

Supplementary material for:
**Steel surface defects analysis with machine
vision and deep learning**

authored by:

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1 Statistics

A single result of a convolutional neural network training is subject to some randomness. That is, classification correctness can vary between two network trainings. Therefore, for case 2 (training on NEU and testing on E-NEU), which is the most important outcome of our paper, we have performed 10 network trainings. Tables 1 - 10 present the corresponding metrics. Mean and standard deviation of each metric computed based on the results of 10 trainings are provided in tables 11 and 12, respectively.

Table 1: Results of case 2 (training no. 1): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.703	0.683	0.846	0.683
HE	0.665	0.656	0.806	0.656
B 3	0.819	0.824	0.871	0.824
B 5	0.936	0.936	0.947	0.936
B 7	0.949	0.949	0.957	0.949
MB 3	0.942	0.940	0.951	0.940
MB 5	0.943	0.942	0.945	0.942
MB 7	0.857	0.848	0.899	0.848
GB 3	0.964	0.964	0.968	0.964
GB 5	0.969	0.969	0.970	0.969
GB 7	0.971	0.971	0.972	0.971
BF 3	0.861	0.861	0.922	0.861
BF 5	0.792	0.788	0.890	0.788
BF 7	0.861	0.866	0.921	0.866
SN-MRFLM				
No	0.812	0.805	0.853	0.805
HE	0.794	0.794	0.811	0.794
B 3	0.953	0.952	0.956	0.952
B 5	0.922	0.922	0.938	0.922
B 7	0.972	0.971	0.972	0.971
MB 3	0.974	0.974	0.976	0.974
MB 5	0.966	0.966	0.969	0.966
MB 7	0.971	0.971	0.973	0.971
GB 3	0.963	0.963	0.964	0.963
GB 5	0.944	0.944	0.947	0.944
GB 7	0.967	0.966	0.971	0.966
BF 3	0.965	0.964	0.967	0.964
BF 5	0.958	0.958	0.960	0.958
BF 7	0.970	0.970	0.971	0.970

Table 2: Results of case 2 (training no. 2): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.789	0.782	0.840	0.782
HE	0.728	0.727	0.859	0.727
B 3	0.861	0.866	0.908	0.866
B 5	0.892	0.892	0.907	0.892
B 7	0.911	0.913	0.939	0.913
MB 3	0.874	0.868	0.901	0.868
MB 5	0.910	0.910	0.916	0.910
MB 7	0.887	0.885	0.904	0.885
GB 3	0.870	0.867	0.913	0.867
GB 5	0.983	0.983	0.984	0.983
GB 7	0.971	0.971	0.973	0.971
BF 3	0.946	0.946	0.949	0.946
BF 5	0.962	0.962	0.962	0.962
BF 7	0.896	0.901	0.927	0.901
SN-MRFLM				
No	0.910	0.909	0.922	0.909
HE	0.817	0.818	0.826	0.818
B 3	0.965	0.965	0.967	0.965
B 5	0.954	0.954	0.955	0.954
B 7	0.965	0.965	0.966	0.965
MB 3	0.966	0.965	0.969	0.965
MB 5	0.978	0.978	0.979	0.978
MB 7	0.971	0.971	0.974	0.971
GB 3	0.967	0.967	0.968	0.967
GB 5	0.967	0.966	0.968	0.966
GB 7	0.979	0.979	0.980	0.979
BF 3	0.971	0.971	0.974	0.971
BF 5	0.963	0.962	0.965	0.962
BF 7	0.982	0.982	0.983	0.982

