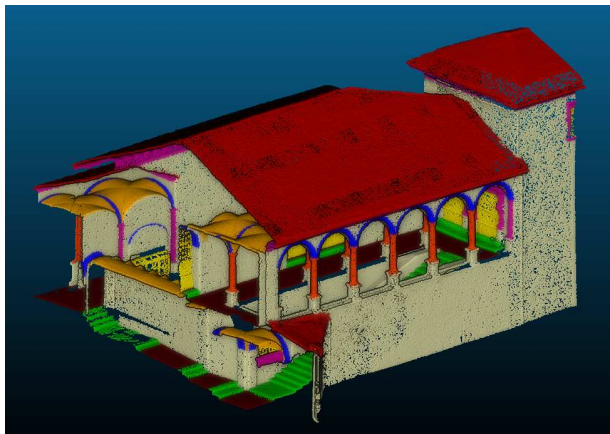
Mean Jaccard (Mean IoU):
0.5105985313458619

Jaccard:

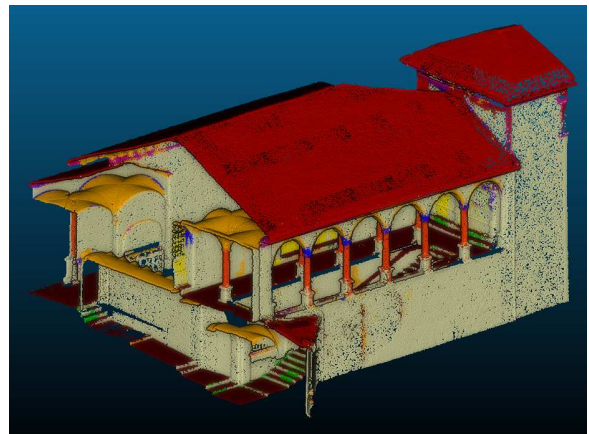
- arc: 0.13981505047934165
- column: 0.6767217699645408
- moldings: 0.37062199836007964
- floor: 0.4604184141306384
- doorwindow: 0.49607429295061206
- wall: 0.7125632249599192
- stairs: 0.03171061483025729
- vault: 0.772143296443413
- roof: 0.935318119993955



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_slice_3

Overall Accuracy: **0.8109**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

Accuracy:
0.8109236352237654

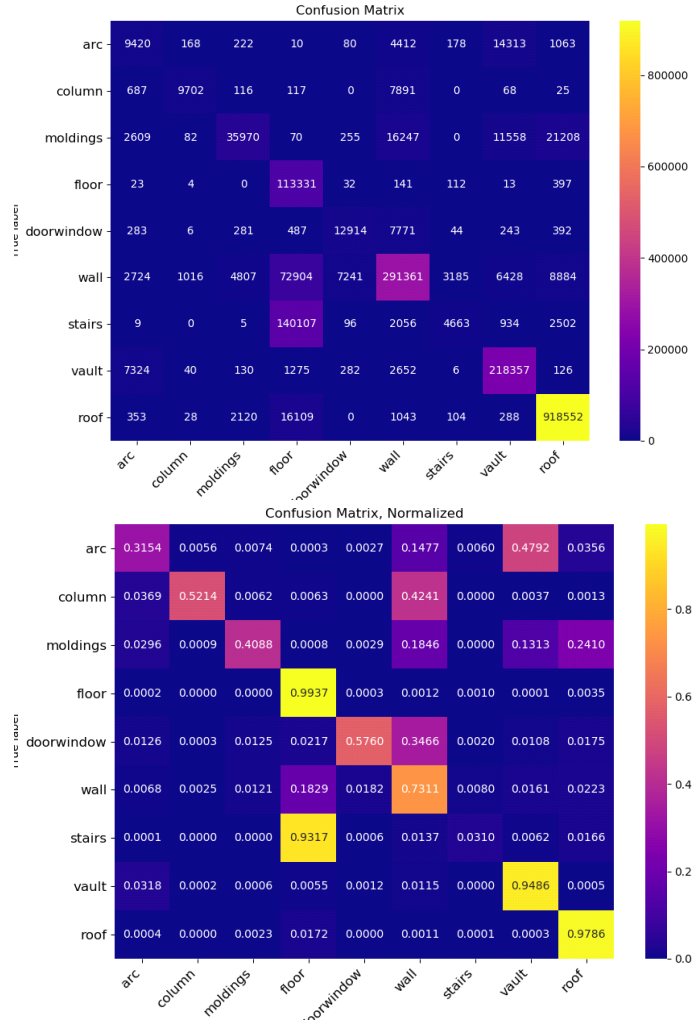
report:

	precision	recall	f1-score	support
arc	0.4020	0.3154	0.3535	29866
column	0.8783	0.5214	0.6544	18606
moldings	0.8240	0.4088	0.5464	87999
floor	0.3291	0.9937	0.4944	114053
doorwindow	0.6179	0.5760	0.5962	22421
wall	0.8735	0.7311	0.7959	398550
stairs	0.5623	0.0310	0.0588	150372
vault	0.8658	0.9486	0.9053	230192
roof	0.9637	0.9786	0.9711	938597
accuracy			0.8109	1990656
macro avg	0.7018	0.6116	0.5973	1990656
weighted avg	0.8483	0.8109	0.7970	1990656

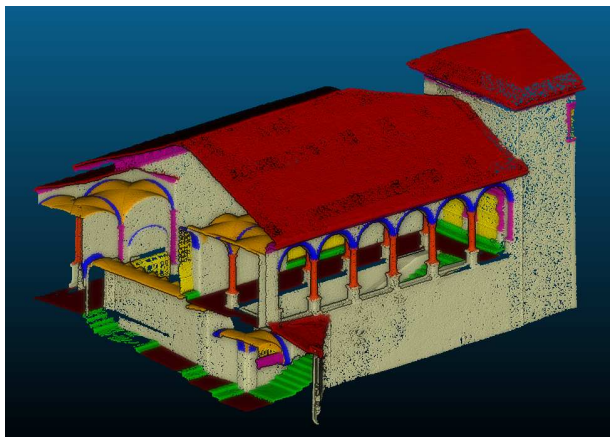
Mean Jaccard (Mean_IoU):
0.47690901486342796

Jaccard:

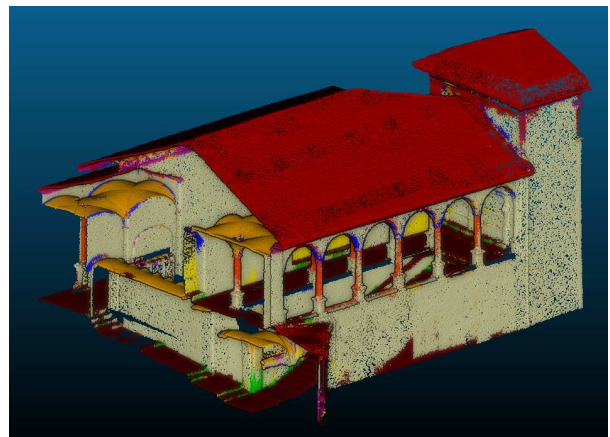
- arc: 0.2146861753042527
- column: 0.4863157894736842
- moldings: 0.375940635451505
- floor: 0.3283700149508014
- doorwindow: 0.424704837701845
- wall: 0.6610377912846587
- stairs: 0.030279024162180763
- vault: 0.8269939440305715
- roof: 0.9438529214113527



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_slice_4

Overall Accuracy: **0.8276**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 844.314474
eval accuracy: 0.827658

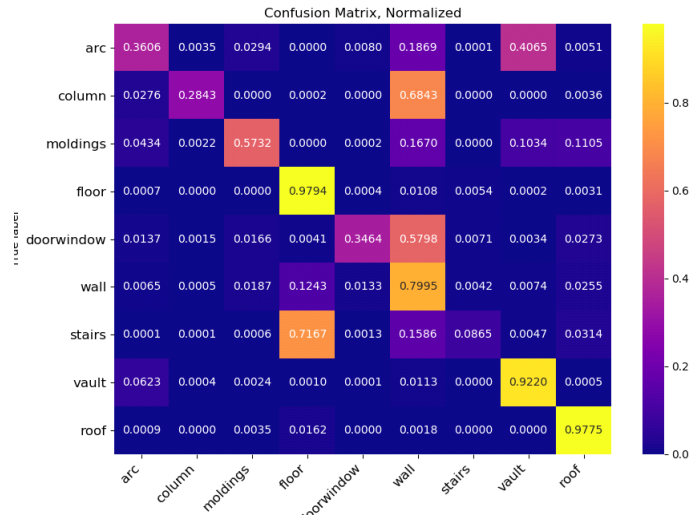
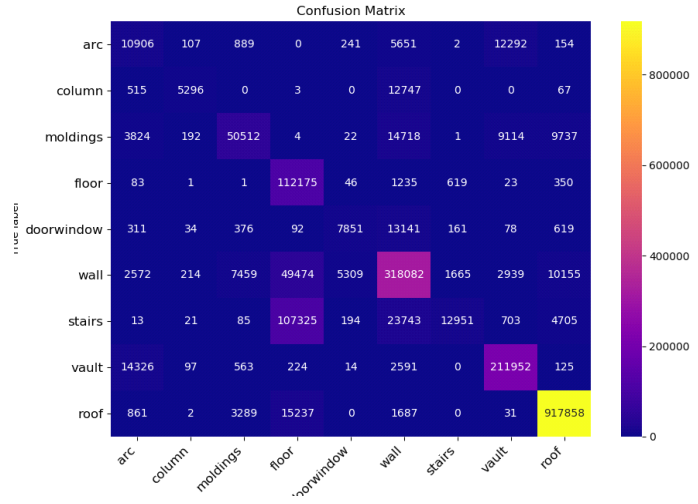
Accuracy:
0.8276583196694959

report:	precision	recall	f1-score	support
arc	0.3264	0.3606	0.3427	30242
column	0.8880	0.2843	0.4307	18628
moldings	0.7996	0.5732	0.6677	88124
floor	0.3942	0.9794	0.5622	114533
doorwindow	0.5740	0.3464	0.4321	22663
wall	0.8081	0.7995	0.8038	397869
stairs	0.8410	0.0865	0.1568	149740
vault	0.8938	0.9220	0.9077	229892
roof	0.9725	0.9775	0.9750	938965
accuracy			0.8277	1990656
macro avg	0.7220	0.5922	0.5865	1990656
weighted avg	0.8646	0.8277	0.8132	1990656

