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Model Report: DeepNN

18/12/2024

Introduction

This is an automated report for the Experiment with neural networks on traffic volume dataset; the DeepNN model.

This report will first introduce the model setup, including the hyperparameters and search algorithms used. Hereafter the base dataset will be described, and the differently created training datasets will be listed. After that, the results for the different forecast types will be presented, and the best results will be shown in plots.

Experiment description:

Experiment with neural networks on traffic volume dataset

Model setup

The model has been used for the following forecast purposes:

○ one_step

○ multistep

○ recursive

The model has been optimized using the following hyperparameters:

- optimizer: ['adam', 'sgd']

- epochs: [100, 200]

- batch_size: [32, 64]

- scaler: [None, StandardScaler(), MinMaxScaler(), RobustScaler(), PowerTransformer()]

And with the following search algorithms:

○ grid

○ random

The used performance measure is the neg_mean_absolute_error measure.

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Dataset setup

The baseline dataset used for these forecasts is
the 'Metro Interstate Traffic Volume with hourly features and holiday markings.' dataset: *'Metro Interstate Traffic Volume with hourly features and holiday markings.'.*

The test size used for the forecasts is 0.2.

○ Dataset 1

- name: univariate_lagged

- dataset_type: univariate

- prediction_type: one_step

- components: ['one_step_target', 'lagged_target']

○ Dataset 2

- name: univariate_temporal

- dataset_type: univariate

- prediction_type: one_step

- components: ['one_step_target', 'temporal_features']

○ Dataset 3

- name: multivariate_lagged

- dataset_type: multivariate

- prediction_type: one_step

- components: ['one_step_target', 'lagged_target', 'feature_columns']

○ Dataset 4

- name: multivariate_lagged_temporal

- dataset_type: multivariate

- prediction_type: one_step

- components: ['one_step_target', 'temporal_features', 'feature_columns', 'lagged_target']

○ Dataset 5

- name: univariate_lagged_multistep

- dataset_type: univariate

- prediction_type: multistep

- components: ['multistep_target', 'lagged_target']

○ Dataset 6

- name: multivariate_lagged_temporal_multistep

- dataset_type: multivariate

- prediction_type: multistep

- components: ['multistep_target', 'temporal_features', 'feature_columns', 'lagged_target']

Results: DeepNN

The presentation of the results follows this system: For each prediction type, the best and worst results for each combination of search method and dataset type are presented in heat plots along with the corresponding model setup.
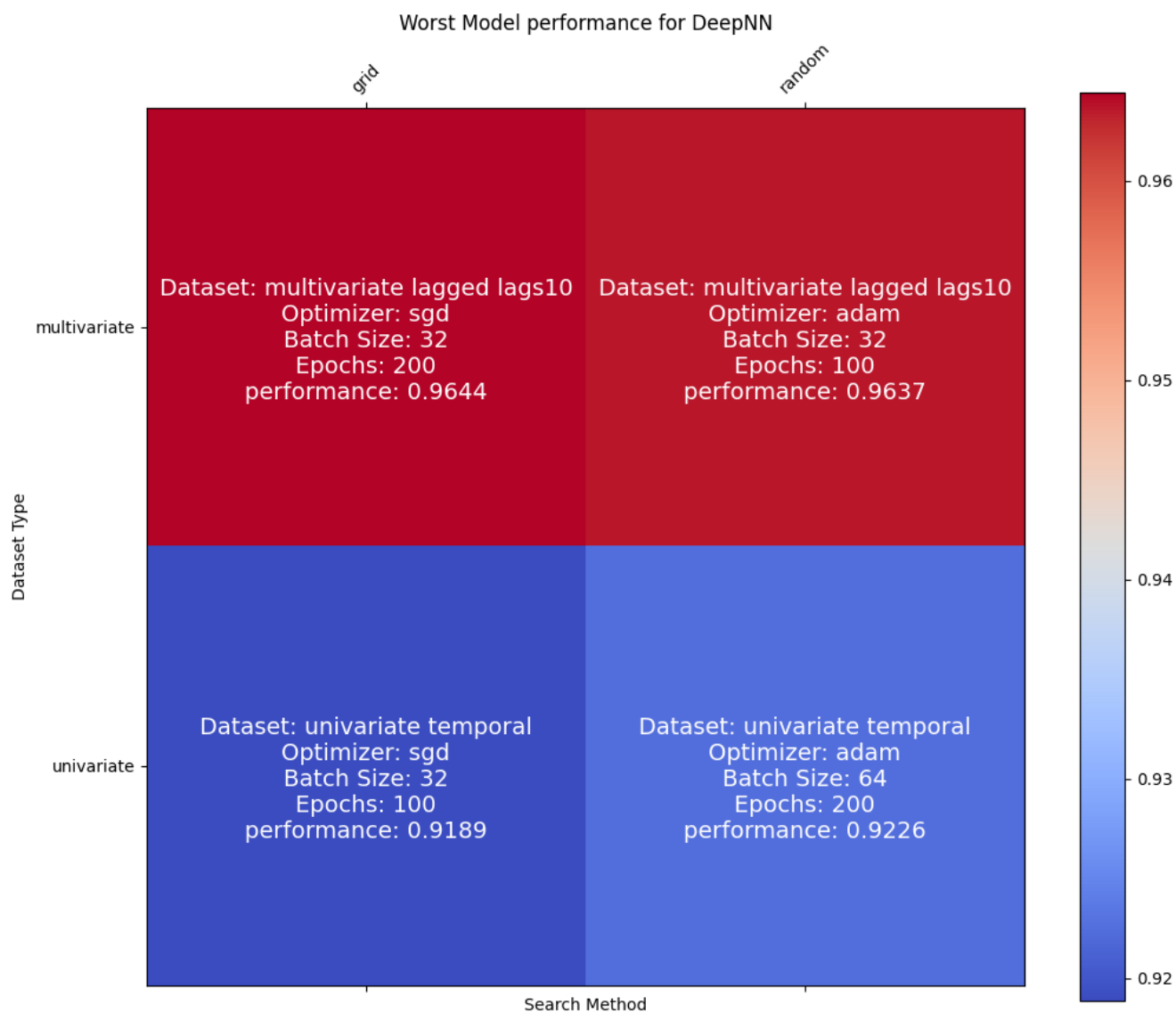
 - Then, if the prediction type is one-step forecasts, the best prediction over time is visualized in a line plot.

