**Data:**

- m4_hourly
- freq: H,
- N=414,
- forecast_range=48,
- batches_per_epoch=50)

| Data: M4 Hourly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 42 | 1.3395 | 0.1140 | 21.7360 | 0.0483 | 0.0319 |
| | 43 | 1.4938 | 0.1258 | 27.8691 | 0.0641 | 1.0240 |
| | 44 | 2.1627 | 0.1421 | 47.4823 | 0.1348 | 0.1822 |
| 150 | 42 | 1.4928 | 0.1132 | 30.2772 | 0.0499 | 0.0304 |
| | 43 | 1.5034 | 0.1260 | 28.9090 | 0.0610 | 0.0237 |
| | 44 | 1.5602 | 0.1353 | 34.2699 | 0.1392 | 0.1980 |
| 200 | 42 | 1.3969 | 0.1119 | 27.9817 | 0.0502 | 0.0307 |
| | 43 | 1.4291 | 0.1259 | 27.8703 | 0.0769 | 0.0253 |
| | 44 | 1.5606 | 0.1355 | 35.2268 | 0.1433 | 0.2088 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 42 | 1.4337 | 0.1427 | 21.0560 | 0.0549 | 0.0220 |
| | 43 | 1.4967 | 0.1513 | 21.5971 | 0.0511 | 0.0223 |
| | 44 | 1.4700 | 0.1521 | 21.9186 | 0.0596 | 0.0226 |
| **Deep Factor RNN Model (DF-RNN)** | | | | | | |
| 100 | 42 | 13.7530 | 0.3461 | 260.7183 | 0.1002 | 0.1185 |
| | 43 | 13.7492 | 0.3423 | 234.7375 | 0.0978 | 0.1085 |
| | 44 | 15.0872 | 0.3550 | 292.8645 | 0.1272 | 0.1121 |
| 150 | 42 | 14.7166 | 0.3483 | 293.4810 | 0.0876 | 0.0669 |
| | 43 | 13.9692 | 0.3415 | 242.0005 | 0.1013 | 0.0861 |
| | 44 | 15.0451 | 0.3359 | 301.0107 | 0.0840 | 0.0856 |
| 200 | 42 | 15.1655 | 0.3506 | 305.8029 | 0.0981 | 0.0508 |
| | 43 | 13.9596 | 0.3396 | 246.5995 | 0.0979 | 0.0773 |
| | 44 | 15.4097 | 0.3423 | 315.2729 | 0.1082 | 0.0504 |

| **Benchmark and Competition Methods** | | |
|---|---|---|
| **Method** | MASE | sMAPE |
| Naive2 | 2,395 | 0,1838 |
| Comb | 4,582 | 0,2205 |
| ARIMA | 0,943 | 0,1398 |

| | | |
|---|---|---|
| ETS | 1,824 | 0,1731 |
| Smyl (#1) | 0,893 | 0,0933 |
| MM (#2) | 0,819 | 0,1151 |
| Doornik et al. (H#1) | 0,801 | 0,0891 |

| Data: M4 Hourly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 43 | 1.4938 | 0.1258 | 27.8691 | 0.0641 | 1.0240 |
| 150 | 43 | 1.5034 | 0.1260 | 28.9090 | 0.0610 | 0.0237 |
| 200 | 43 | 1.4291 | 0.1259 | 27.8703 | 0.0769 | 0.0253 |
| 500 | 43 | 1.4965 | 0.1232 | 31.5952 | 0.0736 | 0.0253 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 44 | 1.4700 | 0.1521 | 21.9186 | 0.0596 | 0.0226 |
| **Deep Factor RNN Model (DF-RNN)** | | | | | | |
| 100 | 42 | 13.7530 | 0.3461 | 260.7183 | 0.1002 | 0.1185 |
| 150 | 42 | 14.7166 | 0.3483 | 293.4810 | 0.0876 | 0.0669 |
| 200 | 42 | 15.1655 | 0.3506 | 305.8029 | 0.0981 | 0.0508 |
| **Benchmark and Competition Methods** | | | | | | |
| **Method** | | | | | | |
| Naive2 | | 2.395 | 0.1838 | | | |
| Comb | | 4.582 | 0.2205 | | | |
| ARIMA | | 0.943 | 0.1398 | | | |
| ETS | | 1.824 | 0.1731 | | | |
| Smyl (#1) | | 0.893 | 0.0933 | | | |
| MM (#2) | | 0.819 | 0.1151 | | | |
| Doornik et al. (H#1) | | 0.801 | 0.0891 | | | |