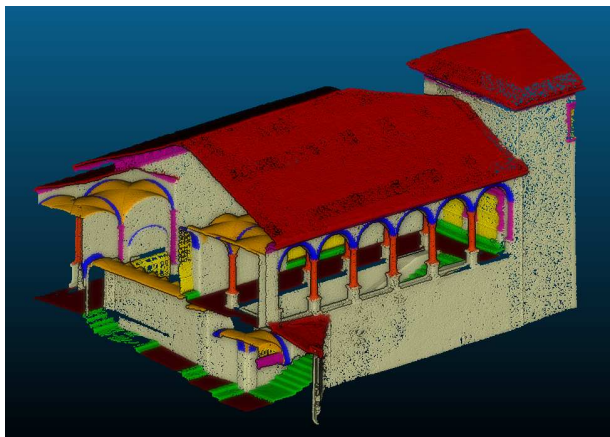
Mean Jaccard (Mean_IoU):
0.4653595696440933

Jaccard:

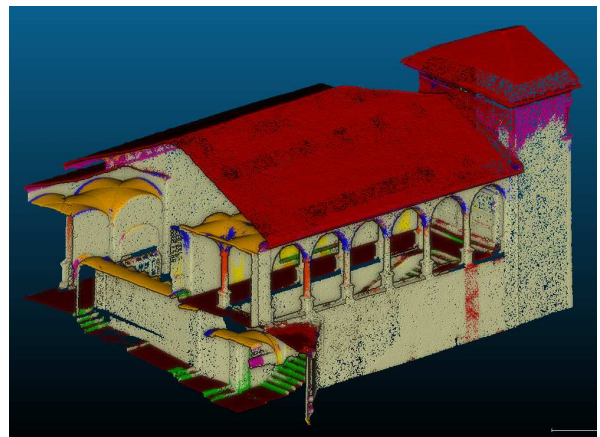
- arc: 0.20676057406108403
- column: 0.2744610281923715
- moldings: 0.5011807195443811
- floor: 0.39100079472414706
- doorwindow: 0.27558004843974865
- wall: 0.6719351390631667
- stairs: 0.08509869372092412
- vault: 0.8309496926358048
- roof: 0.9512694364152114



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: FT_slice_5

Overall Accuracy: **0.8401**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/window":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 679.344561
eval accuracy: 0.840197

Accuracy:

0.8401974022633745

report:

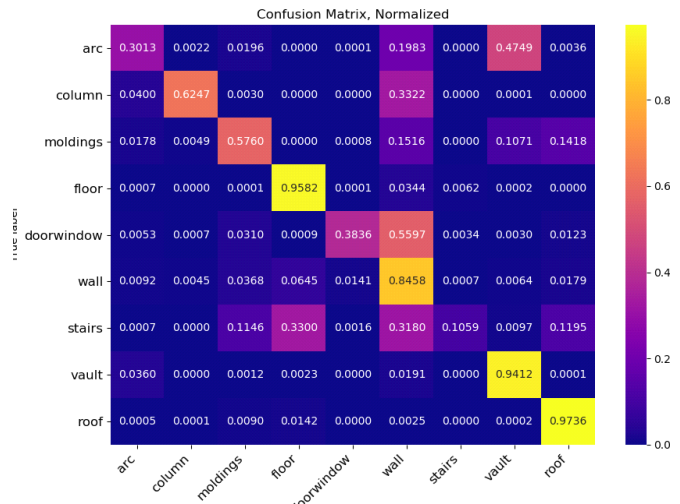
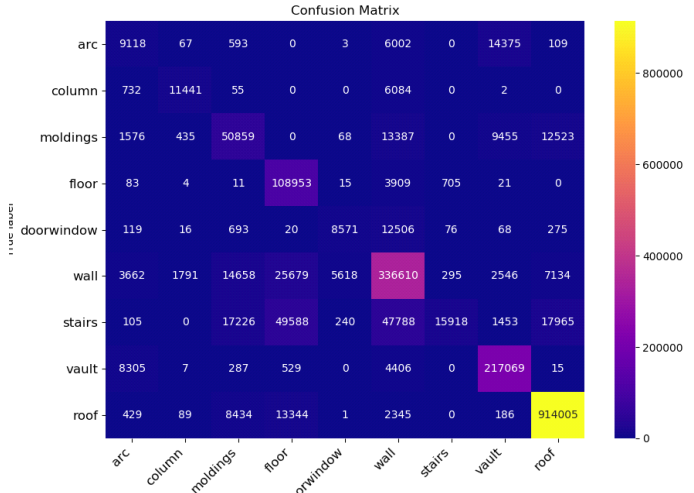
	precision	recall	f1-score	support
arc	0.3779	0.3013	0.3352	30267
column	0.8261	0.6247	0.7114	18314
moldings	0.5480	0.5760	0.5616	88303
floor	0.5500	0.9582	0.6988	113701
doorwindow	0.5905	0.3836	0.4651	22344
wall	0.7773	0.8458	0.8101	397993
stairs	0.9367	0.1059	0.1903	150283
vault	0.8854	0.9412	0.9125	230618
roof	0.9601	0.9736	0.9668	938833
accuracy			0.8402	1990656
macro avg	0.7169	0.6345	0.6280	1990656
weighted avg	0.8572	0.8402	0.8197	1990656

Mean Jaccard (Mean_IoU):

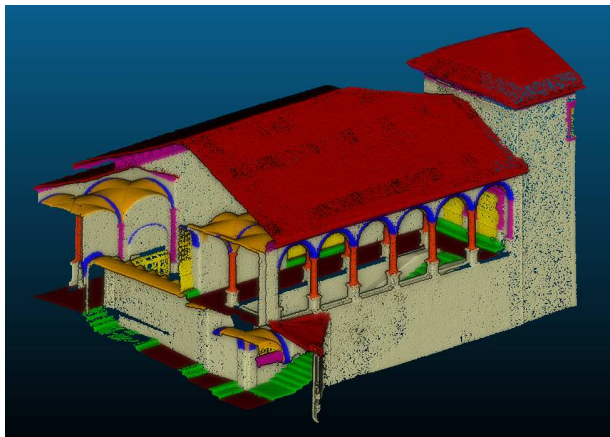
0.5049577198906203

Jaccard:

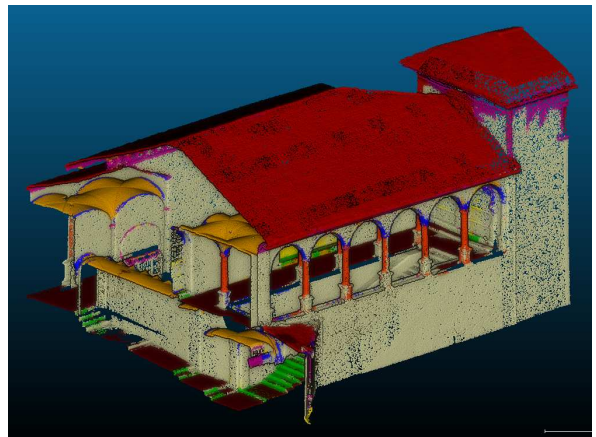
- arc: 0.2013781527452626
- column: 0.5520918785890074
- moldings: 0.39044219253800094
- floor: 0.5370820413978044
- doorwindow: 0.3029799568736965
- wall: 0.6808179280773432
- stairs: 0.10516718530117139
- vault: 0.838998314806512
- roof: 0.9356618286867843



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

■ Wall
 ■ Floor
 ■ Roof
 ■ Column
 ■ Moldings
 ■ Vault
 ■ Arch
 ■ Stair
 ■ Window/Door

TEST: FT_slice_6

Overall Accuracy: **0.2355**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 14283.009143
eval accuracy: 0.23555

Accuracy:
0.23555501302083334

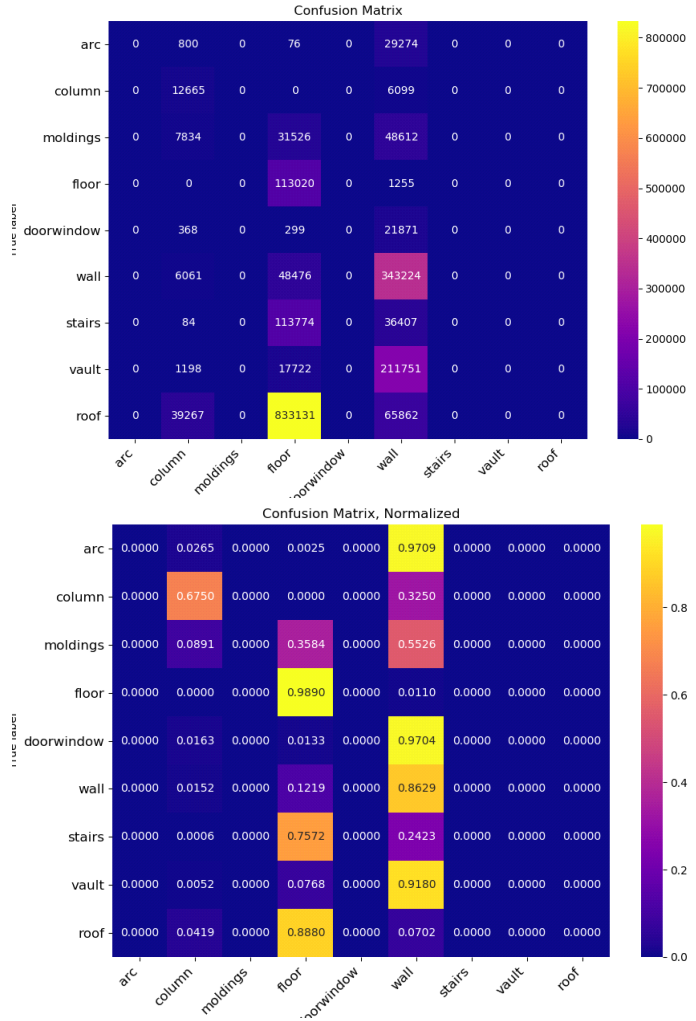
report:

	precision	recall	f1-score	support
arc	0.0000	0.0000	0.0000	30150
column	0.1855	0.6750	0.2910	18764
moldings	0.0000	0.0000	0.0000	87972
floor	0.0976	0.9890	0.1777	114275
doorwindow	0.0000	0.0000	0.0000	22538
wall	0.4490	0.8629	0.5907	397761
stairs	0.0000	0.0000	0.0000	150265
vault	0.0000	0.0000	0.0000	230671
roof	0.0000	0.0000	0.0000	938260
accuracy			0.2356	1990656
macro avg	0.0813	0.2808	0.1177	1990656
weighted avg	0.0971	0.2356	0.1310	1990656

