

# Model Report: GradientBoosting

15/02/2025

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## Introduction

*This is an automated report for the Experiment with tree models on traffic volume dataset; the GradientBoosting 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 tree models on traffic volume dataset

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## 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:

- max\_depth: [2, 4, 6, 8, 10, 15, 20]
- criterion: ['squared\_error']
- random\_state: [42]
- min\_samples\_split: [5, 10, 50, 150, 200, 250]
- min\_samples\_leaf: [5, 10, 25, 50, 100]
- scaler: [None, StandardScaler(), MinMaxScaler(), RobustScaler(), PowerTransformer()]

And with the following search algorithms:

- ☐ grid
- ☐ random

The used performance measure is the  $r^2$  measure.

## 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']

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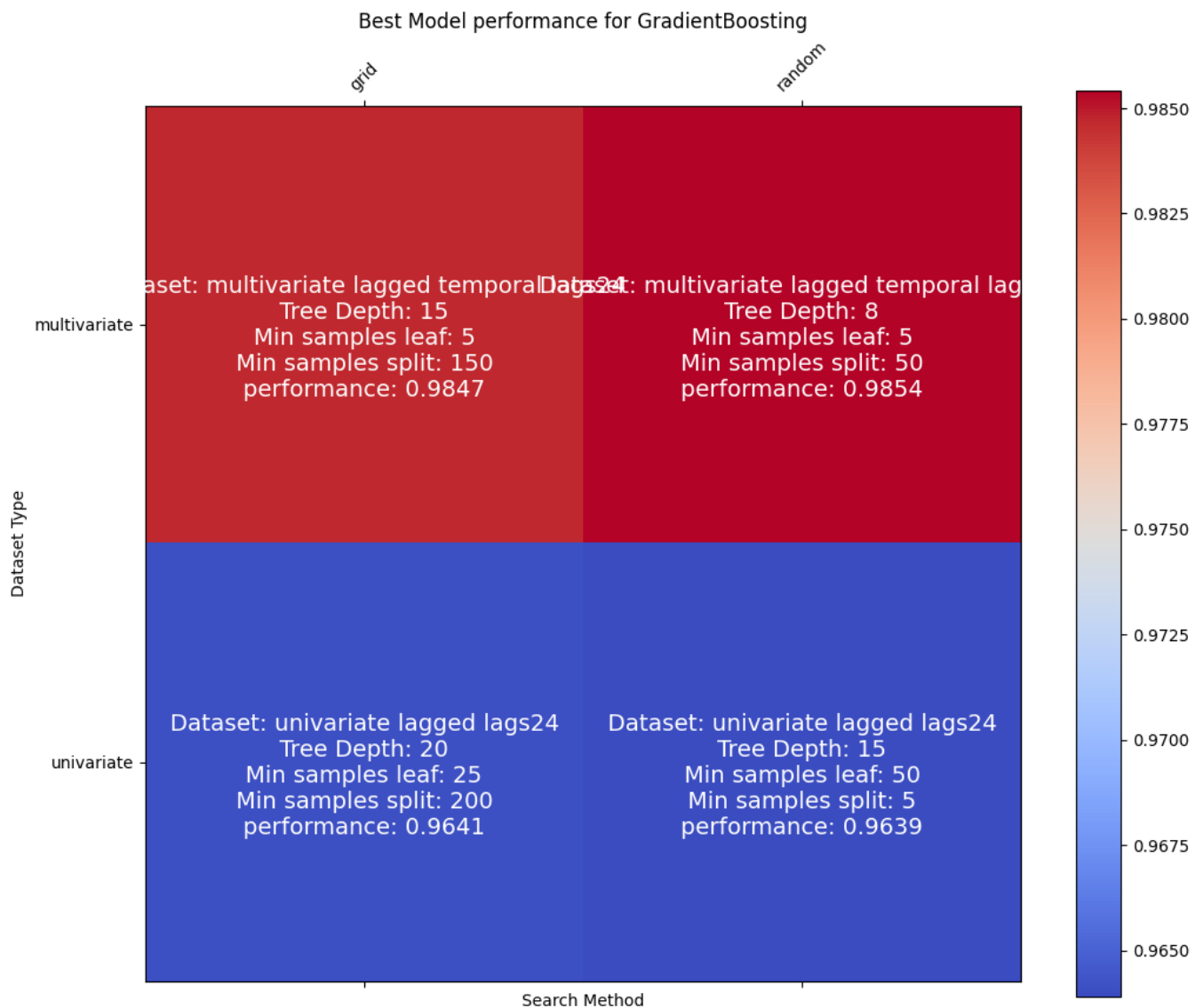
## Results: GradientBoosting

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.