 - If the prediction type is a multi-step forecast, either direct or recursive, the model with the average best r2 score is chosen, and the three best and worst predictions are visualized in a line plot. Furthermore, three steps of the forecasts are plotted.
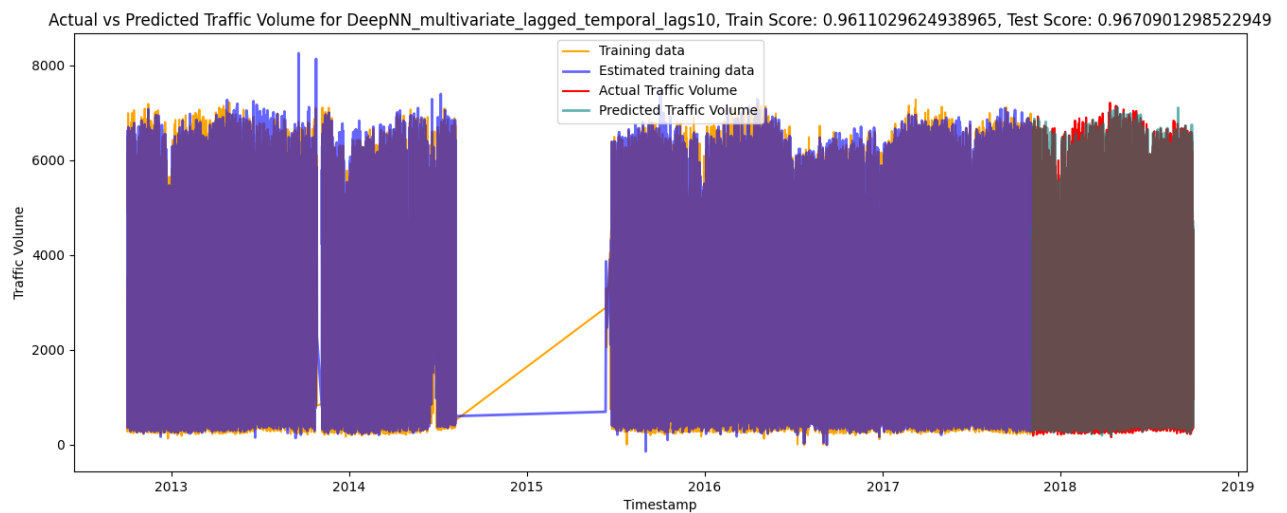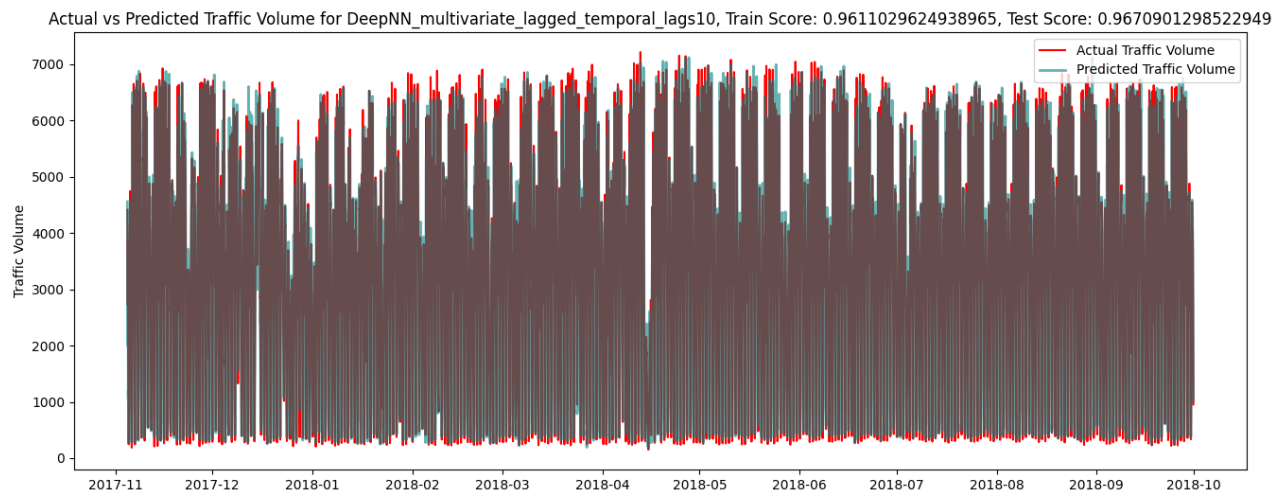
Results for the one_step forecast.

The best results (one_step) for the different setup combinations are as follows:

Best Model performance for DeepNN
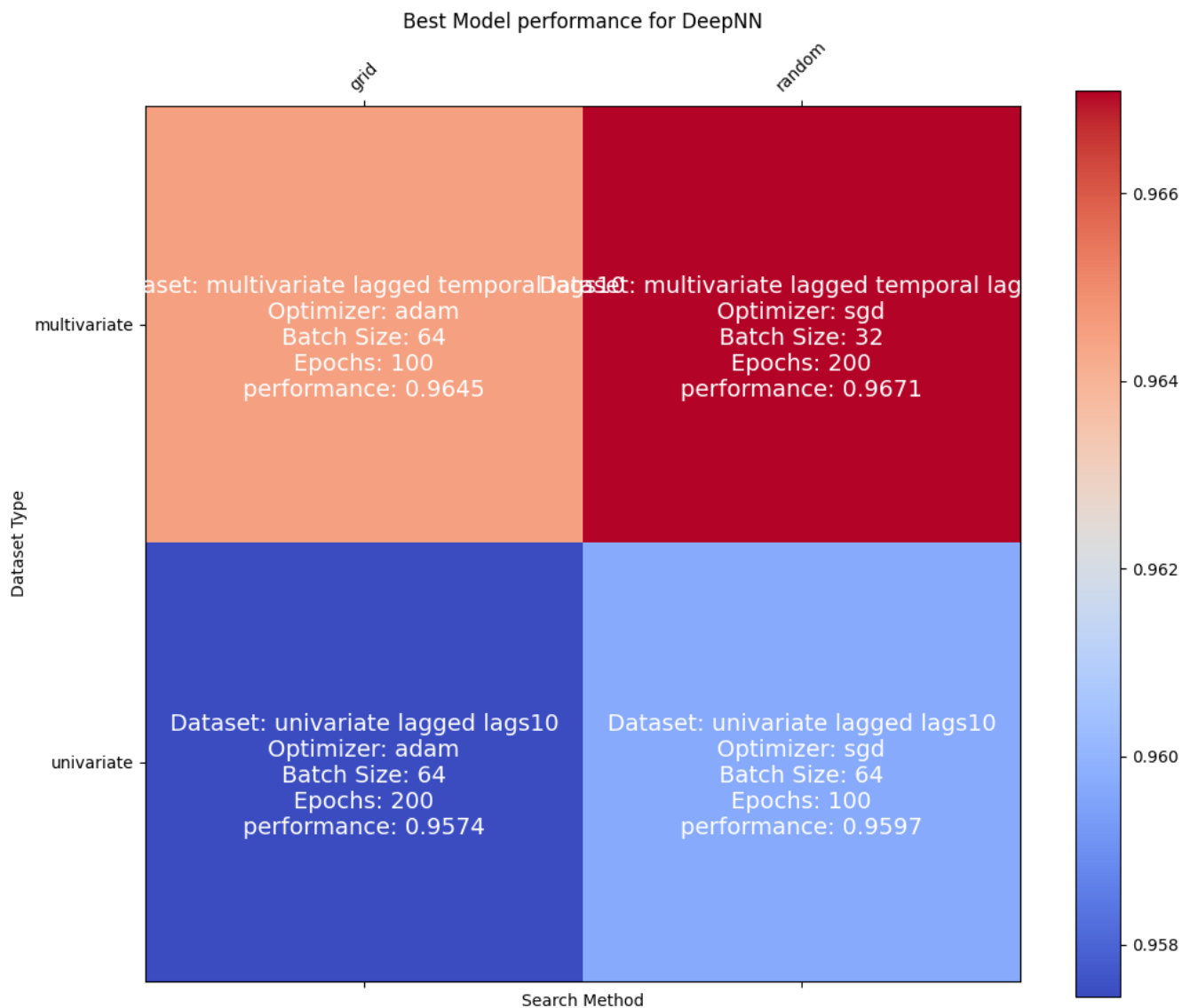
The worst results (one_step) for the different setup combinations are as follows:

Worst Model performance for DeepNN

Best one_step forecast over time

Actual vs Predicted Traffic Volume for DeepNN_multivariate_lagged_temporal_lags10, Train Score: 0.9611029624938965, Test Score: 0.9670901298522949

Actual vs Predicted Traffic Volume for DeepNN_multivariate_lagged_temporal_lags10, Train Score: 0.9611029624938965, Test Score: 0.9670901298522949

Results for the multistep forecast.