**Data:**

- m4_daily
- freq: D,
- N=4227
- Forecast_range=14

- Batches_per_epoch=50

The main question of this project is to whether RNN-based algorithms may be a valuable tool in time series forecasting.

| Data: M4 Daily | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 42 | 4.9019 | 0.0444 | 69.7043 | 0.0401 | 0.0224 |
| | 43 | 4.0038 | 0.0367 | 53.0936 | 0.0308 | 0.0141 |
| | 44 | 3.5157 | 0.0334 | 49.9993 | 0.0299 | 0.0159 |
| 150 | 42 | 3.5682 | 0.0337 | 46.5829 | 0.0305 | 0.0151 |
| | 43 | 3.4648 | 0.0331 | 45.4494 | 0.0294 | 0.0145 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 44 | 3.3860 | 0.0324 | 47.7585 | 0.0285 | 0.0150 |
| 200 | 42 | 3.5650 | 0.0337 | 46.4284 | 0.0305 | 0.0151 |
| | 43 | 3.4639 | 0.0330 | 45.6046 | 0.0294 | 0.0146 |
| | 44 | 3.9249 | 0.0362 | 57.0281 | 0.0339 | 0.0191 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 42 | 3.9000 | 0.0363 | 53.7291 | 0.0335 | 0.0196 |
| | 43 | 3.9448 | 0.0363 | 68.0217 | 0.0338 | 0.0229 |
| | 44 | 3.9256 | 0.0365 | 67.5212 | 0.0337 | 0.0229 |
| 35 | 42 | 3.9599 | 0.0362 | 71.0214 | 0.0339 | 0.0235 |
| | 43 | 3.9666 | 0.0365 | 62.9762 | 0.0341 | 0.0217 |
| | 44 | 3.9310 | 0.0360 | 61.4739 | 0.0335 | 0.0209 |
| 45 | 42 | 4.0065 | 0.0367 | 64.1235 | 0.0343 | 0.0218 |
| | 43 | 3.9555 | 0.0363 | 61.9066 | 0.0339 | 0.0212 |
| | 44 | 3.9444 | 0.0360 | 62.4846 | 0.0337 | 0.0212 |
| **Deep Factor RNN Model (DF-RNN)** | | | | | | |
| 100 | 42 | 39.8111 | 0.2951 | 1532.6129 | 0.3057 | 0.2866 |
| | 43 | 56.8153 | 0.3249 | 2221.3670 | 0.4959 | 0.1569 |
| | 44 | 63.9779 | 0.3686 | 2501.5459 | 0.5380 | 0.2000 |
| 200 | 42 | 16.0541 | 0.1295 | 552.5237 | 0.1273 | 0.1275 |
| | 43 | 20.0279 | 0.1428 | 746.1202 | 0.1752 | 0.0764 |
| | 44 | 16.5529 | 0.1294 | 574.2444 | 0.1308 | 0.1208 |
| 400 | 42 | 7.8022 | 0.0671 | 236.0365 | 0.0645 | 0.0722 |
| | 43 | 12.5952 | 0.1034 | 446.3705 | 0.1054 | 0.1470 |
| | 44 | 7.9463 | 0.0673 | 242.2802 | 0.0655 | 0.0820 |

**Benchmark and Competition Methods**

| **Method** | | |
|---|---|---|
| Naive2 | 3.278 | 0.0305 |
| Comb | 3.203 | 0.0298 |
| ARIMA | 3.410 | 0.0319 |
| ETS | 3.253 | 0.0305 |
| Smyl (#1) | 3.446 | 0.0317 |
| MM (#2) | 3.344 | 0.0310 |
| Pawlikowski, et al. (D#1) | 2.642 | 0.0245 |

| Data: M4 Daily | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 43 | 4.0038 | 0.0367 | 53.0936 | 0.0308 | 0.0141 |
| 150 | 43 | 3.4648 | 0.0331 | 45.4494 | 0.0294 | 0.0145 |
| 200 | 42 | 3.5650 | 0.0337 | 46.4284 | 0.0305 | 0.0151 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 44 | 3.9256 | 0.0365 | 67.5212 | 0.0337 | 0.0229 |
| 35 | 42 | 3.9599 | 0.0362 | 71.0214 | 0.0339 | 0.0235 |
| 45 | 43 | 3.9555 | 0.0363 | 61.9066 | 0.0339 | 0.0212 |
| **Deep Factor RNN Model (DF-RNN)** | | | | | | |
| 100 | 43 | 56.8153 | 0.3249 | 2221.3670 | 0.4959 | 0.1569 |
| 200 | 44 | 16.5529 | 0.1294 | 574.2444 | 0.1308 | 0.1208 |
| 400 | 44 | 7.9463 | 0.0673 | 242.2802 | 0.0655 | 0.0820 |
| **Benchmark and Competition Methods** | | | | | | |
| **Method** | | | | | | |
| Naive2 | | 3.278 | 0.0305 | | | |
| Comb | | 3.203 | 0.0298 | | | |
| ARIMA | | 3.410 | 0.0319 | | | |
| ETS | | 3.253 | 0.0305 | | | |
| Smyl (#1) | | 3.446 | 0.0317 | | | |
| MM (#2) | | 3.344 | 0.0310 | | | |
| Pawlikowski, et al. (D#1) | | 2.642 | 0.0245 | | | |