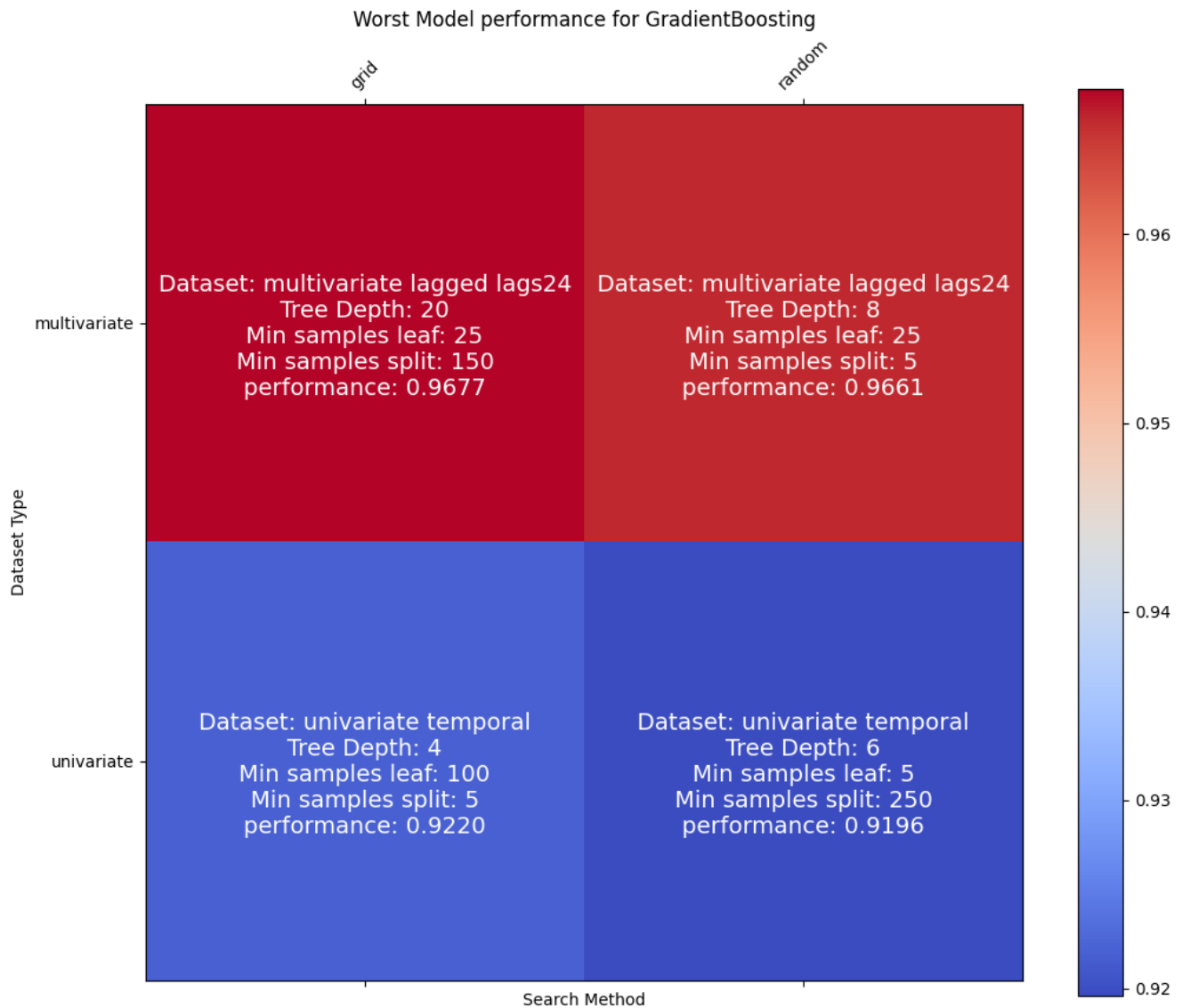
- Then, if the prediction type is one-step forecasts, the best prediction over time is visualized in a line plot.
- If the prediction type is a multi-step forecast, either direct or recursive, the model with the average best  $r^2$  score is chosen, and the three best and worst predictions are visualized 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:

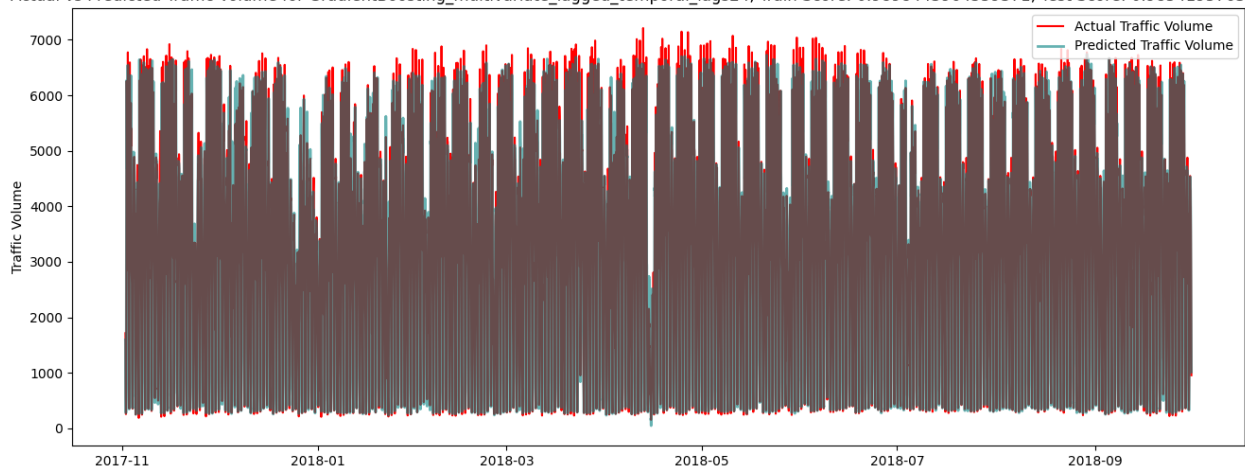


The worst results (one\_step) for the different setup combinations are as follows:



### Best one\_step forecast over time

Actual vs Predicted Traffic Volume for GradientBoosting\_multivariate\_lagged\_temporal\_lags24, Train Score: 0.9898443964559371, Test Score: 0.9854195763139223