The best results (multistep) for the different setup combinations are as follows:

Best Model performance for DeepNN
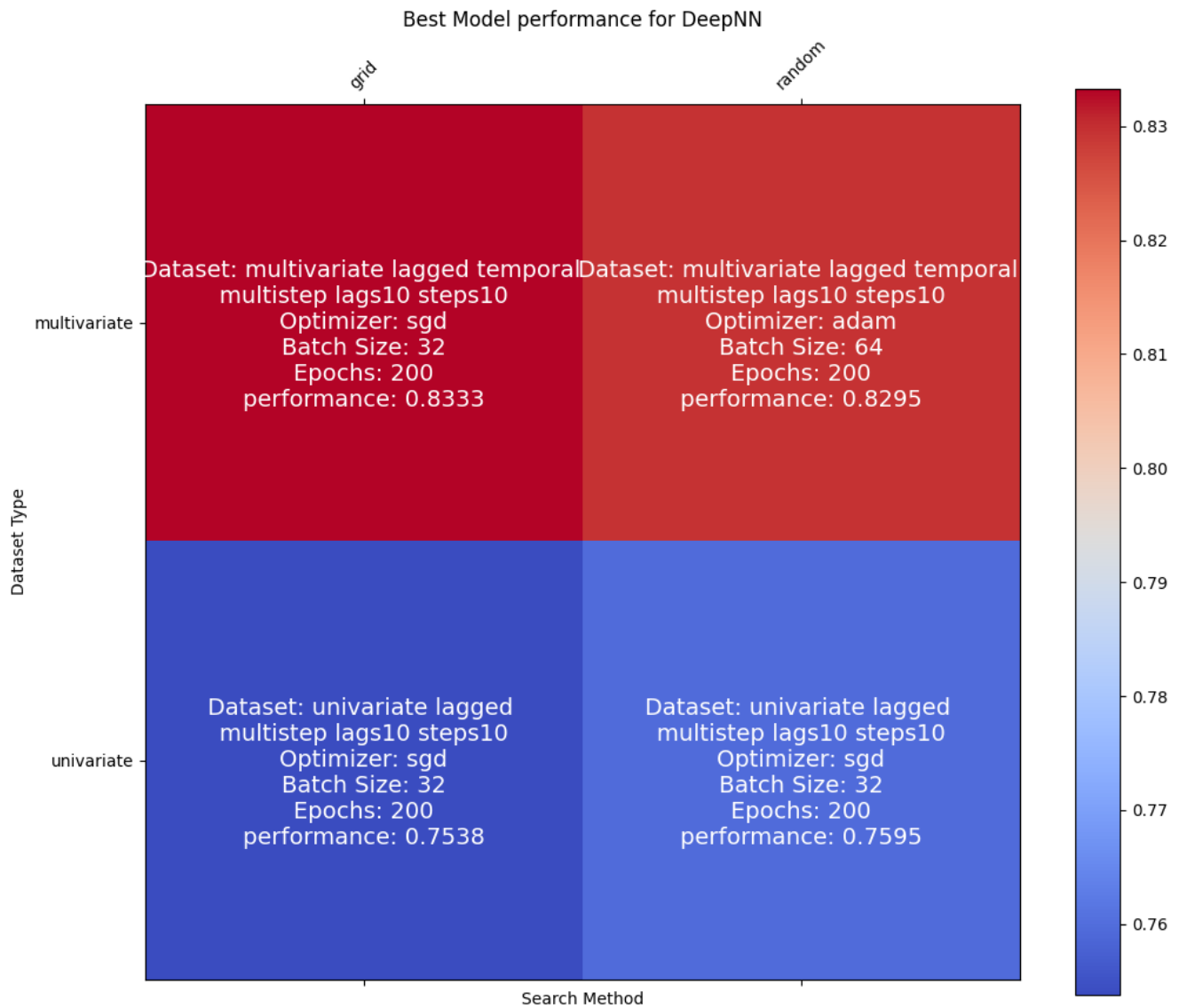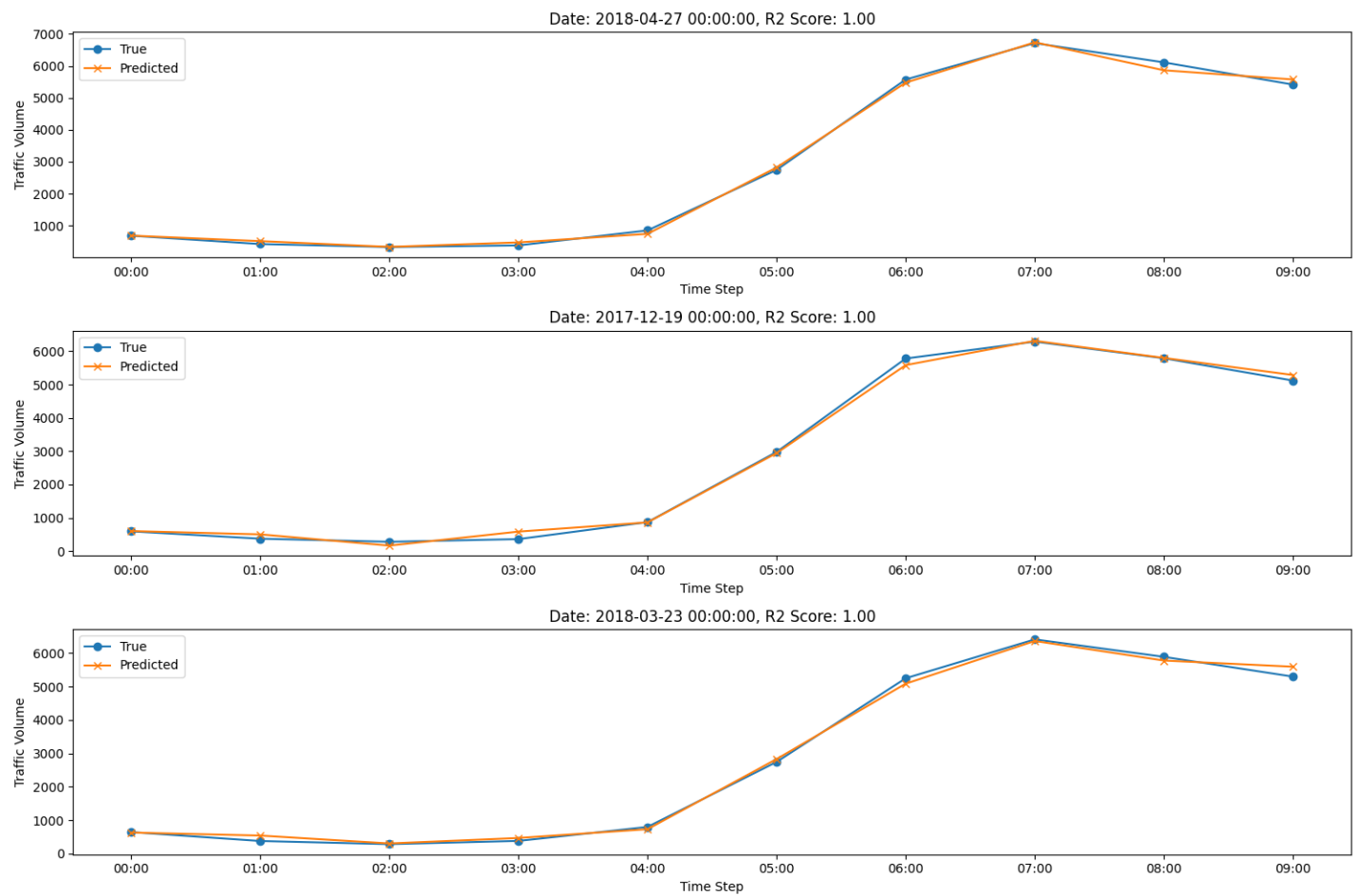