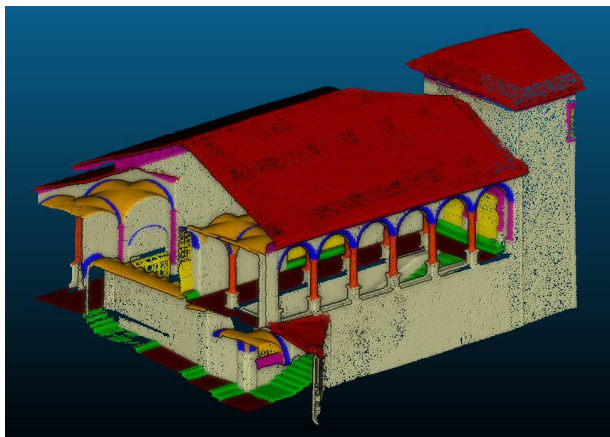
Mean Jaccard (Mean_IoU):
0.07632302762119554

Jaccard:

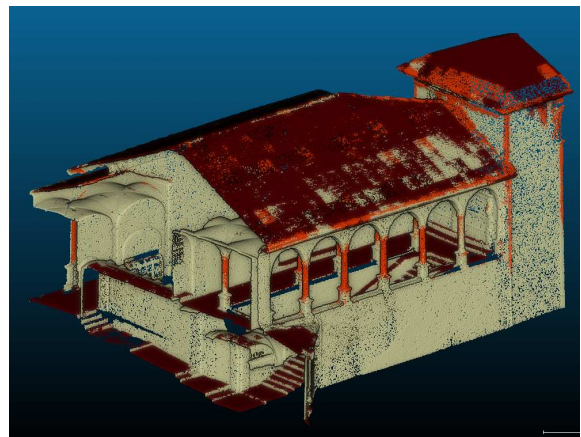
- arc: 0.0
- column: 0.17028342476067548
- moldings: 0.0
- floor: 0.0974916305738308
- doorwindow: 0.0
- wall: 0.41913219325625356
- stairs: 0.0
- vault: 0.0
- roof: 0.0



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Data augmentation

TEST: DA_1

Overall Accuracy: **0.7960**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

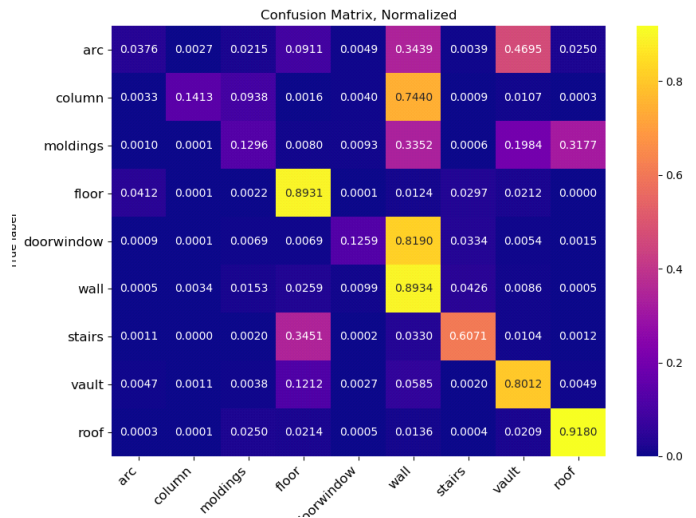
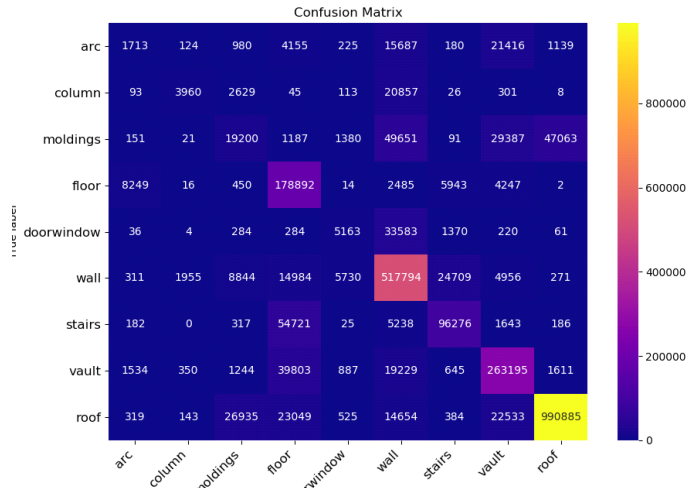
eval mean loss: 1.087316
eval accuracy: 0.796074

Accuracy:
0.7960739734595761

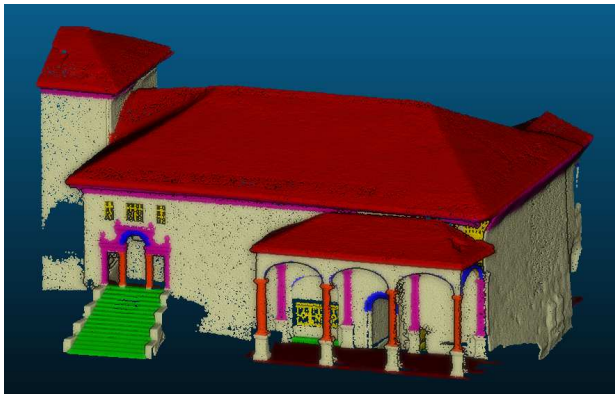
report:	precision	recall	f1-score	support
arc	0.1361	0.0376	0.0589	45619
column	0.6025	0.1413	0.2289	28032
moldings	0.3154	0.1296	0.1837	148131
floor	0.5641	0.8931	0.6915	200298
doorwindow	0.3672	0.1259	0.1875	41005
wall	0.7624	0.8934	0.8227	579554
stairs	0.7427	0.6071	0.6681	158588
vault	0.7565	0.8012	0.7782	328498
roof	0.9517	0.9180	0.9345	1079427
accuracy			0.7961	2609152
macro avg	0.5776	0.5052	0.5060	2609152
weighted avg	0.7793	0.7961	0.7779	2609152

Mean Jaccard (Mean_IoU):
0.40078596819085643

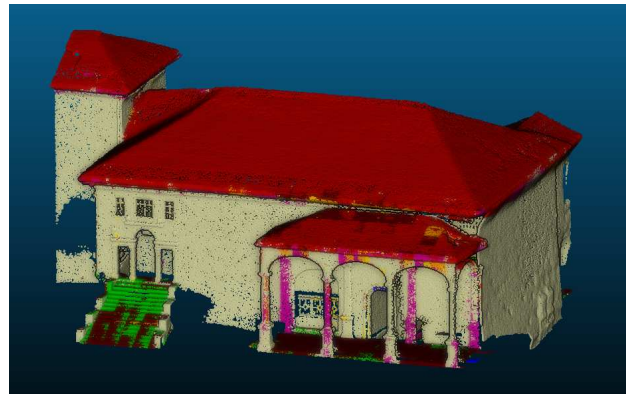
Jaccard:
- arc: 0.0303218040853896
- column: 0.12922173274596183
- moldings: 0.10115165372417208
- floor: 0.5284439009115991
- doorwindow: 0.10345864058993268
- wall: 0.698835800026453
- stairs: 0.5016047015671891
- vault: 0.6369660286398146
- roof: 0.8770694514271957



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Molding Vault Arch Stair Window/Door

TEST: DA_2

Overall Accuracy: **0.8384**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: -

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 0.783783
eval accuracy: 0.838421

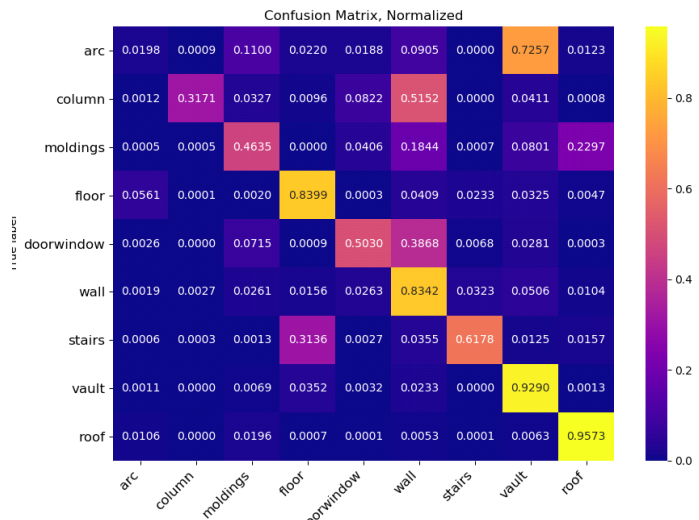
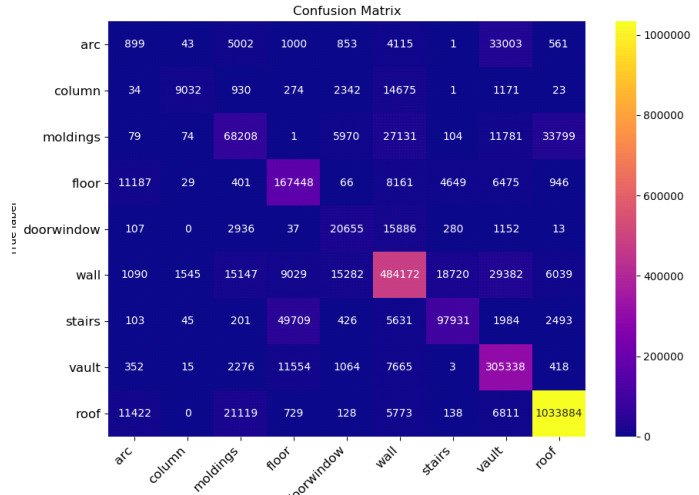
Accuracy:
0.838420682275314

report:

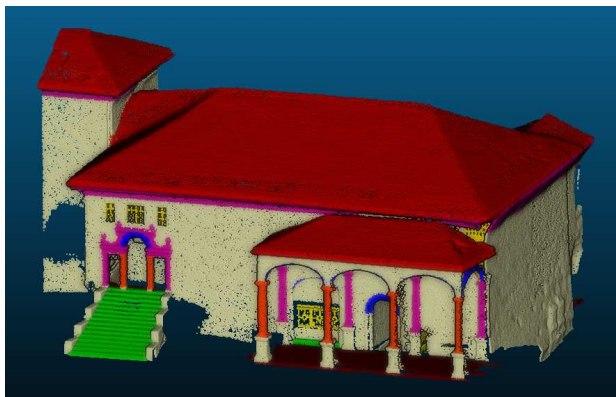
	precision	recall	f1-score	support
arc	0.0356	0.0198	0.0254	45477
column	0.8376	0.3171	0.4601	28482
moldings	0.5869	0.4635	0.5180	147147
floor	0.6983	0.8399	0.7626	199362
doorwindow	0.4415	0.5030	0.4702	41066
wall	0.8447	0.8342	0.8394	580406
stairs	0.8039	0.6178	0.6986	158523
vault	0.7689	0.9290	0.8414	328685
roof	0.9589	0.9573	0.9581	1080004
accuracy			0.8384	2609152
macro avg	0.6640	0.6091	0.6193	2609152
weighted avg	0.8337	0.8384	0.8321	2609152

Mean Jaccard (Mean_IoU):
0.4989675906394647

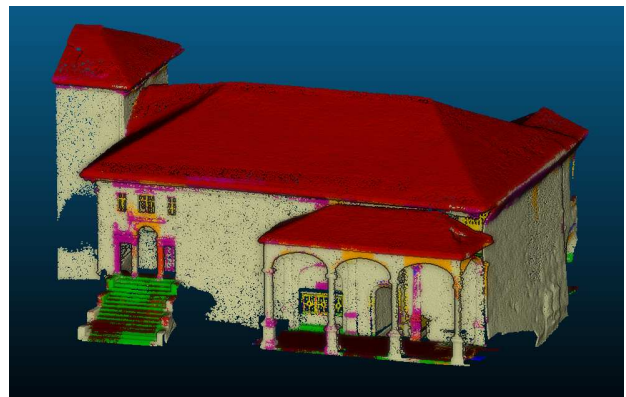
Jaccard:
- arc: 0.012870252394382328
- column: 0.29874640293718785
- moldings: 0.3494996387560912
- floor: 0.6163087285375145
- doorwindow: 0.307379793740792
- wall: 0.7232460418586796
- stairs: 0.5368464907712465
- vault: 0.7262275118684057
- roof: 0.9195834548908828



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Molding Vault Arch Stair Window/Door

TEST: DA_3

Overall Accuracy: **0.8397**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 1

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

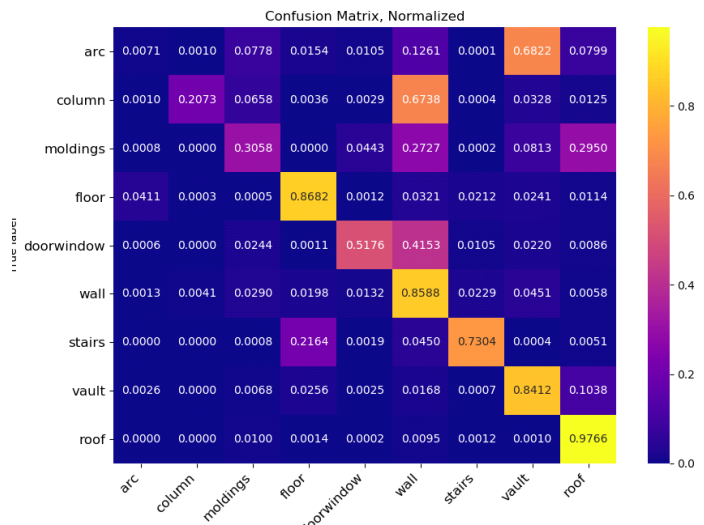
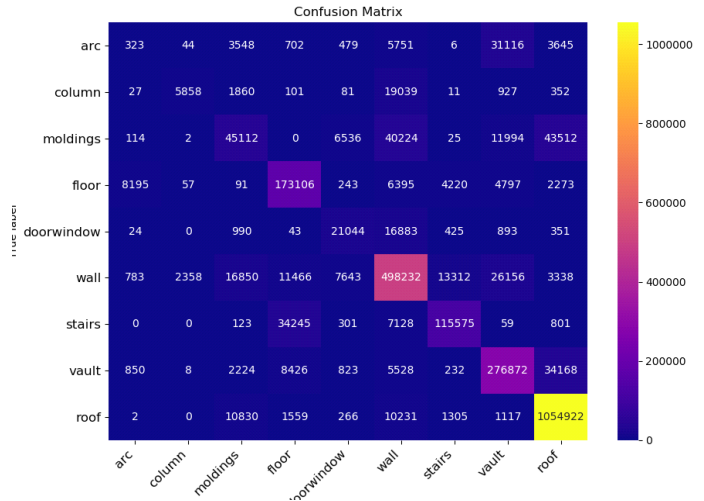
eval mean loss: 1.038319
eval accuracy: 0.839753

Accuracy:
0.8397532991562009

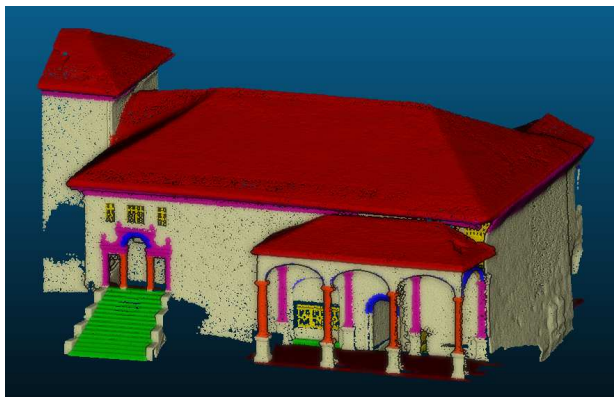
report:	precision	recall	f1-score	support
arc	0.0313	0.0071	0.0115	45614
column	0.7035	0.2073	0.3203	28256
moldings	0.5527	0.3058	0.3937	147519
floor	0.7538	0.8682	0.8070	199377
doorwindow	0.5624	0.5176	0.5391	40653
wall	0.8176	0.8588	0.8377	580138
stairs	0.8554	0.7304	0.7880	158232
vault	0.7823	0.8412	0.8107	329131
roof	0.9226	0.9766	0.9488	1080232
accuracy			0.8398	2609152
macro avg	0.6646	0.5903	0.6063	2609152
weighted avg	0.8201	0.8398	0.8251	2609152

Mean Jaccard (Mean_IoU):
0.4935754642354923

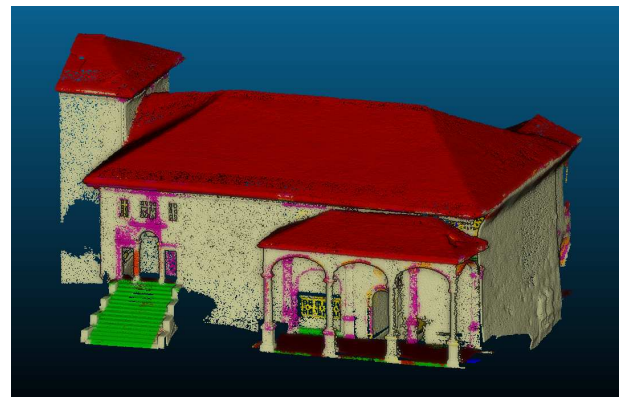
Jaccard:
- arc: 0.005808412307360319
- column: 0.19065907241659885
- moldings: 0.2451272855706795
- floor: 0.6764093326404057
- doorwindow: 0.3690311266988163
- wall: 0.7206997658093176
- stairs: 0.650145132982314
- vault: 0.6816317486890372
- roof: 0.9026673010049013



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Molding Vault Arch Stair Window/Door

TEST: DA_4

Overall Accuracy: **0.8542**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 1.142922
eval accuracy: 0.854227

Accuracy:

0.8542273504954867

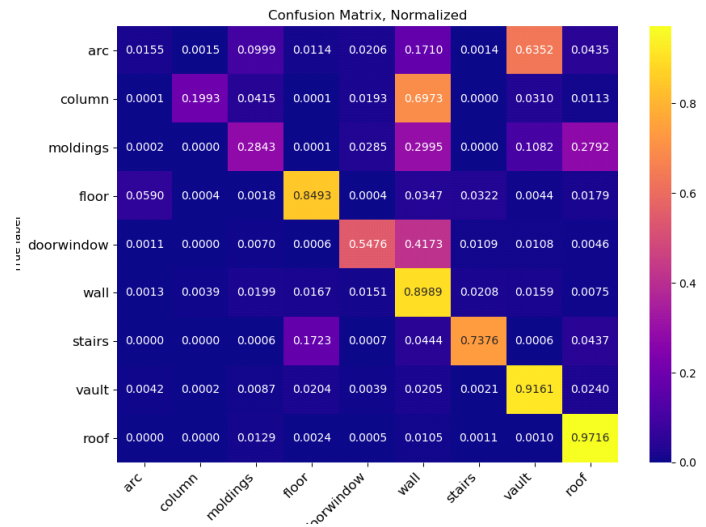
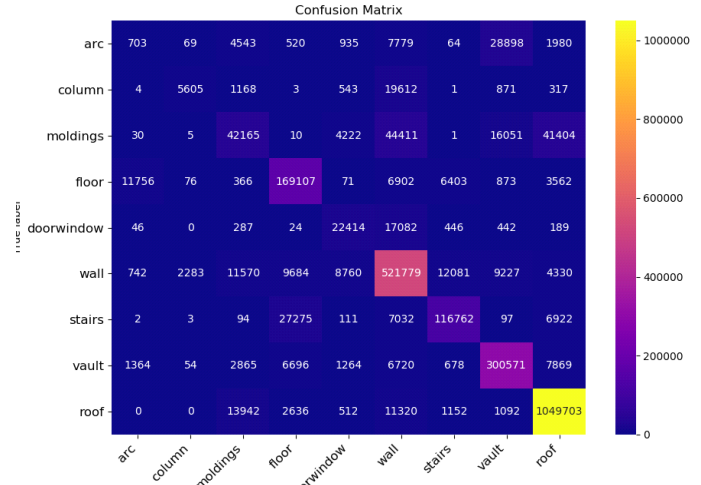
report:

	precision	recall	f1-score	support
arc	0.0480	0.0155	0.0234	45491
column	0.6924	0.1993	0.3095	28124
moldings	0.5476	0.2843	0.3743	148299
floor	0.7831	0.8493	0.8148	199116
doorwindow	0.5772	0.5476	0.5620	40930
wall	0.8119	0.8989	0.8532	580456
stairs	0.8486	0.7376	0.7892	158298
vault	0.8393	0.9161	0.8760	328081
roof	0.9404	0.9716	0.9557	1080357
accuracy			0.8542	2609152
macro avg	0.6765	0.6023	0.6176	2609152
weighted avg	0.8353	0.8542	0.8396	2609152