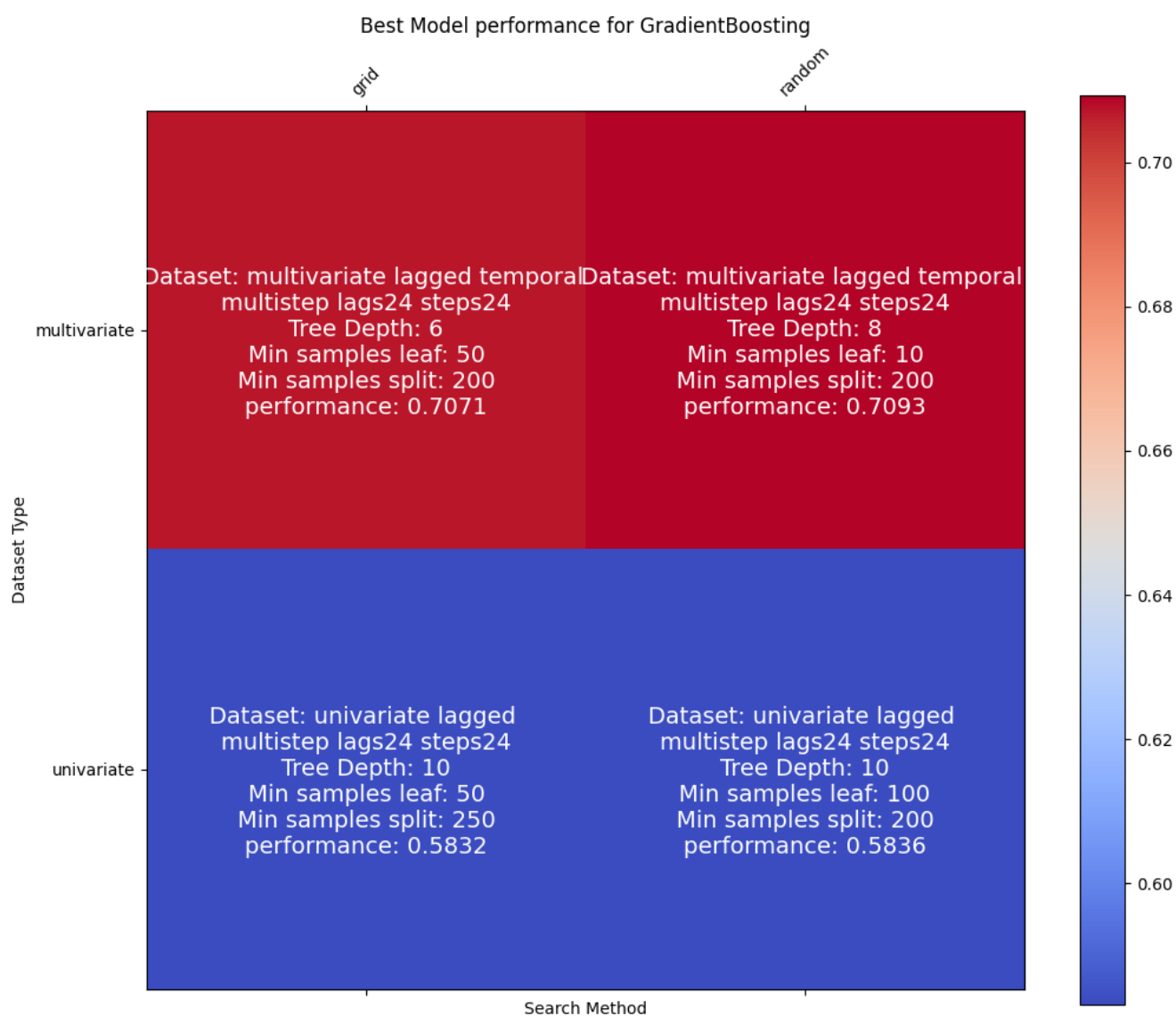


Actual vs Predicted Traffic Volume for GradientBoosting\_multivariate\_lagged\_temporal\_lags24, Train Score: 0.9898443964559371, Test Score: 0.9854195763139223