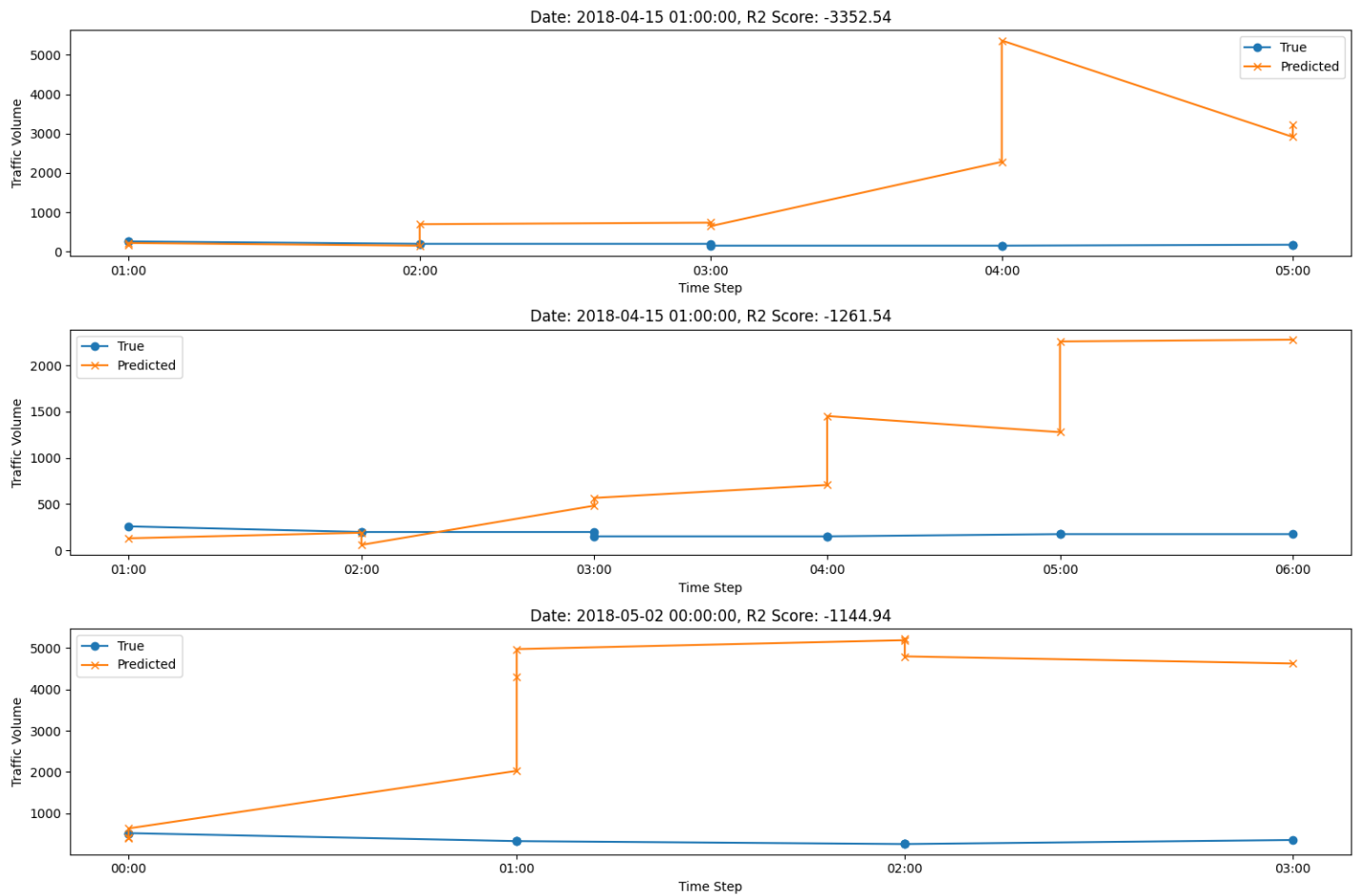
The worst results (multistep) for the different setup combinations are as follows:
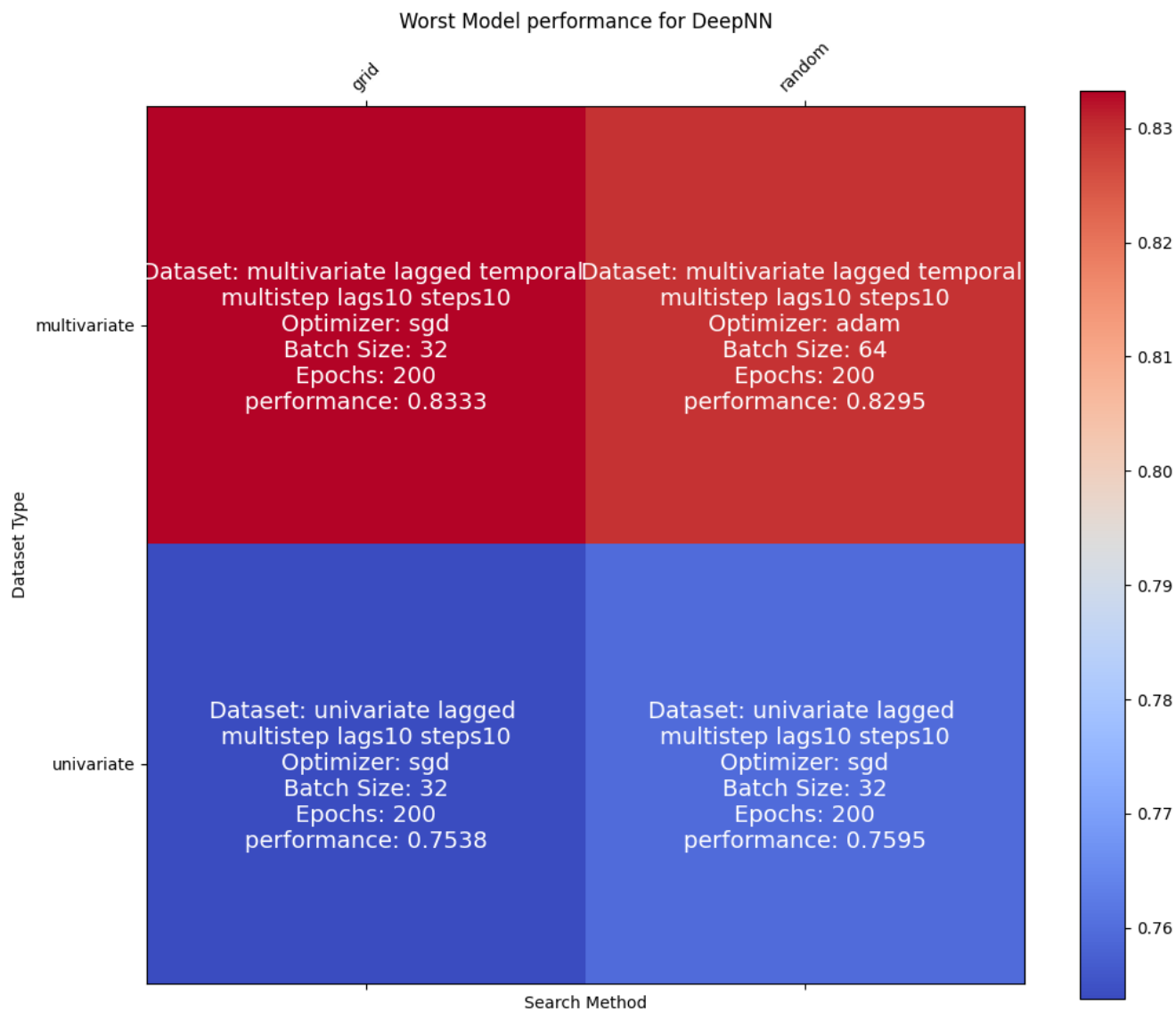
Worst Model performance for DeepNN