**Data:**

- M4 Weekly
- Freq: W
- N = 359
- Forecast range=13
- Batches per epoch=50

| Data: M4 Weekly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 42 | 2.6230 | 0.0952 | 25.3990 | 0.0668 | 0.0310 |
| | 43 | 2.5731 | 0.0891 | 26.2968 | 0.0643 | 0.0282 |
| | 44 | 2.5440 | 0.0895 | 25.7917 | 0.0634 | 0.0299 |
| 150 | 42 | 2.6059 | 0.0932 | 25.3896 | 0.0658 | 0.0286 |
| | 43 | 2.6284 | 0.0930 | 27.5637 | 0.0668 | 0.0285 |
| | 44 | 2.7072 | 0.0890 | 26.5052 | 0.0636 | 0.2813 |
| 200 | 42 | 2.7460 | 0.0922 | 24.8920 | 0.0648 | 0.0284 |
| | 43 | 2.6265 | 0.0930 | 27.4965 | 0.0668 | 0.0282 |
| | 44 | 2.5842 | 0.0896 | 25.6984 | 0.0652 | 0.0291 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 42 | 2.8736 | 0.0752 | 38.3546 | 0.0554 | 0.0356 |
| | 43 | 2.9930 | 0.0749 | 38.4508 | 0.0336 | 0.0336 |
| | 44 | 2.9846 | 0.0775 | 49.7592 | 0.0565 | 0.0362 |
| **Deep Factor Models (DeepFactor)** | | | | | | |
| 100 | 42 | 10.7293 | 0.1717 | 399.0404 | 0.1400 | 0.1988 |
| | 43 | 8.7031 | 0.1506 | 320.3608 | 0.1195 | 0.1699 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 44 | 8.6579 | 0.1499 | 317.1048 | 0.1200 | 0.1286 |
| 150 | 42 | 7.0068 | 0.1411 | 242.9934 | 0.1072 | 0.1360 |
| | 43 | 10.4104 | 0.1612 | 383.1427 | 0.1342 | 0.2045 |
| | 44 | 6.6518 | 0.1363 | 235.6849 | 0.1050 | 0.1120 |
| 200 | 42 | 6.0038 | 0.1335 | 202.3871 | 0.1000 | 0.1058 |
| | 43 | 6.7529 | 0.1381 | 235.7220 | 0.1051 | 0.1343 |
| | 44 | 6.5236 | 0.1369 | 229.5552 | 0.1043 | 0.1229 |

**M4 Benchmark and Competition Methods**

| **Method** | MASE | sMAPE |
|---|---|---|
| Naive2 | 2.777 | 0.0916 |
| Comb | 2.432 | 0.0894 |
| ARIMA | 2.556 | 0.0865 |
| ETS | 2.527 | 0.0873 |
| Smyl (#1) | 2.356 | 0.0782 |
| MM (#2) | 2.108 | 0.0763 |
| Darin & Stellwagen (W#1) | 2.107 | 0.0658 |

| Data: M4 Weekly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 43 | 2.5731 | 0.0891 | 26.2968 | 0.0643 | 0.0282 |
| 150 | 43 | 2.6284 | 0.0930 | 27.5637 | 0.0668 | 0.0285 |
| 200 | 43 | 2.6265 | 0.0930 | 27.4965 | 0.0668 | 0.0282 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 43 | 2.9930 | 0.0749 | 38.4508 | 0.0336 | 0.0336 |
| **Deep Factor RNN Model (DF-RNN)** | | | | | | |
| 100 | 43 | 8.7031 | 0.1506 | 320.3608 | 0.1195 | 0.1699 |
| 150 | 42 | 7.0068 | 0.1411 | 242.9934 | 0.1072 | 0.1360 |
| 200 | 43 | 6.7529 | 0.1381 | 235.7220 | 0.1051 | 0.1343 |
| 500 | 42 | 6.3663 | 0.1364 | 214.2237 | 0.1022 | 0.1273 |
| **Benchmark and Competition Methods** | | | | | | |
| **Method** | | | | | | |
| Naive2 | | 2.777 | 0.0916 | | | |
| Comb | | 2.432 | 0.0894 | | | |
| ARIMA | | 2.556 | 0.0865 | | | |
| ETS | | 2.527 | 0.0873 | | | |
| Smyl (#1) | | 2.356 | 0.0782 | | | |
| MM (#2) | | 2.108 | 0.0763 | | | |
| Darin & Stellwagen (W#1) | | 2.107 | 0.0658 | | | |