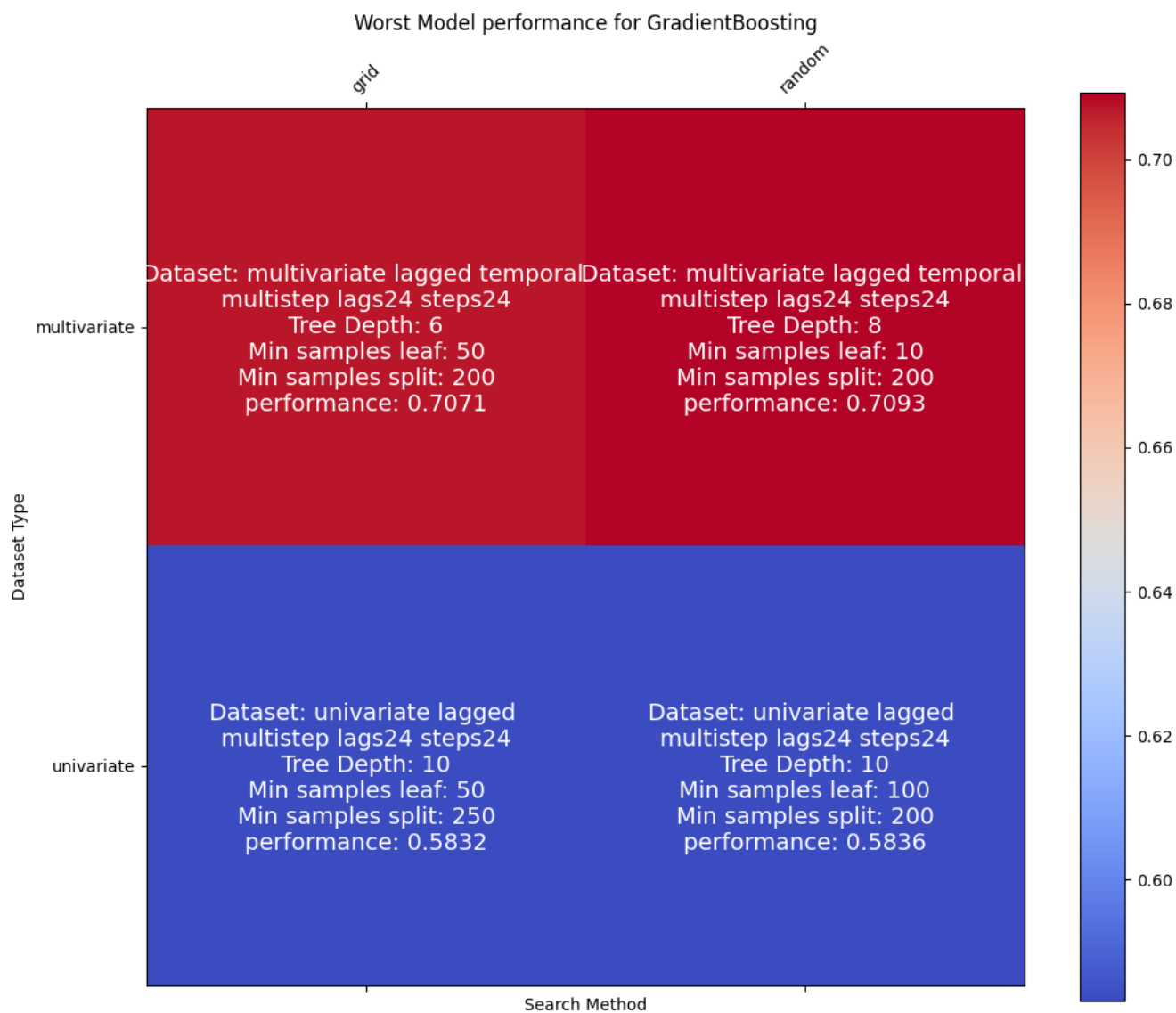
## Results for the multistep forecast.

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



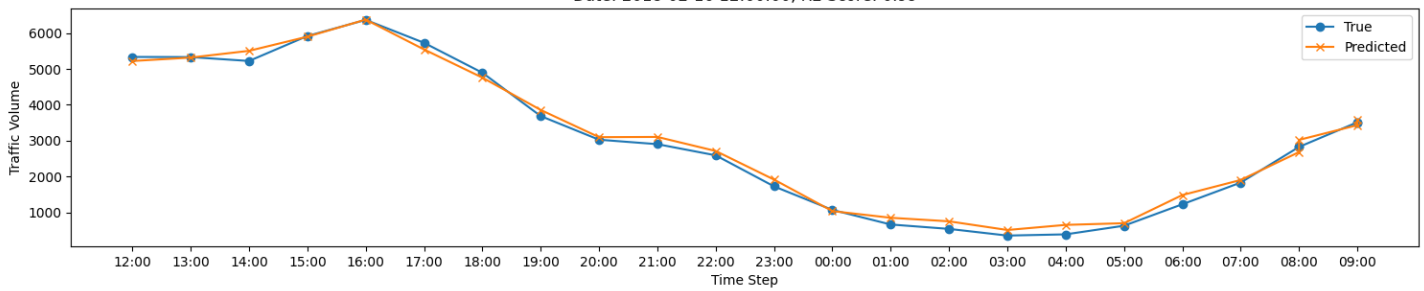


The worst results (multistep) for the different setup combinations are as follows:

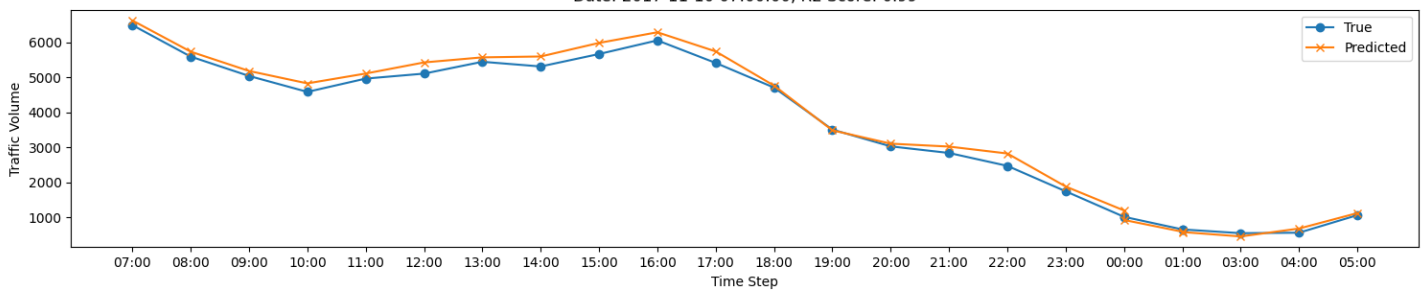


*Best predicted days for GradientBoosting.*

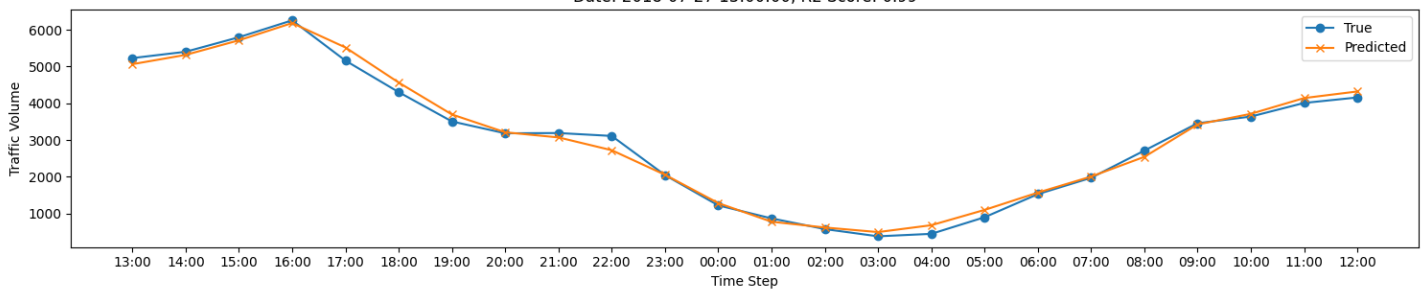