Table 3: Results of case 2 (training no. 3): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.801	0.791	0.851	0.791
HE	0.616	0.594	0.782	0.594
B 3	0.942	0.943	0.942	0.943
B 5	0.889	0.888	0.906	0.888
B 7	0.928	0.929	0.932	0.929
MB 3	0.910	0.908	0.924	0.908
MB 5	0.909	0.905	0.935	0.905
MB 7	0.932	0.931	0.944	0.931
GB 3	0.888	0.885	0.906	0.885
GB 5	0.966	0.966	0.969	0.966
GB 7	0.987	0.987	0.987	0.987
BF 3	0.856	0.854	0.885	0.854
BF 5	0.946	0.946	0.954	0.946
BF 7	0.842	0.846	0.906	0.846
SN-MRFLM				
No	0.936	0.936	0.941	0.936
HE	0.753	0.760	0.772	0.760
B 3	0.959	0.959	0.963	0.959
B 5	0.970	0.970	0.971	0.970
B 7	0.926	0.925	0.936	0.925
MB 3	0.924	0.923	0.927	0.923
MB 5	0.964	0.963	0.966	0.963
MB 7	0.946	0.946	0.952	0.946
GB 3	0.968	0.968	0.970	0.968
GB 5	0.937	0.936	0.942	0.936
GB 7	0.966	0.966	0.967	0.966
BF 3	0.951	0.950	0.955	0.950
BF 5	0.953	0.953	0.954	0.953
BF 7	0.969	0.969	0.970	0.969

Table 4: Results of case 2 (training no. 4): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.750	0.750	0.788	0.750
HE	0.689	0.670	0.864	0.670
B 3	0.909	0.910	0.911	0.910
B 5	0.950	0.949	0.955	0.949
B 7	0.917	0.915	0.929	0.915
MB 3	0.887	0.883	0.901	0.883
MB 5	0.919	0.917	0.940	0.917
MB 7	0.854	0.852	0.919	0.852
GB 3	0.924	0.923	0.928	0.923
GB 5	0.912	0.910	0.935	0.910
GB 7	0.978	0.978	0.978	0.978
BF 3	0.879	0.875	0.911	0.875
BF 5	0.944	0.944	0.949	0.944
BF 7	0.898	0.899	0.904	0.899
SN-MRFLM				
80	0.857	0.858	0.890	0.858
HE	0.765	0.772	0.773	0.772
B 3	0.972	0.972	0.974	0.972
B 5	0.979	0.979	0.980	0.979
B 7	0.986	0.986	0.986	0.986
MB 3	0.970	0.970	0.971	0.970
MB 5	0.944	0.942	0.949	0.942
MB 7	0.960	0.959	0.962	0.959
GB 3	0.950	0.950	0.953	0.950
GB 5	0.947	0.947	0.950	0.947
GB 7	0.968	0.968	0.969	0.968
BF 3	0.946	0.946	0.948	0.946
BF 5	0.970	0.970	0.972	0.970
BF 7	0.964	0.964	0.966	0.964

Table 5: Results of case 2 (training no. 5): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.682	0.688	0.804	0.688
HE	0.705	0.701	0.841	0.701
B 3	0.861	0.865	0.891	0.865
B 5	0.905	0.904	0.926	0.904
B 7	0.950	0.951	0.960	0.951
MB 3	0.943	0.943	0.948	0.943
MB 5	0.949	0.949	0.951	0.949
MB 7	0.920	0.918	0.936	0.918
GB 3	0.891	0.888	0.900	0.888
GB 5	0.970	0.970	0.972	0.970
GB 7	0.987	0.987	0.987	0.987
BF 3	0.873	0.869	0.905	0.869
BF 5	0.902	0.897	0.930	0.897
BF 7	0.820	0.829	0.860	0.829
SN-MRFLM				
80	0.884	0.879	0.906	0.879
HE	0.759	0.762	0.779	0.762
B 3	0.970	0.970	0.972	0.970
B 5	0.977	0.977	0.978	0.977
B 7	0.723	0.734	0.818	0.734
MB 3	0.965	0.965	0.966	0.965
MB 5	0.962	0.962	0.963	0.962
MB 7	0.969	0.969	0.970	0.969
GB 3	0.965	0.965	0.966	0.965
GB 5	0.963	0.963	0.965	0.963
GB 7	0.970	0.970	0.970	0.970
BF 3	0.900	0.900	0.914	0.900
BF 5	0.975	0.975	0.976	0.975
BF 7	0.972	0.972	0.972	0.972