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Best predicted days for DeepNN.

Date: 2018-04-27 00:00:00, R2 Score: 1.00

Date: 2017-12-19 00:00:00, R2 Score: 1.00
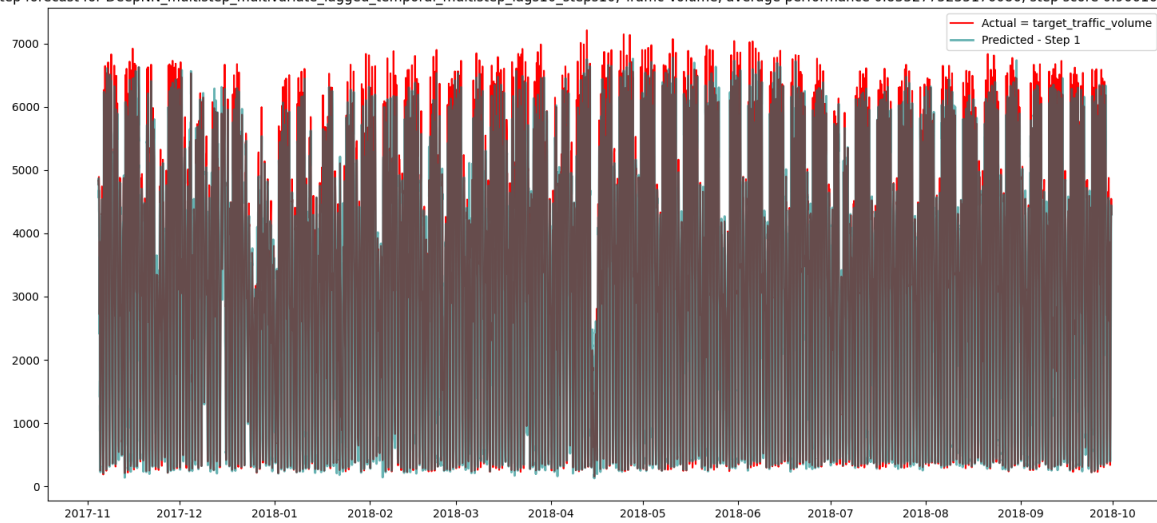

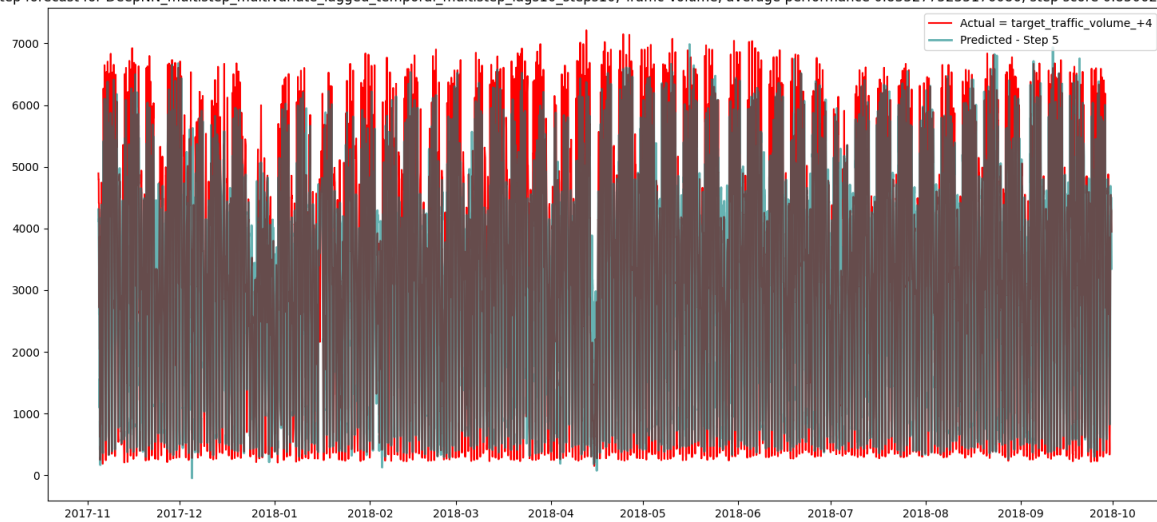Date: 2018-03-23 00:00:00, R2 Score: 1.00

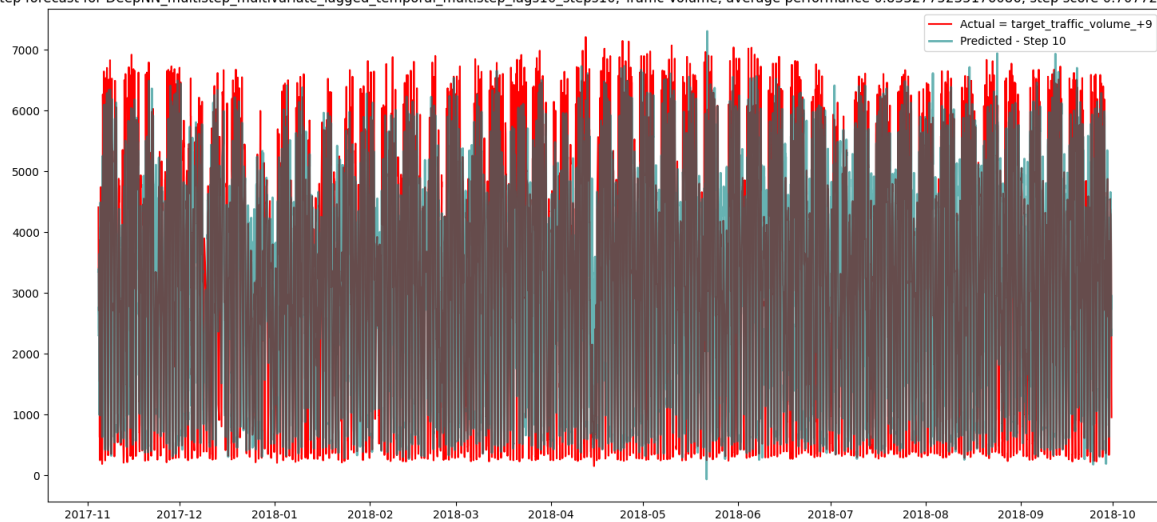*Worst predicted days for DeepNN.*

Steps plots for DeepNN forecasts over time

Multistep forecast for DeepNN_multistep_multivariate_lagged_temporal_multistep_lags10_steps10, Traffic Volume, average performance 0.8332775235176086, step score 0.9661677806747329

