

Классификация временных рядов

Отливанчик Павел

Table 17: Full results for the classification task. *. in the Transformers indicates the name of *former. We report the classification accuracy (%) as the result. The standard deviation is within 0.1%.

| Datasets / Models | Classical methods | | RNN | | TCN | | Transformers | | | | | | | | MLP | | | | Signature | Log-Signature | |
|----------------------|-------------------|---------|--------|------|--------|-------|--------------|--------|------|-------|-------|-------|----------|-------|-------|-------|---------|----------|-----------|-----------------------|-----------------------|
| | DTW | XGBoost | Rocket | LSTM | LSTNet | LSSL | TCN | Trans. | Re. | In. | Pyra. | Auto. | Station. | FED. | ETS. | Flow. | DLinear | LightTS. | | | TimesNet |
| | 1994 | 2016 | 2020 | 1997 | 2018 | 2022 | 2019 | 2017 | 2020 | 2021 | 2021a | 2021 | 2022a | 2022 | 2022 | 2022 | 2023 | 2022 | (Ours) | Accuracy on orig test | Accuracy on orig test |
| EthanolConcentration | 32.3 | 43.7 | 45.2 | 32.3 | 39.9 | 31.1 | 28.9 | 32.7 | 31.9 | 31.6 | 30.8 | 31.6 | 32.7 | 31.2 | 28.1 | 33.8 | 32.6 | 29.7 | 35.7 | 27.4 | 27.4 |
| FaceDetection | 52.9 | 63.3 | 64.7 | 57.7 | 65.7 | 66.7 | 52.8 | 67.3 | 68.6 | 67.0 | 65.7 | 68.4 | 68.0 | 66.0 | 66.3 | 67.6 | 68.0 | 67.5 | 68.6 | 51.9 | 51.6 |
| Handwriting | 28.6 | 15.8 | 58.8 | 15.2 | 25.8 | 24.6 | 53.3 | 32.0 | 27.4 | 32.8 | 29.4 | 36.7 | 31.6 | 28.0 | 32.5 | 33.8 | 27.0 | 26.1 | 32.1 | 42.5 | 34 |
| Heartbeat | 71.7 | 73.2 | 75.6 | 72.2 | 77.1 | 72.7 | 75.6 | 76.1 | 77.1 | 80.5 | 75.6 | 74.6 | 73.7 | 73.7 | 71.2 | 77.6 | 75.1 | 75.1 | 78.0 | 72.2 | 71.7 |
| JapaneseVowels | 94.9 | 86.5 | 96.2 | 79.7 | 98.1 | 98.4 | 98.9 | 98.7 | 97.8 | 98.9 | 98.4 | 96.2 | 99.2 | 98.4 | 95.9 | 98.9 | 96.2 | 96.2 | 98.4 | 84.9 | 84.0 |
| PEMS-SF | 71.1 | 98.3 | 75.1 | 39.9 | 86.7 | 86.1 | 68.8 | 82.1 | 82.7 | 81.5 | 83.2 | 82.7 | 87.3 | 80.9 | 86.0 | 83.8 | 75.1 | 88.4 | 89.6 | 78.0 | 80.9 |
| SelfRegulationSCP1 | 77.7 | 84.6 | 90.8 | 68.9 | 84.0 | 90.8 | 84.6 | 92.2 | 90.4 | 90.1 | 88.1 | 84.0 | 89.4 | 88.7 | 89.6 | 92.5 | 87.3 | 89.8 | 91.8 | 73.0 | 67.2 |
| SelfRegulationSCP2 | 53.9 | 48.9 | 53.3 | 46.6 | 52.8 | 52.2 | 55.6 | 53.9 | 56.7 | 53.3 | 53.3 | 50.6 | 57.2 | 54.4 | 55.0 | 56.1 | 50.5 | 51.1 | 57.2 | 51.7 | 53.9 |
| SpokenArabicDigits | 96.3 | 69.6 | 71.2 | 31.9 | 100.0 | 100.0 | 95.6 | 98.4 | 97.0 | 100.0 | 99.6 | 100.0 | 100.0 | 100.0 | 100.0 | 98.8 | 81.4 | 100.0 | 99.0 | 95.1 | 96.7 |
| UWaveGestureLibrary | 90.3 | 75.9 | 94.4 | 41.2 | 87.8 | 85.9 | 88.4 | 85.6 | 85.6 | 85.6 | 83.4 | 85.9 | 87.5 | 85.3 | 85.0 | 86.6 | 82.1 | 80.3 | 85.3 | 89.1 | 80.6 |
| Average Accuracy | 67.0 | 66.0 | 72.5 | 48.6 | 71.8 | 70.9 | 70.3 | 71.9 | 71.5 | 72.1 | 70.8 | 71.1 | 72.7 | 70.7 | 71.0 | 73.0 | 67.5 | 70.4 | 73.6 | 66.58 | 64.86 |