DATA:

- M4 Monthly
- Freq: Monthly
- N=48,000
- Prediction range, forecast range =
- Batches per epoch=50

| Data: M4 Monthly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 | 42 | 1.0928 | 0.1386 | 24.8620 | 0.1246 | 0.0980 |
| | 43 | 1.0212 | 0.1368 | 21.9949 | 0.1226 | 0.0963 |
| | 44 | 1.1101 | 0.1385 | 22.6532 | 0.1245 | 0.0973 |
| 150 | 42 | 1.1624 | 0.1375 | 20.1148 | 0.1263 | 0.0931 |
| | 43 | 1.1237 | 0.1393 | 19.1640 | 0.1267 | 0.0933 |
| | 44 | 1.0619 | 0.1359 | 21.2501 | 0.1218 | 0.0937 |
| 200 | 42 | 1.0457 | 0.1358 | 19.4718 | 0.1221 | 0.0879 |
| | 43 | 1.1277 | 0.1392 | 21.3198 | 0.1266 | 0.0978 |
| | 44 | 1.0809 | 0.1395 | 20.1820 | 0.1242 | 0.0907 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 | 42 | | | | | |
| | 43 | | | | | |
| | 44 | | | | | |
| **M4 Benchmark and Competition Methods** | | | | | | |
| **Method** | | MASE | sMAPE | | | |
| Naive2 | | 1.063 | 0.1427 | | | |

| | | |
|---|---|---|
| Comb | 0.966 | 0.1343 |
| ARIMA | 0.930 | 0.1344 |
| ETS | 0.948 | 0.1353 |
| Smyl (#1) | 0.884 | 0.1213 |
| MM (#2) | 0.893 | 0.1264 |

| Data: M4 Monthly | | | | | | |
|---|---|---|---|---|---|---|
| **Epochs (batches)** | **Seed** | **MASE** | **sMAPE** | **MSIS** | **wQ50L** | **wQ90L** |
| **Deep Autoregressive Recurrent Neural Network (DeepAR)** | | | | | | |
| 100 (50) | 42 | 1.0928 | 0.1386 | 24.8620 | 0.1246 | 0.0980 |
| 150 (50) | 42 | 1.1624 | 0.1375 | 20.1148 | 0.1263 | 0.0931 |
| 200 (50) | 44 | 1.0809 | 0.1395 | 20.1820 | 0.1242 | 0.0907 |
| 250 (50) | 43 | 1.0212 | 0.1368 | 21.9949 | 0.1226 | 0.0963 |
| 100 (200) | 42 | 0.9972 | 20.7128 | 0.1356 | 0.1215 | 0.0925 |
| 100 (500) | 44 | 0.9748 | 0.1345 | 16.8940 | 0.1187 | 0.0731 |
| 100 (1000) | 42 | 0.9894 | 0.1306 | 9.7987 | 0.1160 | 0.0679 |
| **Deep State Space Models (DeepState)** | | | | | | |
| 25 (50) | 43 | 1.0535 | 0.1449 | 24.9133 | 0.1291 | 0.1057 |
| 50 (50) | 43 | 1.0536 | 0.1449 | 24.9146 | 0.1291 | 0.1057 |
| 50 (100) | 43 | 1.0536 | 0.1449 | 24.9142 | 0.1291 | 0.1057 |
| 50 (1000) | 42 | 1.0374 | 0.1370 | 21.9087 | 0.1231 | 0.0908 |
| **Benchmark and Competition Methods** | | | | | | |
| **Method** | | | | | | |
| Naive2 | | 1.063 | 0.1427 | | | |
| Comb | | 0.966 | 0.1343 | | | |
| ARIMA | | 0.930 | 0.1344 | | | |
| ETS | | 0.948 | 0.1353 | | | |
| Smyl (#1) | | 0.884 | 0.1213 | | | |
| MM (#2) | | 0.893 | 0.1264 | | | |