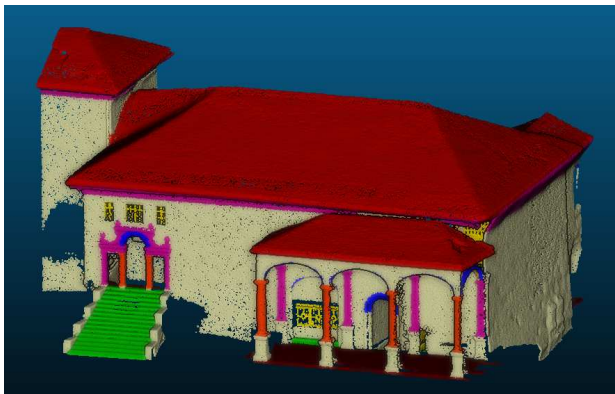
Mean Jaccard (Mean IoU):
0.5104477528107391

Jaccard:

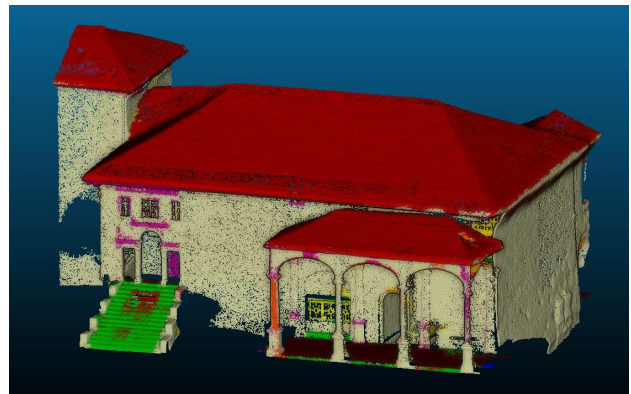
- arc: 0.011828047446790611
- column: 0.18308616972626904
- moldings: 0.23024124411633012
- floor: 0.687527443040445
- doorwindow: 0.3908418776592035
- wall: 0.7440019734384313
- stairs: 0.6518501150041313
- vault: 0.7794244253588913
- roof: 0.9152284795061599



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: DA_5

Overall Accuracy: **0.8458**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

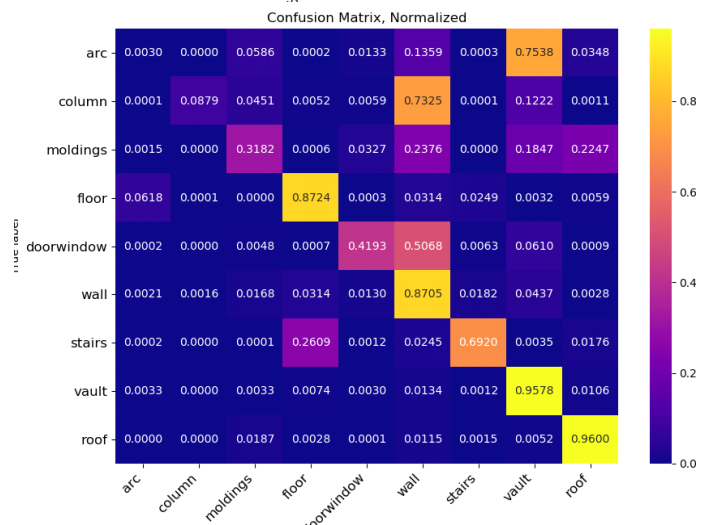
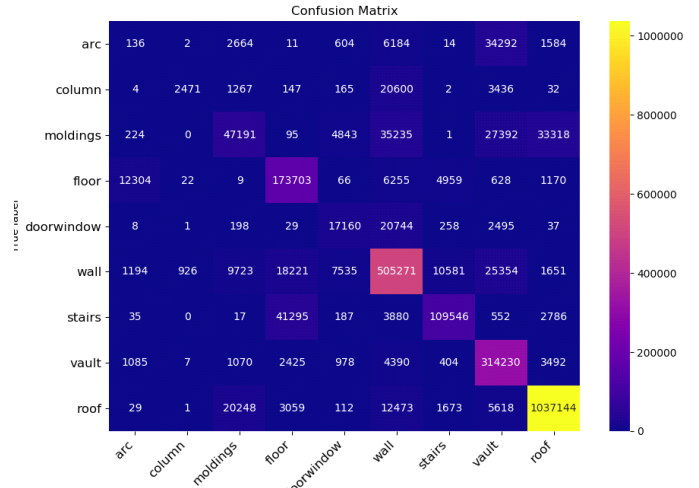
eval mean loss: 1269.248050
eval accuracy: 0.845812

Accuracy:
0.8458119726255887

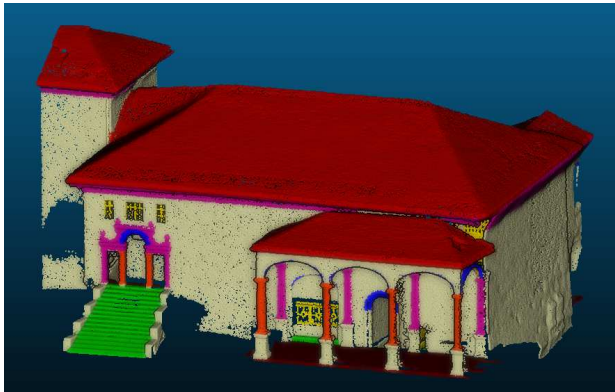
report:	precision	recall	f1-score	support
arc	0.0091	0.0030	0.0045	45491
column	0.7204	0.0879	0.1566	28124
moldings	0.5728	0.3182	0.4091	148299
floor	0.7268	0.8724	0.7930	199116
doorwindow	0.5422	0.4193	0.4729	40930
wall	0.8215	0.8705	0.8453	580456
stairs	0.8596	0.6920	0.7668	158298
vault	0.7590	0.9578	0.8469	328081
roof	0.9592	0.9600	0.9596	1080357
accuracy			0.8458	2609152
macro avg	0.6634	0.5757	0.5839	2609152
weighted avg	0.8320	0.8458	0.8314	2609152

Mean Jaccard (Mean_IoU):
0.48018005364918526

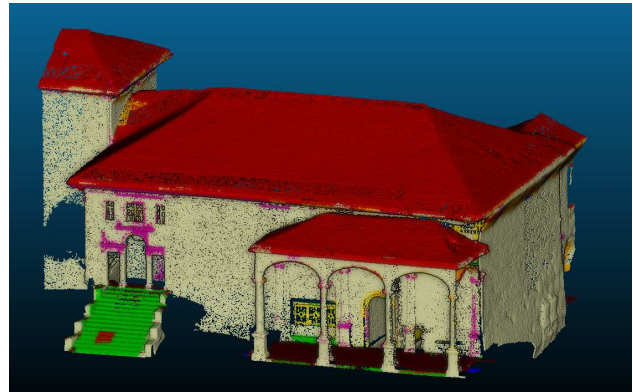
Jaccard:
- arc: 0.0022526253022824394
- column: 0.08496372451260187
- moldings: 0.25717866971852094
- floor: 0.656975468800823
- doorwindow: 0.30963551064597616
- wall: 0.7320465882468846
- stairs: 0.6217492479709404
- vault: 0.734443073240964
- roof: 0.922375574403674



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

TEST: DA_6

Overall Accuracy: **0.8533**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8

k-NN features: x y z R G B Nx Ny Nz f1 f2 f3 f4 f5 f6

Scaler: 2

No Z normalisation | Focal loss | Skip connections

METRICS and CONFUSION MATRIX

eval mean loss: 885.128411
eval accuracy: 0.853300

Accuracy:

0.853299846080259

report:

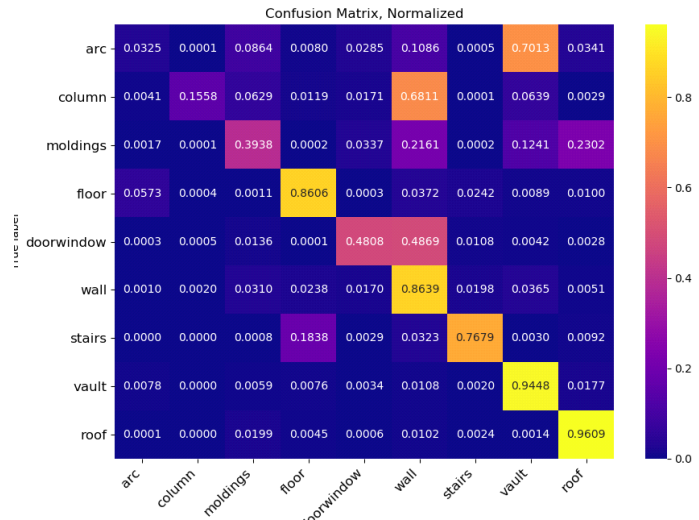
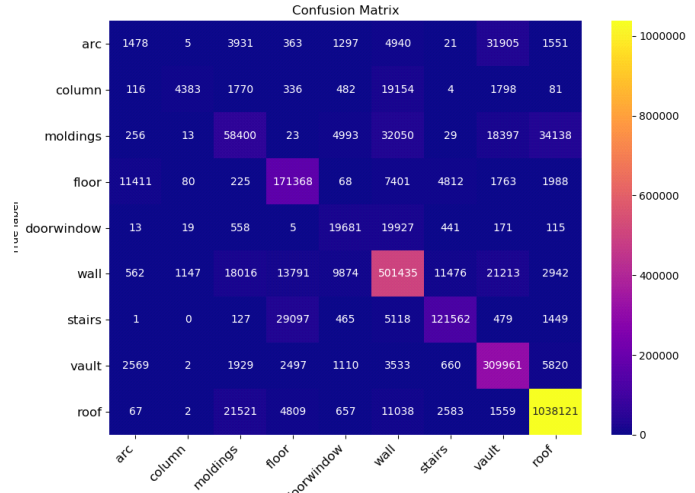
	precision	recall	f1-score	support
arc	0.0897	0.0325	0.0477	45491
column	0.7756	0.1558	0.2595	28124
moldings	0.5485	0.3938	0.4584	148299
floor	0.7709	0.8606	0.8133	199116
doorwindow	0.5095	0.4808	0.4948	40930
wall	0.8294	0.8639	0.8463	580456
stairs	0.8586	0.7679	0.8107	158298
vault	0.8004	0.9448	0.8666	328081
roof	0.9557	0.9609	0.9583	1080357
accuracy			0.8533	2609152
macro avg	0.6820	0.6068	0.6173	2609152
weighted avg	0.8409	0.8533	0.8427	2609152