Multistep forecast for DeepNN_multistep_multivariate_lagged_temporal_multistep_lags10_steps10, Traffic Volume, average performance 0.8332775235176086, step score 0.8506241997479447
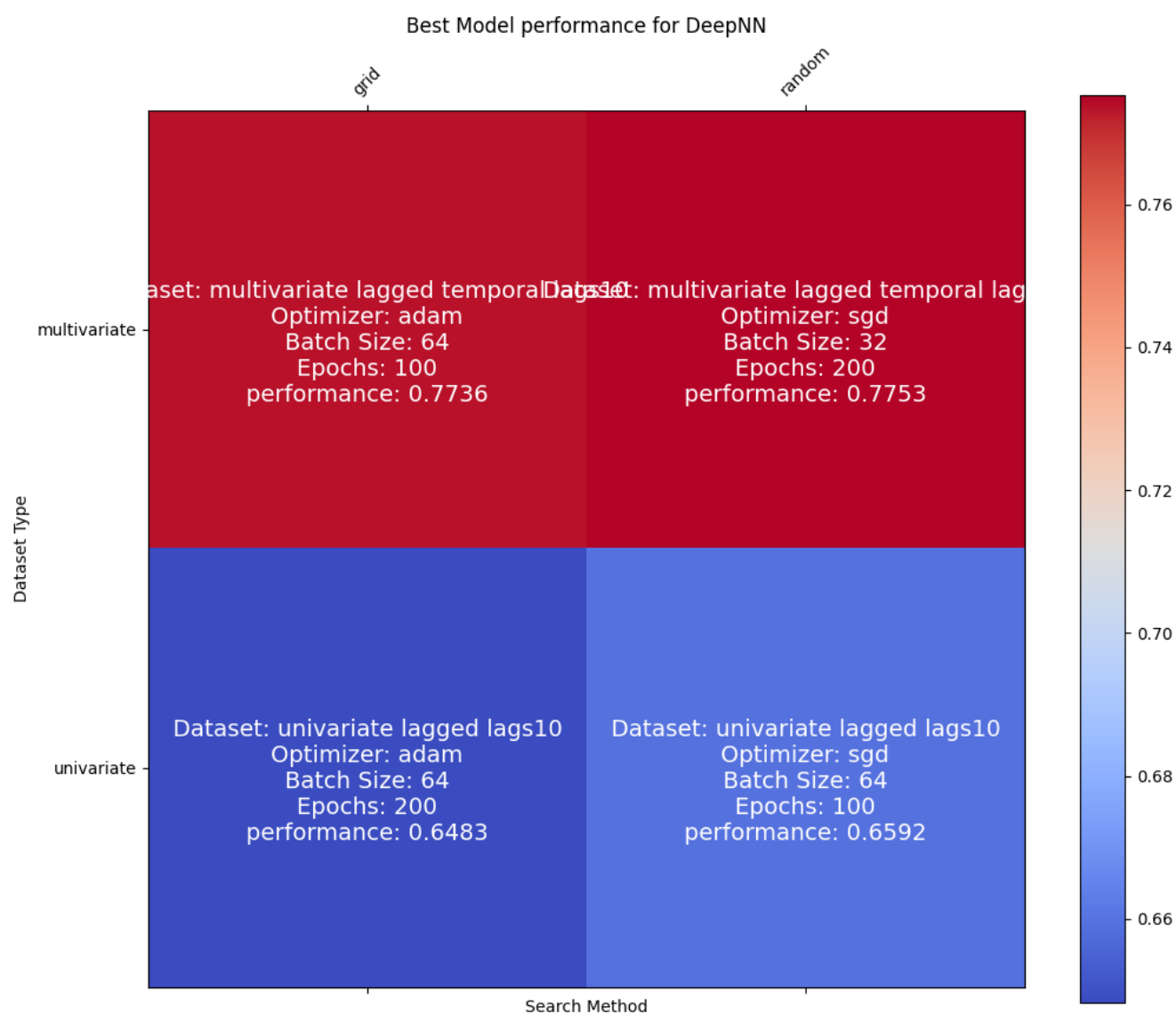

Multistep forecast for DeepNN_multistep_multivariate_lagged_temporal_multistep_lags10_steps10, Traffic Volume, average performance 0.8332775235176086, step score 0.7077272630710357
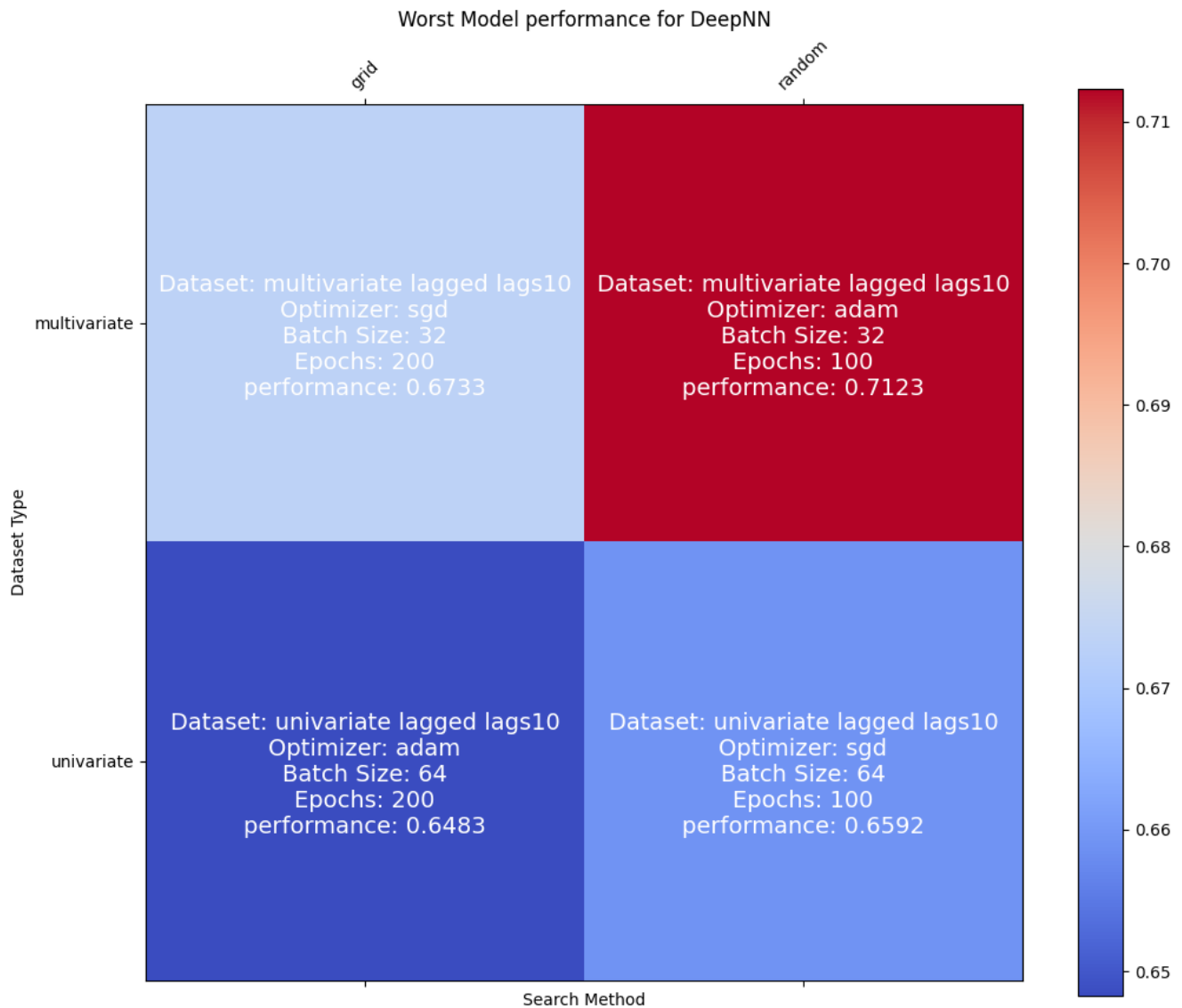
Results for the recursive forecast.