Table 6: Results of case 2 (training no. 6): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.681	0.688	0.818	0.688
HE	0.762	0.755	0.868	0.755
B 3	0.876	0.873	0.921	0.873
B 5	0.958	0.958	0.962	0.958
B 7	0.827	0.823	0.867	0.823
MB 3	0.916	0.916	0.924	0.916
MB 5	0.956	0.956	0.958	0.956
MB 7	0.920	0.918	0.938	0.918
GB 3	0.857	0.854	0.892	0.854
GB 5	0.979	0.979	0.980	0.979
GB 7	0.932	0.931	0.940	0.931
BF 3	0.906	0.904	0.916	0.904
BF 5	0.970	0.970	0.973	0.970
BF 7	0.898	0.894	0.934	0.894
SN-MRFLM				
No	0.839	0.840	0.874	0.840
HE	0.698	0.705	0.713	0.705
B 3	0.953	0.952	0.958	0.952
B 5	0.956	0.956	0.957	0.956
B 7	0.965	0.965	0.966	0.965
MB 3	0.852	0.858	0.876	0.858
MB 5	0.973	0.973	0.975	0.973
MB 7	0.978	0.978	0.979	0.978
GB 3	0.962	0.962	0.963	0.962
GB 5	0.950	0.949	0.953	0.949
GB 7	0.935	0.935	0.943	0.935
BF 3	0.967	0.967	0.970	0.967
BF 5	0.945	0.945	0.946	0.945
BF 7	0.970	0.970	0.971	0.970

Table 7: Results of case 2 (training no. 7): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.683	0.686	0.802	0.686
HE	0.622	0.618	0.805	0.618
B 3	0.897	0.900	0.926	0.900
B 5	0.955	0.955	0.961	0.955
B 7	0.953	0.953	0.959	0.953
MB 3	0.878	0.875	0.899	0.875
MB 5	0.943	0.941	0.954	0.941
MB 7	0.900	0.901	0.923	0.901
GB 3	0.922	0.920	0.936	0.920
GB 5	0.944	0.946	0.952	0.946
GB 7	0.961	0.962	0.964	0.962
BF 3	0.866	0.867	0.909	0.867
BF 5	0.919	0.918	0.928	0.918
BF 7	0.917	0.918	0.935	0.918
SN-MRFLM				
No	0.887	0.887	0.910	0.887
HE	0.766	0.768	0.779	0.768
B 3	0.950	0.950	0.954	0.950
B 5	0.956	0.956	0.957	0.956
B 7	0.982	0.982	0.982	0.982
MB 3	0.952	0.951	0.956	0.951
MB 5	0.973	0.973	0.975	0.973
MB 7	0.965	0.965	0.967	0.965
GB 3	0.978	0.978	0.978	0.978
GB 5	0.966	0.966	0.968	0.966
GB 7	0.968	0.968	0.969	0.968
BF 3	0.968	0.967	0.969	0.967
BF 5	0.961	0.960	0.963	0.960
BF 7	0.976	0.976	0.978	0.976

Table 8: Results of case 2 (training no. 8): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.682	0.688	0.804	0.688
HE	0.705	0.701	0.841	0.701
B 3	0.861	0.865	0.891	0.865
B 5	0.905	0.904	0.926	0.904
B 7	0.950	0.951	0.960	0.951
MB 3	0.943	0.943	0.948	0.943
MB 5	0.949	0.949	0.951	0.949
MB 7	0.920	0.918	0.936	0.918
GB 3	0.891	0.888	0.900	0.888
GB 5	0.970	0.970	0.972	0.970
GB 7	0.987	0.987	0.987	0.987
BF 3	0.873	0.869	0.905	0.869
BF 5	0.902	0.897	0.930	0.897
BF 7	0.820	0.829	0.860	0.829
SN-MRFLM				
80	0.884	0.879	0.906	0.879
HE	0.759	0.762	0.779	0.762
B 3	0.970	0.970	0.972	0.970
B 5	0.977	0.977	0.978	0.977
B 7	0.723	0.734	0.818	0.734
MB 3	0.965	0.965	0.966	0.965
MB 5	0.962	0.962	0.963	0.962
MB 7	0.969	0.969	0.970	0.969
GB 3	0.965	0.965	0.966	0.965
GB 5	0.963	0.963	0.965	0.963
GB 7	0.970	0.970	0.970	0.970
BF 3	0.900	0.900	0.914	0.900
BF 5	0.975	0.975	0.976	0.975
BF 7	0.972	0.972	0.972	0.972