Mean Jaccard (Mean_IoU):

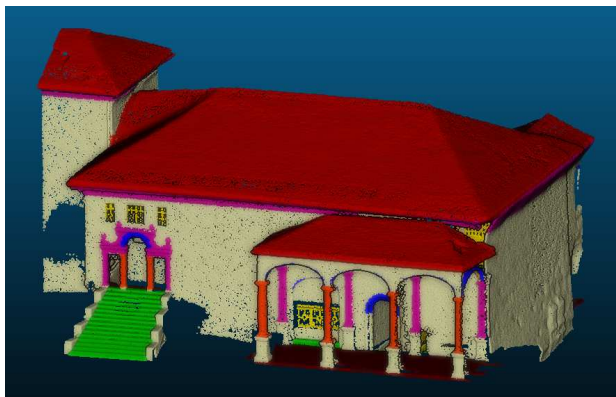
0.5094236191907396

Jaccard:

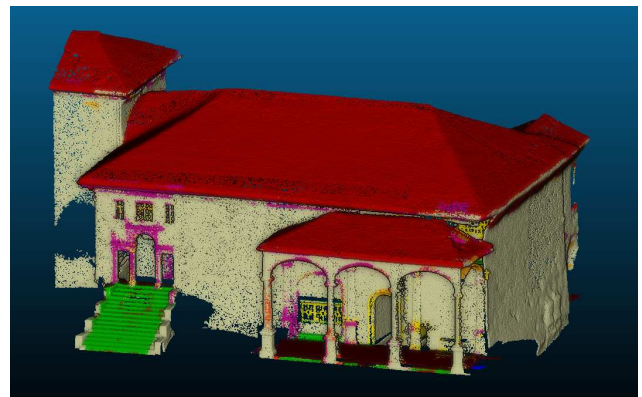
- arc: 0.024435406540356447
- column: 0.14912221012520413
- moldings: 0.29738868293477816
- floor: 0.6853705651563569
- doorwindow: 0.3286959716747946
- wall: 0.7335028239496677
- stairs: 0.6816917520916983
- vault: 0.7646447901402683
- roof: 0.9199603701035323



VISUAL INSPECTION (the missing slice was used for training)



Ground truth



Predicted

Wall Floor Roof Column Moldings Vault Arch Stair Window/Door

Automatic training data generation

TEST: ATDG_KAS_1

Overall Accuracy: **0.9183**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

Automatic annotation

METRICS and CONFUSION MATRIX

eval mean loss: 0.298790
eval accuracy: 0.918360

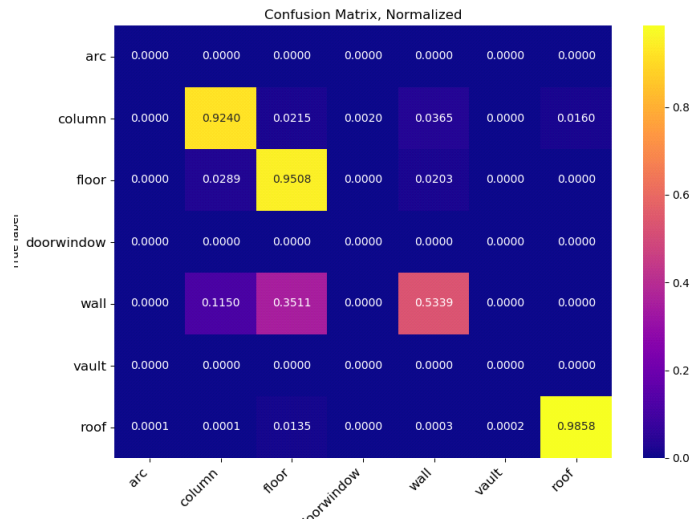
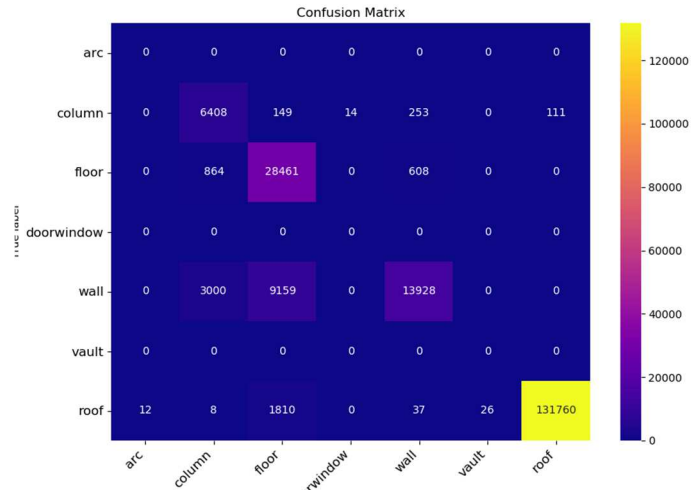
Accuracy:
0.9183603922526041

report:

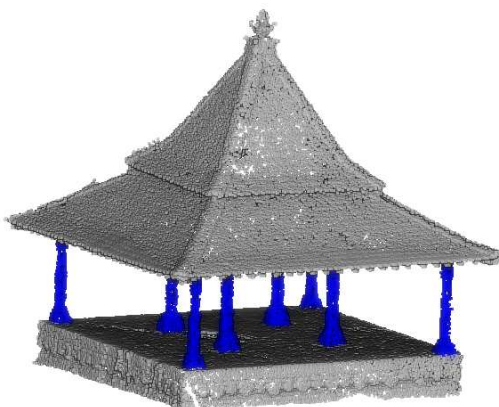
	precision	recall	f1-score	support
arc	0.0000	0.0000	0.0000	0
column	0.6233	0.9240	0.7445	6935
floor	0.7191	0.9508	0.8189	29933
doorwindow	0.0000	0.0000	0.0000	0
wall	0.9394	0.5339	0.6809	26087
vault	0.0000	0.0000	0.0000	0
roof	0.9992	0.9858	0.9925	133653
accuracy			0.9184	196608
macro avg	0.4687	0.4849	0.4624	196608
weighted avg	0.9353	0.9184	0.9159	196608

Jaccard:

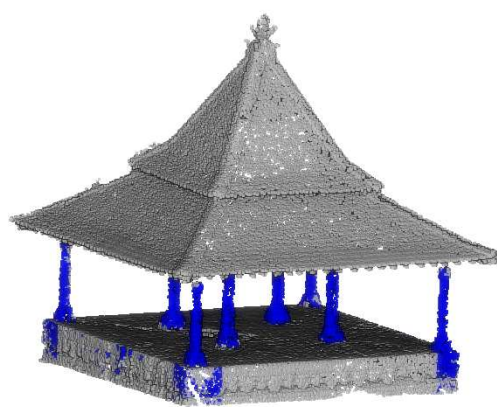
- arc: 0.0
- column: 0.5929490145276209
- floor: 0.6933083237923559
- doorwindow: 0.0
- wall: 0.5161385955160275
- vault: 0.0
- roof: 0.9850183905983673



VISUAL INSPECTION



Ground truth



Predicted

TEST: ATDG_KAS_2

Overall Accuracy: **0.9246**

Classes: "arch":0 - "column":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

Manual annotation

METRICS and CONFUSION MATRIX

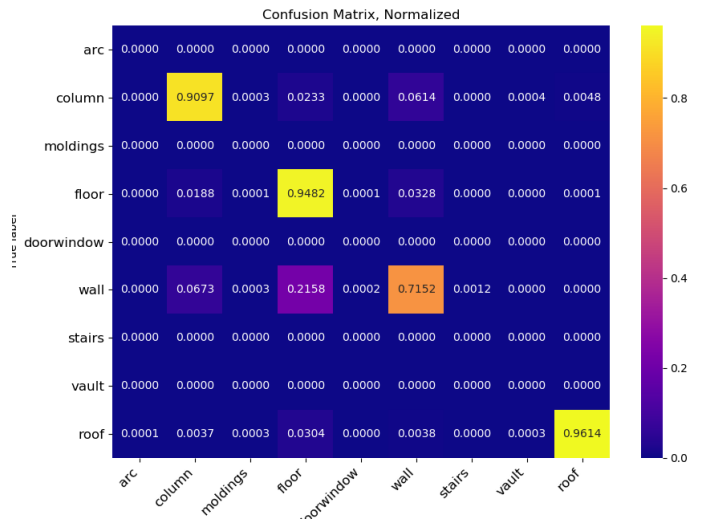
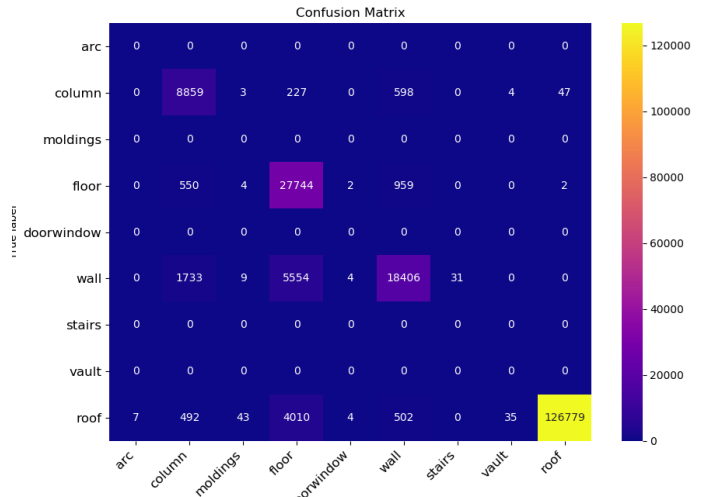
eval mean loss: 0.322533
 eval accuracy: 0.924622