*The best results (recursive) for the different setup combinations are as follows:*

Best Model performance for DeepNN

	grid	random
multivariate	Dataset: multivariate lagged temporal lags10 Optimizer: adam Batch Size: 64 Epochs: 100 performance: 0.7736	Dataset: multivariate lagged temporal lags10 Optimizer: sgd Batch Size: 32 Epochs: 200 performance: 0.7753
univariate	Dataset: univariate lagged lags10 Optimizer: adam Batch Size: 64 Epochs: 200 performance: 0.6483	Dataset: univariate lagged lags10 Optimizer: sgd Batch Size: 64 Epochs: 100 performance: 0.6592

The worst results (recursive) for the different setup combinations are as follows:
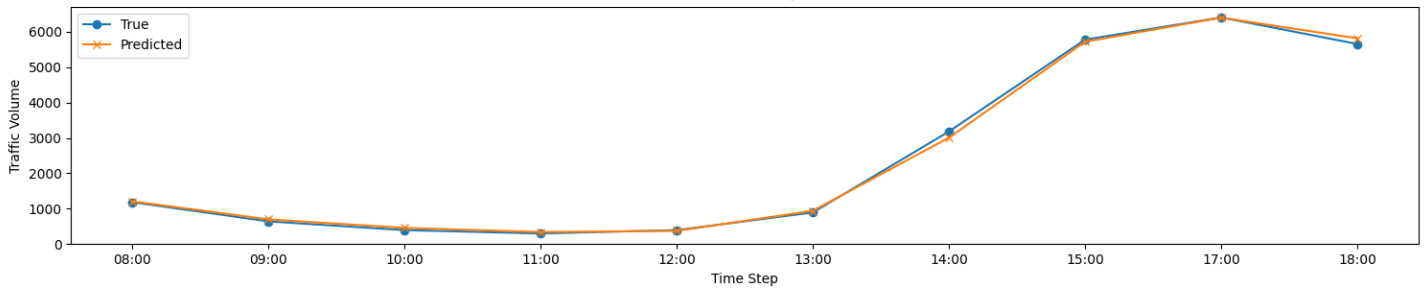

Worst Model performance for DeepNN

Best predicted days for DeepNN.