Table 9: Results of case 2 (training no. 9): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.750	0.750	0.788	0.750
HE	0.689	0.670	0.864	0.670
B 3	0.909	0.910	0.911	0.910
B 5	0.950	0.949	0.955	0.949
B 7	0.917	0.915	0.929	0.915
MB 3	0.887	0.883	0.901	0.883
MB 5	0.919	0.917	0.940	0.917
MB 7	0.854	0.852	0.919	0.852
GB 3	0.924	0.923	0.928	0.923
GB 5	0.912	0.910	0.935	0.910
GB 7	0.978	0.978	0.978	0.978
BF 3	0.879	0.875	0.911	0.875
BF 5	0.944	0.944	0.949	0.944
BF 7	0.898	0.899	0.904	0.899
SN-MRFLM				
No	0.857	0.858	0.890	0.858
HE	0.765	0.772	0.773	0.772
B 3	0.972	0.972	0.974	0.972
B 5	0.979	0.979	0.980	0.979
B 7	0.986	0.986	0.986	0.986
MB 3	0.970	0.970	0.971	0.970
MB 5	0.944	0.942	0.949	0.942
MB 7	0.960	0.959	0.962	0.959
GB 3	0.950	0.950	0.953	0.950
GB 5	0.947	0.947	0.950	0.947
GB 7	0.968	0.968	0.969	0.968
BF 3	0.946	0.946	0.948	0.946
BF 5	0.970	0.970	0.972	0.970
BF 7	0.964	0.964	0.966	0.964

Table 10: Results of case 2 (training no. 10): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.605	0.616	0.789	0.616
HE	0.622	0.618	0.805	0.618
B 3	0.897	0.900	0.926	0.900
B 5	0.955	0.955	0.961	0.955
B 7	0.953	0.953	0.959	0.953
MB 3	0.878	0.875	0.899	0.875
MB 5	0.943	0.941	0.954	0.941
MB 7	0.900	0.901	0.923	0.901
GB 3	0.922	0.920	0.936	0.920
GB 5	0.944	0.946	0.952	0.946
GB 7	0.961	0.962	0.964	0.962
BF 3	0.866	0.867	0.909	0.867
BF 5	0.919	0.918	0.928	0.918
BF 7	0.917	0.918	0.935	0.918
SN-MRFLM				
No	0.942	0.941	0.947	0.941
HE	0.766	0.768	0.779	0.768
B 3	0.950	0.950	0.954	0.950
B 5	0.956	0.956	0.957	0.956
B 7	0.982	0.982	0.982	0.982
MB 3	0.952	0.951	0.956	0.951
MB 5	0.973	0.973	0.975	0.973
MB 7	0.965	0.965	0.967	0.965
GB 3	0.978	0.978	0.978	0.978
GB 5	0.966	0.966	0.968	0.966
GB 7	0.968	0.968	0.969	0.968
BF 3	0.968	0.967	0.969	0.967
BF 5	0.961	0.960	0.963	0.960
BF 7	0.976	0.976	0.978	0.976

Table 11: Results of case 2 (Mean over 10 trainings): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.713	0.712	0.813	0.712
HE	0.680	0.671	0.833	0.671
B 3	0.884	0.885	0.910	0.885
B 5	0.929	0.929	0.941	0.929
B 7	0.926	0.925	0.939	0.925
MB 3	0.906	0.903	0.920	0.903
MB 5	0.934	0.933	0.944	0.933
MB 7	0.894	0.892	0.924	0.892
GB 3	0.905	0.903	0.921	0.903
GB 5	0.955	0.955	0.962	0.955
GB 7	0.971	0.971	0.973	0.971
BF 3	0.881	0.879	0.912	0.879
BF 5	0.920	0.918	0.939	0.918
BF 7	0.877	0.880	0.908	0.880
SN-MRFLM				
No	0.881	0.879	0.904	0.879
HE	0.764	0.768	0.778	0.768
B 3	0.961	0.961	0.964	0.961
B 5	0.963	0.962	0.965	0.962
B 7	0.921	0.923	0.941	0.923
MB 3	0.949	0.949	0.953	0.949
MB 5	0.964	0.963	0.966	0.963
MB 7	0.965	0.965	0.968	0.965
GB 3	0.965	0.965	0.966	0.965
GB 5	0.955	0.955	0.958	0.955
GB 7	0.966	0.966	0.968	0.966
BF 3	0.948	0.948	0.953	0.948
BF 5	0.963	0.963	0.965	0.963
BF 7	0.972	0.971	0.972	0.971

Table 12: Results of case 2 (Standard deviation over 10 trainings): training on NEU and testing on E-NEU when all images were preprocessed with either histogram equalization (HE) or one of the filters: blur (B), median blur (MB), Gaussian blur (GB) and bilateral filter (BF).