| Dataset | Accuracy on orig test | Mean Accuracy ± Variance | sig_len | hidden_layers | Dataset | Accuracy on orig test | Mean Accuracy ± Variance | sig_len | hidden_layers |
|----------------------|-----------------------|--------------------------|---------|---------------------|----------------------|-----------------------|--------------------------|---------|---------------------|
| EthanolConcentration | 27.4 | 26.9 ± 0.1 | 170 | 1024-512-256-128-64 | EthanolConcentration | 27.4 | 27.5 ± 0.1 | 120 | 1024-512-256-128-64 |
| FaceDetection | 51.9 | 51.9 ± 0.0 | 5292 | 512-256-128-64 | FaceDetection | 51.6 | 51.6 ± 0.0 | 1323 | 1024-512-256-128-64 |
| Handwriting | 42.5 | 42.5 ± 0.0 | 1364 | 256-128-64 | Handwriting | 34 | 34.1 ± 0.0 | 241 | 128-64 |
| Heartbeat | 72.2 | 72.0 ± 0.1 | 488 | 128-64 | Heartbeat | 71.7 | 72.3 ± 0.1 | 1953 | 512-256-128-64 |
| JapaneseVowels | 84.9 | 85.0 ± 0.0 | 297 | 256-128-64 | JapaneseVowels | 84.6 | 84.6 ± 0.0 | 102 | 256-128-64 |
| PEMS-SF | 78.0 | 78.1 ± 0.1 | 232565 | 128-64 | PEMS-SF | 80.9 | 81.1 ± 0.1 | 116282 | 128-64 |
| SelfRegulationSCP1 | 73.0 | 73.1 ± 0.1 | 2800 | 128-64 | SelfRegulationSCP1 | 67.2 | 67.2 ± 0.1 | 91 | 512-256-128-64 |
| SelfRegulationSCP2 | 51.7 | 50.8 ± 0.2 | 585 | 256-128-64 | SelfRegulationSCP2 | 53.9 | 53.8 ± 0.1 | 606 | 512-256-128-64 |
| SpokenArabicDigits | 95.1 | 95.1 ± 0.0 | 369 | 512-256-128-64 | SpokenArabicDigits | 96.7 | 96.7 ± 0.0 | 507 | 256-128-64 |
| UWaveGestureLibrary | 89.1 | 89.3 ± 0.0 | 1364 | 256-128-64 | UWaveGestureLibrary | 80.6 | 80.9 ± 0.0 | 241 | 1024-512-256-128-64 |
| | 66.58 | | | | | 64.86 | | | |

| dataset | train_samples | test_samples | equal_lengths | series_length | num_features | num_classes | signature | log-signature |
|----------------------|---------------|--------------|---------------|---------------|--------------|-------------|-----------|---------------|
| EthanolConcentration | 261 | 263 | TRUE | 1751 | 3 | 4 | -6,1 | -6,1 |
| FaceDetection | 5890 | 3524 | TRUE | 62 | 144 | 2 | -13 | -13,3 |
| Handwriting | 150 | 850 | TRUE | 152 | 3 | 26 | 11,4 | 2,9 |
| Heartbeat | 204 | 205 | TRUE | 405 | 61 | 2 | -2,9 | -3,4 |
| JapaneseVowels | 270 | 370 | FALSE | 15,6 | 12 | 9 | -11,2 | -11,5 |
| PEMS-SF | 267 | 173 | TRUE | 144 | 963 | 7 | -2,5 | 0,4 |
| SelfRegulationSCP1 | 268 | 293 | TRUE | 896 | 6 | 2 | -14,1 | -19,9 |
| SelfRegulationSCP2 | 200 | 180 | TRUE | 1152 | 7 | 2 | -1,6 | 0,6 |
| SpokenArabicDigits | 6599 | 2199 | FALSE | 39,8 | 13 | 10 | 3,6 | 5,2 |
| UWaveGestureLibrary | 120 | 320 | TRUE | 315 | 3 | 8 | 5,8 | -2,7 |