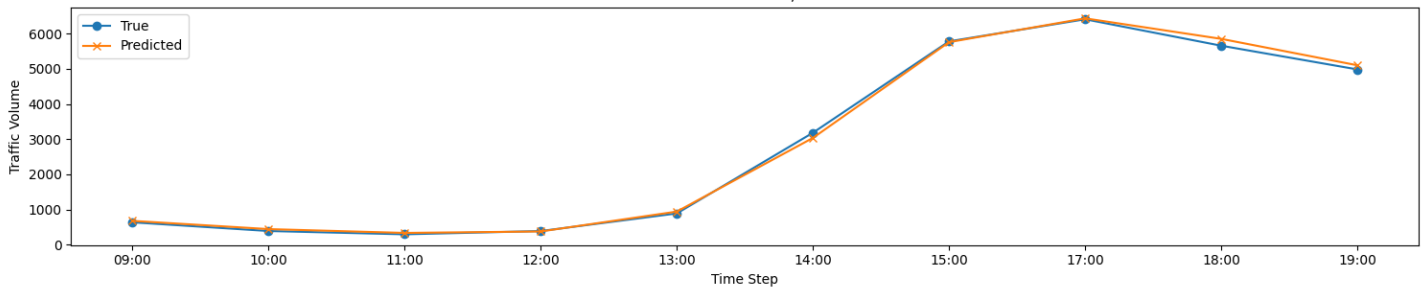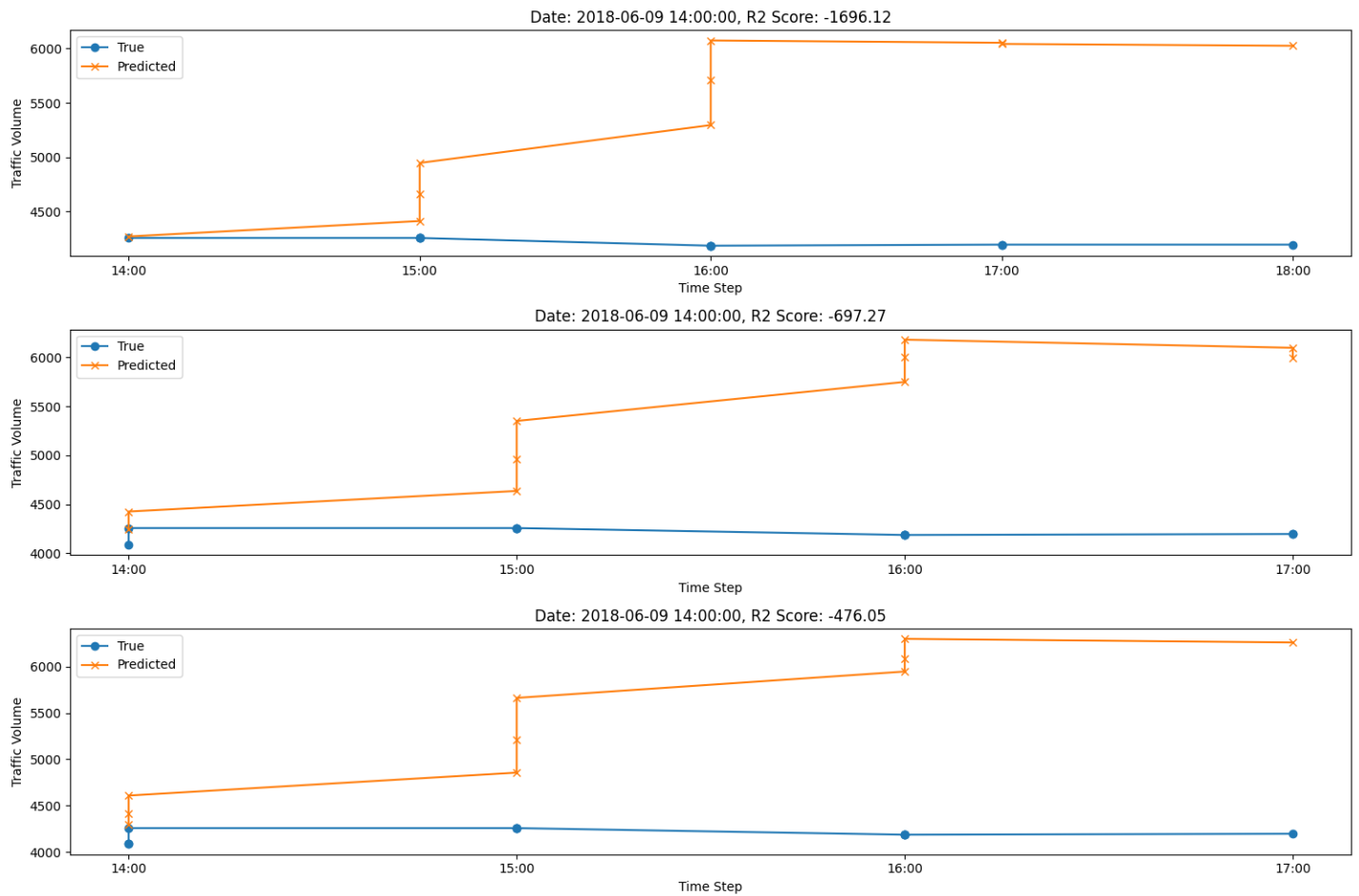
Date: 2017-11-22 08:00:00, R2 Score: 1.00
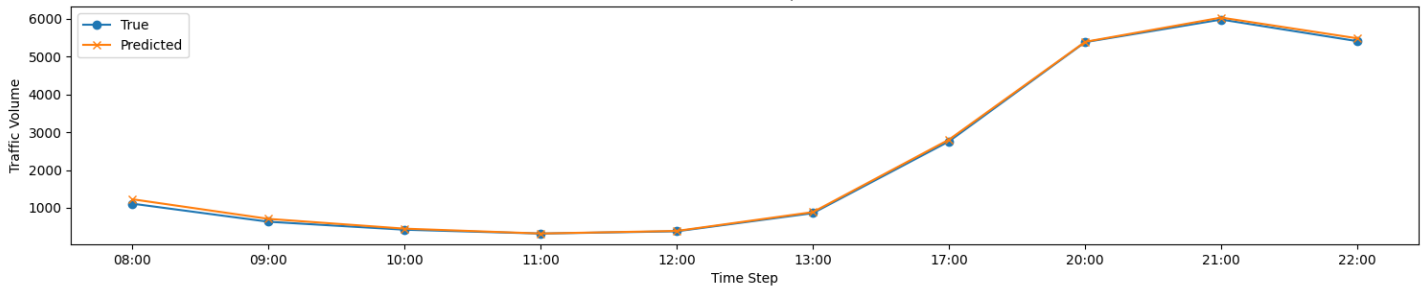
Date: 2018-07-24 08:00:00, R2 Score: 1.00
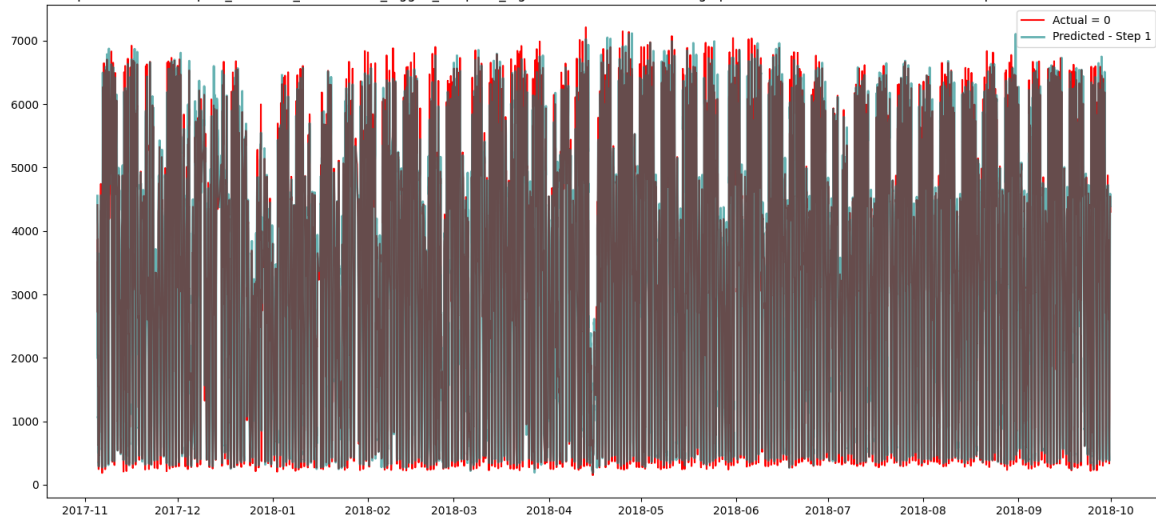
Date: 2018-07-24 09:00:00, R2 Score: 1.00

Worst predicted days for DeepNN.

Steps plots for DeepNN forecasts over time

Multistep forecast for DeepNN_recursive_multivariate_lagged_temporal_lags10, Traffic Volume, average performance 0.7752858400344849, step score 0.9670987868281261

Multistep forecast for DeepNN_recursive_multivariate_lagged_temporal_lags10, Traffic Volume, average performance 0.7752858400344849, step score 0.790562805302786
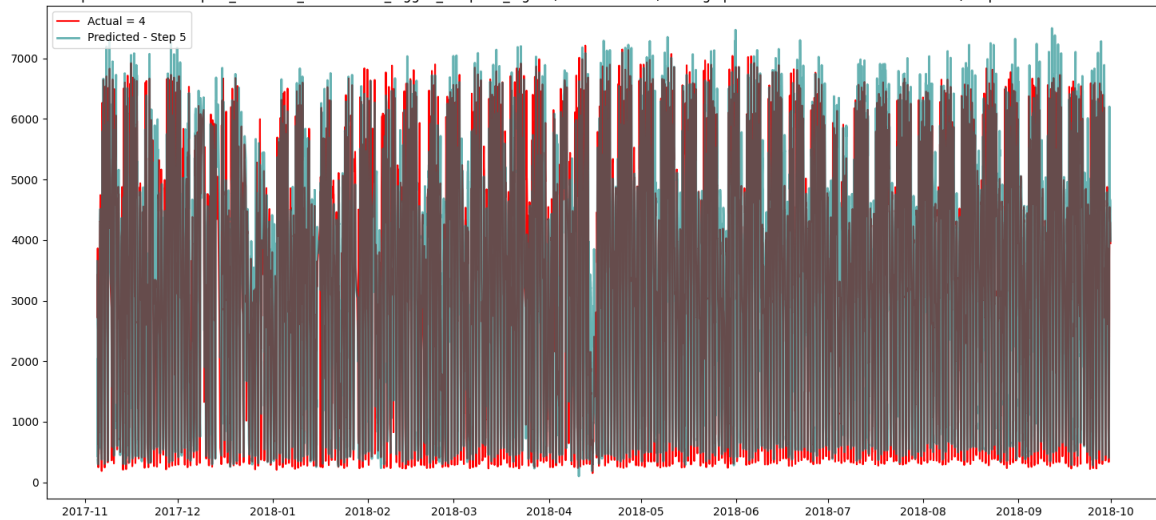
Multistep forecast for DeepNN_recursive_multivariate_lagged_temporal_lags10, Traffic Volume, average performance 0.7752858400344849, step score 0.6094360150231027