Preprocessing	F ₁ score	Accuracy	Precision	Recall
EN2s				
No	0.059	0.054	0.024	0.054
HE	0.049	0.052	0.031	0.052
B 3	0.035	0.033	0.021	0.033
B 5	0.028	0.029	0.022	0.029
B 7	0.039	0.040	0.029	0.040
MB 3	0.029	0.030	0.022	0.030
MB 5	0.018	0.018	0.012	0.018
MB 7	0.030	0.031	0.015	0.031
GB 3	0.031	0.032	0.023	0.032
GB 5	0.026	0.026	0.018	0.026
GB 7	0.017	0.017	0.015	0.017
BF 3	0.027	0.027	0.016	0.027
BF 5	0.051	0.052	0.024	0.052
BF 7	0.038	0.035	0.029	0.035
SN-MRFLM				
No	0.041	0.042	0.029	0.042
HE	0.030	0.029	0.029	0.029
B 3	0.009	0.010	0.008	0.010
B 5	0.018	0.018	0.014	0.018
B 7	0.106	0.101	0.067	0.101
MB 3	0.037	0.035	0.030	0.035
MB 5	0.012	0.012	0.010	0.012
MB 7	0.009	0.009	0.007	0.009
GB 3	0.009	0.009	0.008	0.009
GB 5	0.011	0.011	0.010	0.011
GB 7	0.012	0.012	0.009	0.012
BF 3	0.027	0.027	0.022	0.027
BF 5	0.010	0.010	0.010	0.010
BF 7	0.006	0.006	0.005	0.006

2 Number of epochs

Table 13 presents the effect of the number of epochs on the classification metrics obtained with EN2s.

Table 13: Results of case 1 (both training and testing on NEU) with EN2s – effect of the number of epochs.

No. of epochs	F1	Accuracy	Precision	Recall
1	0.9917	0.9917	0.9921	0.9917
2	1	1	1	1
3	1	1	1	1
4	0.9972	0.9972	0.9973	0.9972
5	0.9944	0.9944	0.9945	0.9944
6	0.9917	0.9917	0.9918	0.9917
7	1	1	1	1
8	0.9944	0.9944	0.9945	0.9944
9	1	1	1	1
10	1	1	1	1
12	0.9917	0.9917	0.9919	0.9917
14	0.9944	0.9944	0.9946	0.9944
16	1	1	1	1
18	1	1	1	1
20	0.9972	0.9972	0.9973	0.9972
40	1	1	1	1
60	1	1	1	1
80	1	1	1	1
100	1	1	1	1
120	1	1	1	1
140	0.9972	0.9972	0.9973	0.9972
160	0.9972	0.9972	0.9973	0.9972
180	1	1	1	1
200	1	1	1	1

3 Confusion matrices – numerical values

This section provides numerical data of all confusion matrices for the ease of future studies and comparisons.

Table 14: Numerical values of the confusion matrices presented in Fig. 12 in the main part of the article.

EN2s							SN-MRFLM						
	Pa	PS	In	Cr	Sc	RS		Pa	PS	In	Cr	Sc	RS
Pa	100.0	0.0	0.0	0.0	0.0	0.0	Pa	100.0	0.0	0.0	0.0	0.0	0.0
PS	0.0	100.0	0.0	0.0	0.0	0.0	PS	1.7	98.3	0.0	0.0	0.0	0.0
In	0.0	0.0	100.0	0.0	0.0	0.0	In	0.0	1.7	98.3	0.0	0.0	0.0
Cr	0.0	0.0	0.0	100.0	0.0	0.0	Cr	0.0	0.0	0.0	100.0	0.0	0.0
Sc	0.0	0.0	0.0	0.0	100.0	0.0	Sc	0.0	0.0	1.7	0.0	98.3	0.0
RS	0.0	0.0	0.0	0.0	0.0	100.0	RS	0.0	0.0	0.0	0.0	0.0	100.0

Table 15: Numerical values of the confusion matrices presented in Fig. 13 in the main part of the article.