Date: 2018-02-16 12:00:00, R2 Score: 0.99



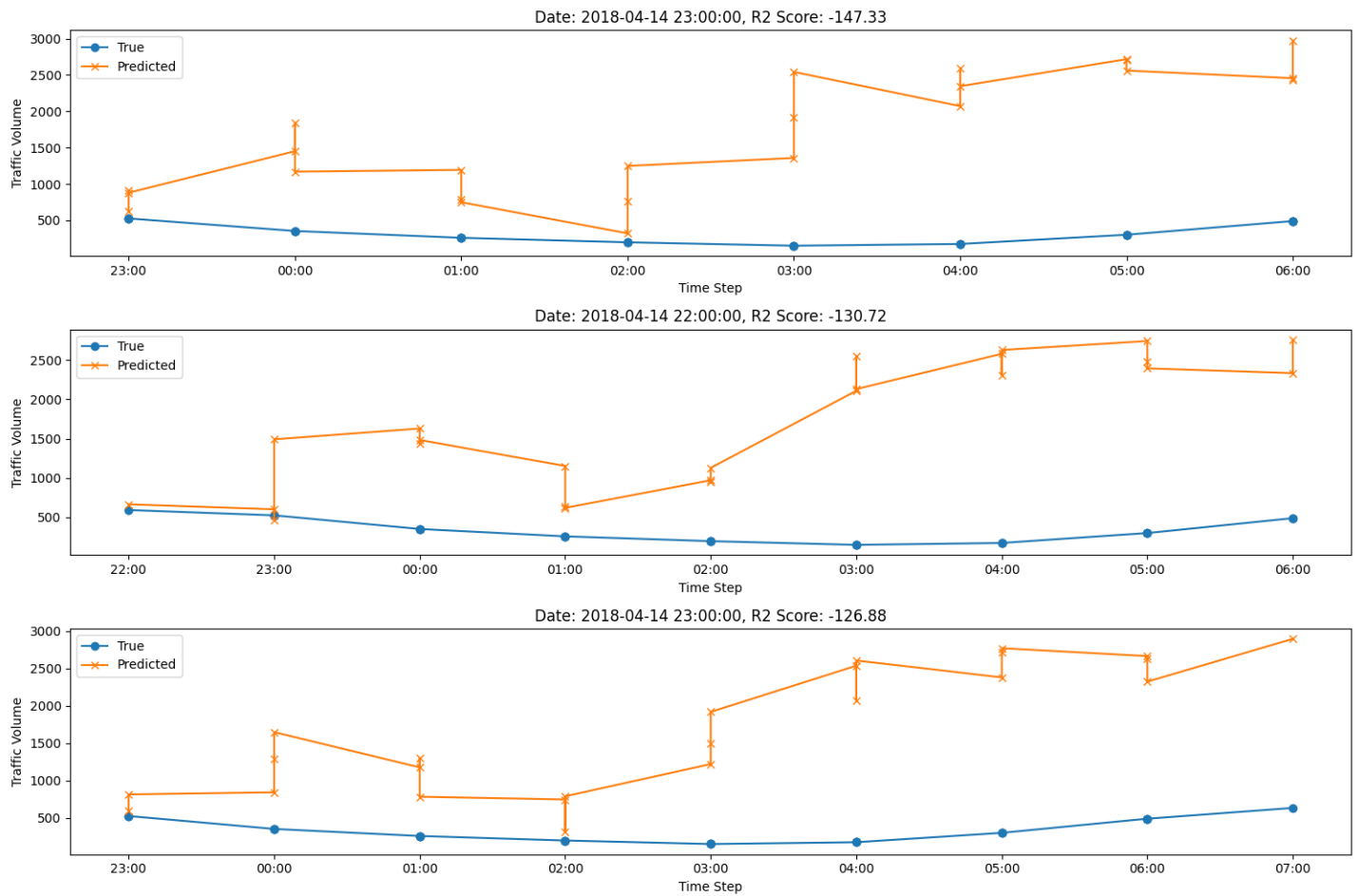
Date: 2017-11-10 07:00:00, R2 Score: 0.99