Accuracy:
 0.92462158203125

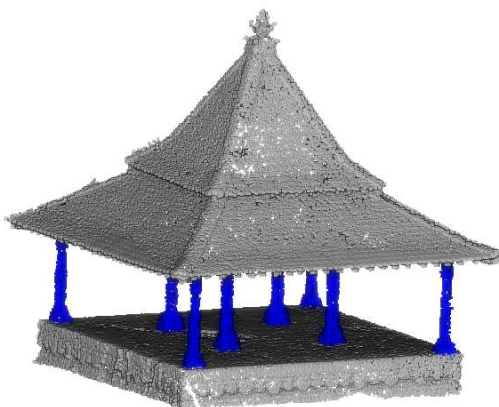
report:	precision	recall	f1-score	support
arc	0.0000	0.0000	0.0000	0
column	0.7615	0.9097	0.8290	9738
moldings	0.0000	0.0000	0.0000	0
floor	0.7392	0.9482	0.8307	29261
doorwindow	0.0000	0.0000	0.0000	0
wall	0.8994	0.7152	0.7968	25737
stairs	0.0000	0.0000	0.0000	0
vault	0.0000	0.0000	0.0000	0
roof	0.9996	0.9614	0.9801	131872
accuracy			0.9246	196608
macro avg	0.3777	0.3927	0.3818	196608
weighted avg	0.9359	0.9246	0.9264	196608

Mean Jaccard (Mean_IoU):
 0.3379583109180645

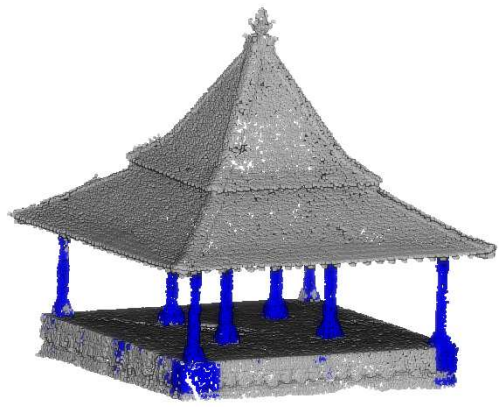
Jaccard:
 - arc: 0.0
 - column: 0.7079836969551666
 - moldings: 0.0
 - floor: 0.7104373655638636
 - doorwindow: 0.0
 - wall: 0.6621816088645849
 - stairs: 0.0
 - vault: 0.0
 - roof: 0.9610221268789655



VISUAL INSPECTION



Ground truth



Predicted

TEST: ATDG_SMG_1

Overall Accuracy: **0.6332**

Classes: "arch":0 - "**column**":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

Automatic annotation

METRICS and CONFUSION MATRIX

eval mean loss: 3.201186
eval accuracy: 0.633202

Accuracy:

0.6332017610858939

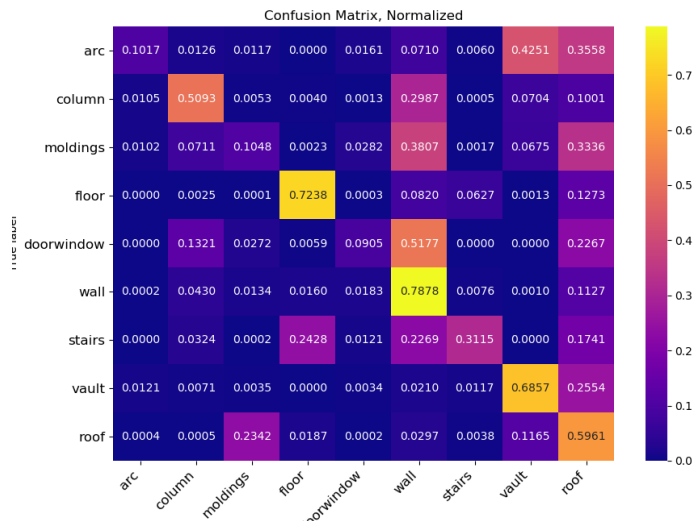
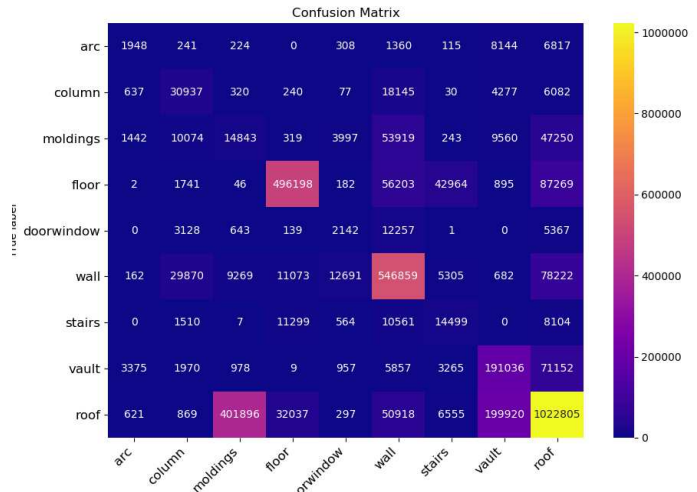
report:

	precision	recall	f1-score	support
arc	0.2379	0.1017	0.1425	19157
column	0.3851	0.5093	0.4386	60745
moldings	0.0347	0.1048	0.0521	141647
floor	0.9000	0.7238	0.8024	685500
doorwindow	0.1010	0.0905	0.0954	23677
wall	0.7233	0.7878	0.7542	694133
stairs	0.1987	0.3115	0.2426	46544
vault	0.4609	0.6857	0.5512	278599
roof	0.7673	0.5961	0.6709	1715918
accuracy			0.6332	3665920
macro avg	0.4232	0.4346	0.4167	3665920
weighted avg	0.7115	0.6332	0.6625	3665920

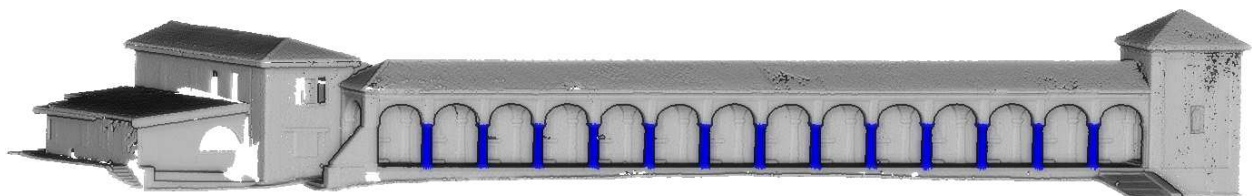
Mean Jaccard (Mean_IoU):
0.30367879344325116

Jaccard:

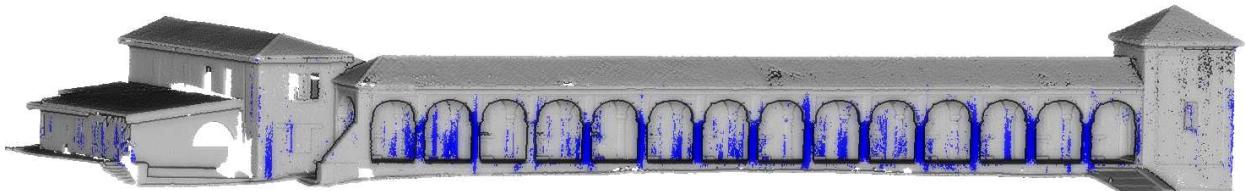
- arc: 0.07670499291226965
- column: 0.28086756001016816
- moldings: 0.026742698592868853
- floor: 0.6699801246529916
- doorwindow: 0.050105263157894736
- wall: 0.6053657872393184
- stairs: 0.13805678810154062
- vault: 0.3804914385642043
- roof: 0.5047944877580038



VISUAL INSPECTION



Ground truth



Predicted

TEST: ATDG_SMG_2

Overall Accuracy: **0.7292**

Classes: "arch":0 - "**column**":1 - "molding":2 - "floor":3 - "door/wind.":4 - "wall":5 - "stair":6 - "vault":7 - "roof":8
k-NN features: x y z R G B Nx Ny Nz

Scaler: -

No Z normalisation | Focal loss | Skip connections

Manual annotation

METRICS and CONFUSION MATRIX

eval mean loss: 1.907524
eval accuracy: 0.729249

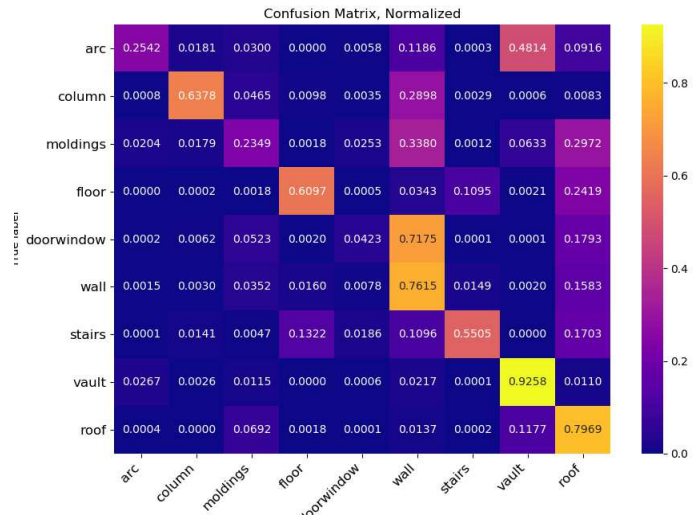
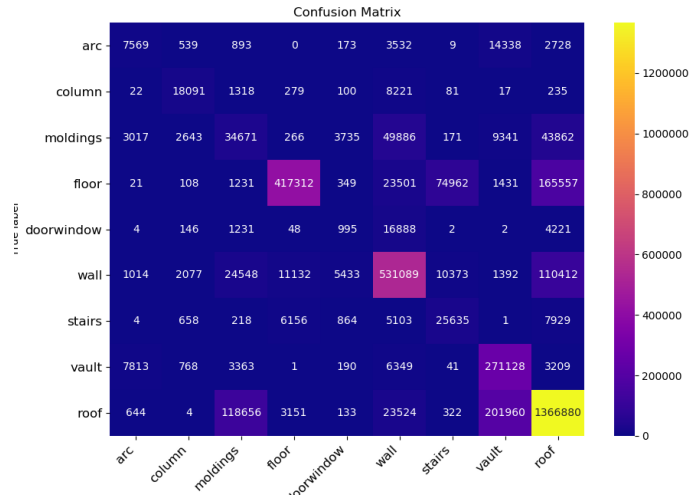
Accuracy:
0.7292494107891061

report:

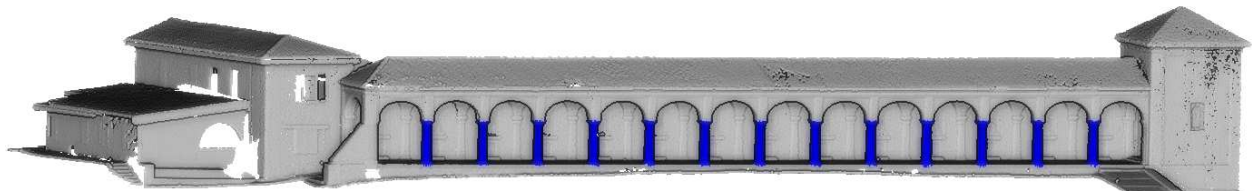
	precision	recall	f1-score	support
arc	0.3764	0.2542	0.3034	29781
column	0.7227	0.6378	0.6776	28364
moldings	0.1863	0.2349	0.2078	147592
floor	0.9520	0.6097	0.7433	684472
doorwindow	0.0831	0.0423	0.0560	23537
wall	0.7949	0.7615	0.7778	697470
stairs	0.2297	0.5505	0.3242	46568
vault	0.5427	0.9258	0.6843	292862
roof	0.8017	0.7969	0.7993	1715274
accuracy			0.7292	3665920
macro avg	0.5211	0.5348	0.5082	3665920
weighted avg	0.7671	0.7292	0.7360	3665920

Mean Jaccard (Mean IoU):
0.38256621718135936

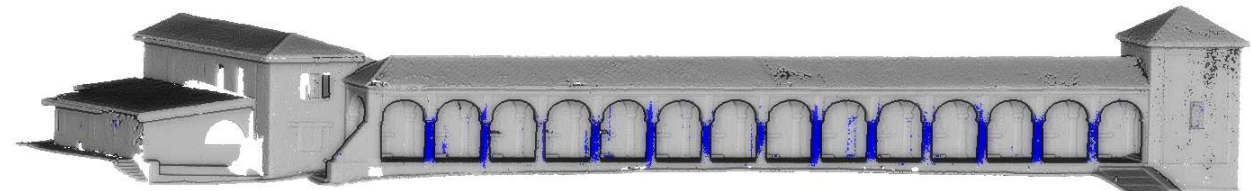
Jaccard:
- arc: 0.178851606805293
- column: 0.512391310504999
- moldings: 0.1159371342584852
- floor: 0.5915082104308261
- doorwindow: 0.028828881033783393
- wall: 0.6364356468865418
- stairs: 0.19342936263006588
- vault: 0.5200558556346673
- roof: 0.6656579464475728



VISUAL INSPECTION



Ground truth



Predicted

ANNEX B

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The DGCNN-Mod implemented code is available at <https://github.com/martinimass/dgcnn>

Focal loss

https://github.com/ailias/Focal-Loss-implement-on-Tensorflow/blob/master/focal_loss.py

```
def focal_loss(prediction_tensor, target_tensor, weights=None, alpha=0.25,
gamma=2, num_classes=10):

    """Compute focal loss for predictions.
    Multi-labels Focal loss formula:
    FL = -alpha * (z-p)^gamma * log(p) - (1-alpha) * p^gamma * log(1-p)
    , which alpha = 0.25, gamma = 2, p = sigmoid(x, z= target_tensor.
    Args:
    prediction_tensor: A float tensor of shape [batch_size, num_anchors,
num_classes] representing the predicted logits for each class
    target_tensor: A float tensor of shape [batch_size, num_anchors,
num_classes] representing one-hot encoded classification targets
    weights: A float tensor of shape [batch_size, num_anchors]
    alpha: A scalar tensor for focal loss alpha hyper-parameter
    gamma: A scalar tensor for focal loss gamma hyper-parameter
    Returns:
    loss: A (scalar) tensor representing the value of the loss function
    """

    print("DEBUG-1 Focal_Loss:", prediction_tensor.shape, target_tensor.shape,
num_classes)
    # I need to transform target_tensor to one-hot label first and then to float32
    # (B x NUM_POINTS) to (B x NUM_POINTS x NUM_CLASSES)
    onehot = tf.one_hot(target_tensor, num_classes) #this function already
transform into float32
    target_tensor = tf.dtypes.cast(onehot, tf.float32)
    #DONE!

    sigmoid_p = tf.nn.sigmoid(prediction_tensor)
    zeros = array_ops.zeros_like(sigmoid_p, dtype=sigmoid_p.dtype)

    # For poitive prediction, only need to consider front part loss, back part is
0;
    # target_tensor > zeros <=> z=1, so poitive coefficient = z - p.

    print("DEBUG-2 Focal_Loss:", target_tensor.get_shape(), zeros.get_shape(),
sigmoid_p.get_shape())
    pos_p_sub = array_ops.where(target_tensor > zeros, target_tensor - sigmoid_p,
zeros)

    # For negative prediction, only need to consider back part loss, front part is
0;
    # target_tensor > zeros <=> z=1, so negative coefficient = 0.
    neg_p_sub = array_ops.where(target_tensor > zeros, zeros, sigmoid_p)
    per_entry_cross_ent = - alpha * (pos_p_sub ** gamma)*
tf.log(tf.clip_by_value(sigmoid_p, 1e-8, 1.0)) \
- (1 - alpha)*(neg_p_sub ** gamma)*
tf.log(tf.clip_by_value(1.0 - sigmoid_p, 1e-8, 1.0))
    return tf.reduce_sum(per_entry_cross_ent)

def get_loss(pred, label, focal_loss=False):
    """ pred: B,N,13; label: B,N """
    if focal_loss:
        loss = focal_loss(pred, label)
    else:
        loss = tf.nn.sparse_softmax_cross_entropy_with_logits(logits=pred,
labels=label)
    return tf.reduce_mean(loss)
```


Data augmentation

```
def rotate_point_cloud_by_angle(batch_data, rotation_angle):
    rotated_data = np.zeros(batch_data.shape, dtype=np.float32)
    for k in xrange(batch_data.shape[0]):
        cosval = np.cos(rotation_angle)
        sinval = np.sin(rotation_angle)
        rotation_matrix = np.array([[cosval, 0, sinval],
                                     [0, 1, 0],
                                     [-sinval, 0, cosval]])
        shape_pc = batch_data[k, ...]
        rotated_data[k, ...] = np.dot(shape_pc.reshape((-1, 3)), rotation_matrix)
    return rotated_data

def jitter_point_cloud(batch_data, sigma=0.01, clip=0.05):
    B, N, C = batch_data.shape
    assert(clip > 0)
    jittered_data = np.clip(sigma * np.random.randn(B, N, C), -1*clip, clip)
    jittered_data += batch_data
    return jittered_data

def shift_point_cloud(batch_data, shift_range=0.1):
    B, N, C = batch_data.shape
    shifts = np.random.uniform(-shift_range, shift_range, (B,3))
    for batch_index in range(B):
        batch_data[batch_index,:,:] += shifts[batch_index,:]
    return batch_data

def random_scale_point_cloud(batch_data, scale_low=0.8, scale_high=1.25):
    B, N, C = batch_data.shape
    scales = np.random.uniform(scale_low, scale_high, B)
    for batch_index in range(B):
        batch_data[batch_index,:,:] *= scales[batch_index]
    return batch_data
```

Point selection for distance computation in the Euclidean space

```
if coords:
    #1) insert the coordinates
    x = 11.058006
    y = 19.310059
    z = 4.917603
else:
    #2) choose a class
    classe=7

-----

if coords:

    npyr = np.round(npy[:, :3], decimals=6)
    a = np.where(npyr[:, 0]==x)
    npyr = npyr[a]
    b = np.where(npyr[:, 1]==y)
    npyr = npyr[b]
    c = np.where(npyr[:, 2]==z)
    random_i = np.random.choice(c[0])
    '''
    npy_x = npy[a]
    npy_xy = npy_x[b]
    rand_el = npy_xy[random_i]
    '''
    pos0 = np.argwhere(c==random_i)
    pos1 = pos0[0][1]
    pos2 = b[0][pos1]
    pos3 = a[0][pos2]
    rand_el = get_point(txt_path, pos3)

else:

    a = np.where(npy[:, 3]==classe)
    b = npy[a]
    c = np.where(npy[:, 4]==classe)
    random_i = np.random.choice(c[0])
    rand_el = npy[random_i]
```

Distance computation

Through `scipy.spatial.distance.cdist` or `numpy.linalg.norm(a-b)`.

```
print(.format(rand_el[0],rand_el[1],rand_el[2],np.shape[0]-1))
log.write(.format(rand_el[0],rand_el[1],rand_el[2],np.shape[0]-1))
distanze=[]
    with open(txt_path, "r") as fr:
        for l in fr:
            feats = l.strip().split(" ")
            lfeats = [float(feats[0]), float(feats[1]), float(feats[2]),
int(feats[3]), int(feats[4]))]
                for fe in feats[5:]:
                    lfeats.append(float(fe))
            p=np.array(lfeats)

            d = np.linalg.norm(rand_el[5:]-p[5:]) # xyz gt pred 256features
            distanze.append(d)

minimo=min(distanze)
massimo=max(distanze)
print("MIN:",minimo,"- MAX:",massimo)
log.write("MIN: {} - MAX: {}\n".format(minimo,massimo))
hist_points, hist_limits = np.histogram(distanze, bins=20)
print("Histogram:",hist_points, hist_limits)
log.write(.format(hist_points,hist_limits))
plt.clf()
plt.hist(distanze, bins=20)
out_plot = base_path + "histogram_" + basename[-10:-4] + ".png"
plt.title("{} - da {:.3f} a {:.3f}".format(basename[-10:-4],minimo,massimo))
plt.savefig(out_plot)
plt.close()

distance_np=np.array(distanze)

conv1 = distance_np * 255 // np.max(distance_np)

conv1=conv1.astype("uint8")

#depth_npt2 = depth_npt2 * 256 // 1000
jet1 = cm.jet(conv1)
jet2 = jet1 * 255
jet3 = np.uint8(jet2)

out_path = base_path + "distance_" + basename[-10:-4]+".txt"
with open(out_path,"w") as fw:
    for i in range(np.shape[0]):
        p = npy[i,:5]
        d = jet3[i,0:3]
        dist = distance_np[i]
        fw.write("{} {} {} {} {} {} {} {} {} {} \n".format(p[0],p[1],p[2],int(p[3]),int(p[4]),dist,d[0],d[1],d[2]))

log.close()
```

Global feature exclusion

```
'''
out7 = tf_util.conv2d(tf.concat([net_1, net_2, net_3], axis=-1), 1024, [1,
1],
                        padding='VALID', stride=[1,1],
                        bn=True, is_training=is_training,
                        scope='adj_conv7', bn_decay=bn_decay, is_dist=True)

out_max = tf_util.max_pool2d(out7, [num_point, 1], padding='VALID',
scope='maxpool')

expand = tf.tile(out_max, [1, num_point, 1, 1])

concat = tf.concat(axis=3, values=[expand,
                                net_1,
                                net_2,
                                net_3])
'''
```