EN2s							SN-MRFLM						
	Pa	PS	In	Cr	Sc	RS		Pa	PS	In	Cr	Sc	RS
Pa	55.1	43.0	0.0	1.3	0.5	0.0	Pa	94.9	1.6	0.0	0.3	0.0	3.2
PS	2.4	90.3	0.0	3.5	3.8	0.0	PS	0.0	92.5	6.2	0.8	0.0	0.5
In	1.3	17.7	78.2	1.3	1.3	0.0	In	0.3	14.5	83.1	0.0	0.0	2.2
Cr	0.3	60.8	0.0	39.0	0.0	0.0	Cr	0.5	17.7	0.0	71.5	0.0	10.2
Sc	0.3	0.0	0.0	0.0	99.7	0.0	Sc	0.0	0.0	0.3	0.0	99.7	0.0
RS	0.0	52.2	0.0	0.0	0.3	47.6	RS	0.3	6.7	0.0	5.4	0.0	87.6

Table 16: Numerical values of the confusion matrices presented in Fig. 14 in the main part of the article.

EN2s							SN-MRFLM						
	Pa	PS	In	Cr	Sc	RS		Pa	PS	In	Cr	Sc	RS
Pa	100.0	0.0	0.0	0.0	0.0	0.0	Pa	100.0	0.0	0.0	0.0	0.0	0.0
PS	0.0	100.0	0.0	0.0	0.0	0.0	PS	0.0	95.0	5.0	0.0	0.0	0.0
In	0.0	0.0	96.7	0.0	3.3	0.0	In	0.0	0.0	96.7	0.0	0.0	3.3
Cr	0.0	0.0	0.0	100.0	0.0	0.0	Cr	0.0	0.0	0.0	100.0	0.0	0.0
Sc	0.0	0.0	15.0	0.0	85.0	0.0	Sc	1.7	0.0	6.7	0.0	91.7	0.0
RS	0.0	0.0	0.0	0.0	0.0	100.0	RS	0.0	0.0	0.0	3.3	0.0	96.7

Table 17: Numerical values of the confusion matrices presented in Fig. 15 in the main part of the article.

EN2s							SN-MRFLM						
	Pa	PS	In	Cr	Sc	RS		Pa	PS	In	Cr	Sc	RS
Pa	99.2	0.0	0.0	0.8	0.0	0.0	Pa	100.0	0.0	0.0	0.0	0.0	0.0
PS	0.0	96.0	0.0	4.0	0.0	0.0	PS	0.3	99.7	0.0	0.0	0.0	0.0
In	0.0	0.5	98.7	0.8	0.0	0.0	In	0.0	0.0	100.0	0.0	0.0	0.0
Cr	0.0	0.0	0.0	100.0	0.0	0.0	Cr	0.0	0.0	0.0	100.0	0.0	0.0
Sc	0.0	0.0	0.0	0.0	100.0	0.0	Sc	0.0	0.0	0.0	0.0	100.0	0.0
RS	0.0	0.0	0.0	0.0	0.0	100.0	RS	0.0	0.0	0.0	0.0	0.0	100.0

Table 18: Numerical values of the confusion matrices presented in Fig. 16 in the main part of the article.

EN2s							SN-MRFLM						
	Pa	PS	In	Cr	Sc	RS		Pa	PS	In	Cr	Sc	RS
Pa	100.0	0.0	0.0	0.0	0.0	0.0	Pa	100.0	0.0	0.0	0.0	0.0	0.0
PS	0.3	99.5	0.0	0.0	0.3	0.0	PS	1.3	95.2	3.5	0.0	0.0	0.0
In	0.8	2.4	96.8	0.0	0.0	0.0	In	0.0	7.8	92.2	0.0	0.0	0.0
Cr	0.8	3.0	0.0	89.0	0.0	7.3	Cr	0.8	3.0	0.0	96.2	0.0	0.0
Sc	0.0	0.0	0.0	0.0	100.0	0.0	Sc	0.0	0.0	0.0	0.0	99.2	0.8
RS	1.6	1.1	0.0	0.0	0.0	97.3	RS	0.8	0.3	0.0	0.0	0.0	98.9