Date: 2018-07-27 13:00:00, R2 Score: 0.99

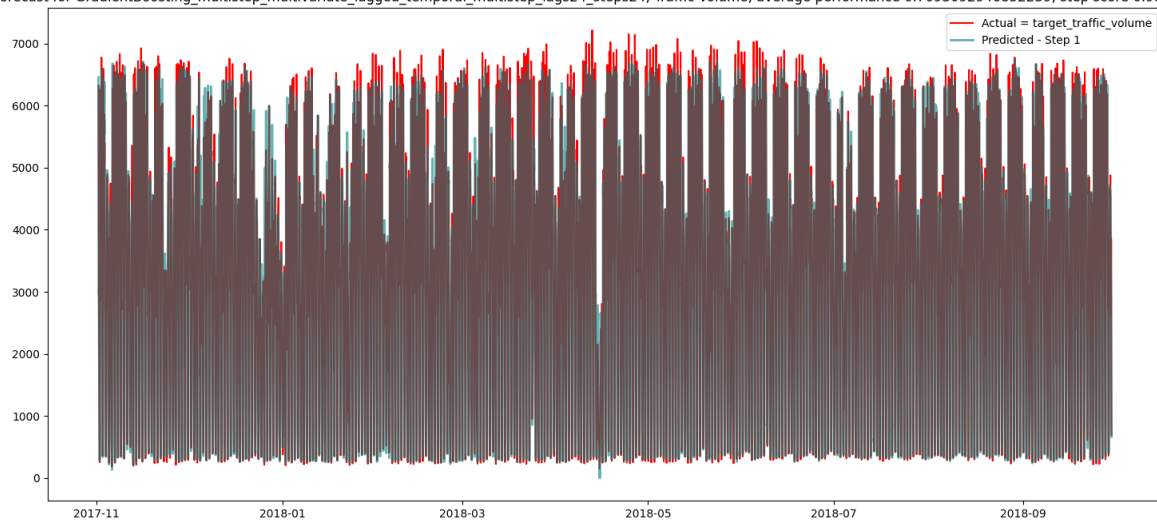


*Worst predicted days for GradientBoosting.*

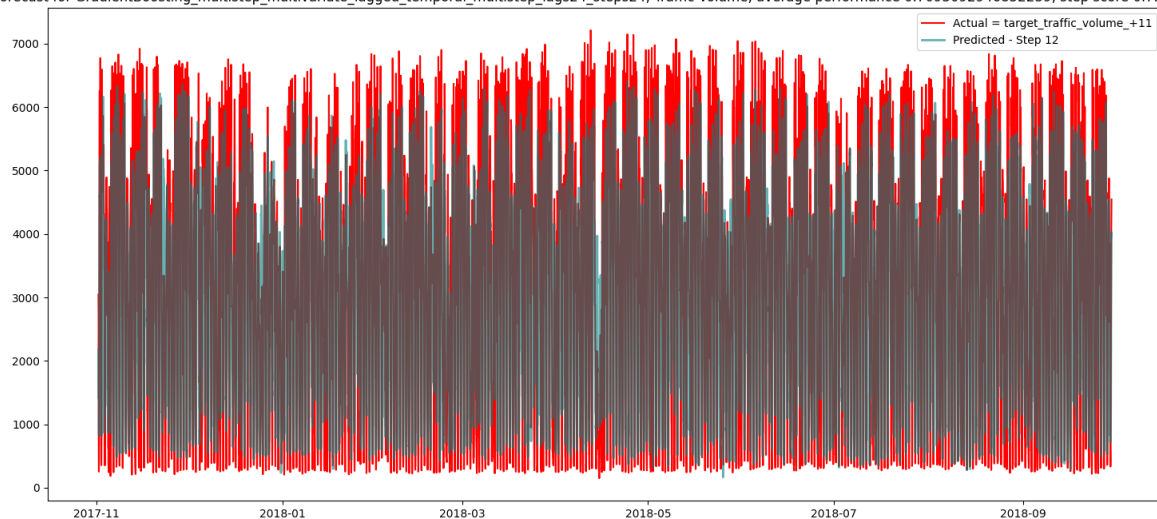


## Steps plots for GradientBoosting forecasts over time

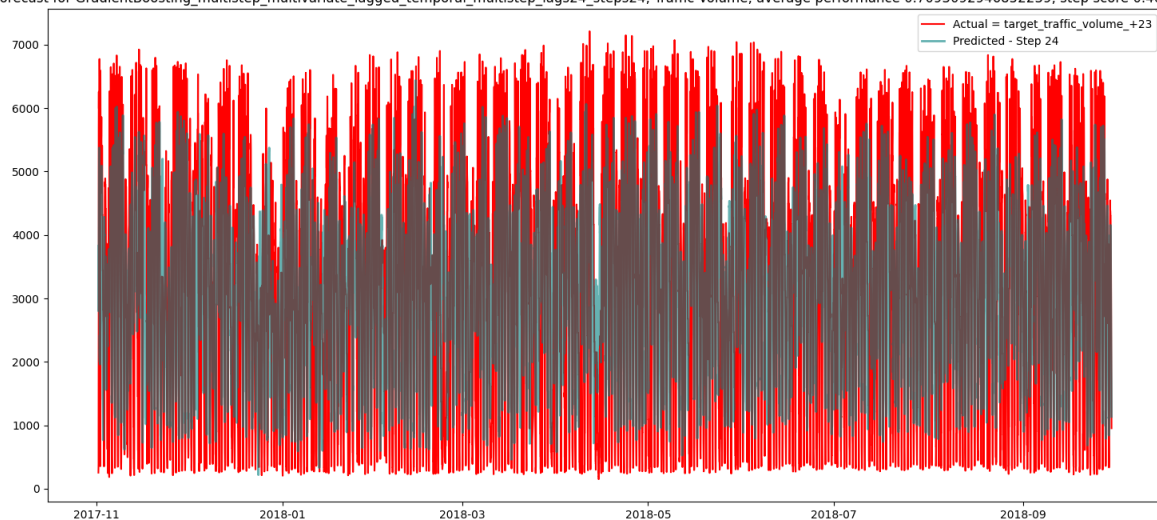
Multistep forecast for GradientBoosting\_multistep\_multivariate\_lagged\_temporal\_multistep\_lags24\_steps24, Traffic Volume, average performance 0.7093092946852239, step score 0.9847141856002299



Multistep forecast for GradientBoosting\_multistep\_multivariate\_lagged\_temporal\_multistep\_lags24\_steps24, Traffic Volume, average performance 0.7093092946852239, step score 0.7327763363378932

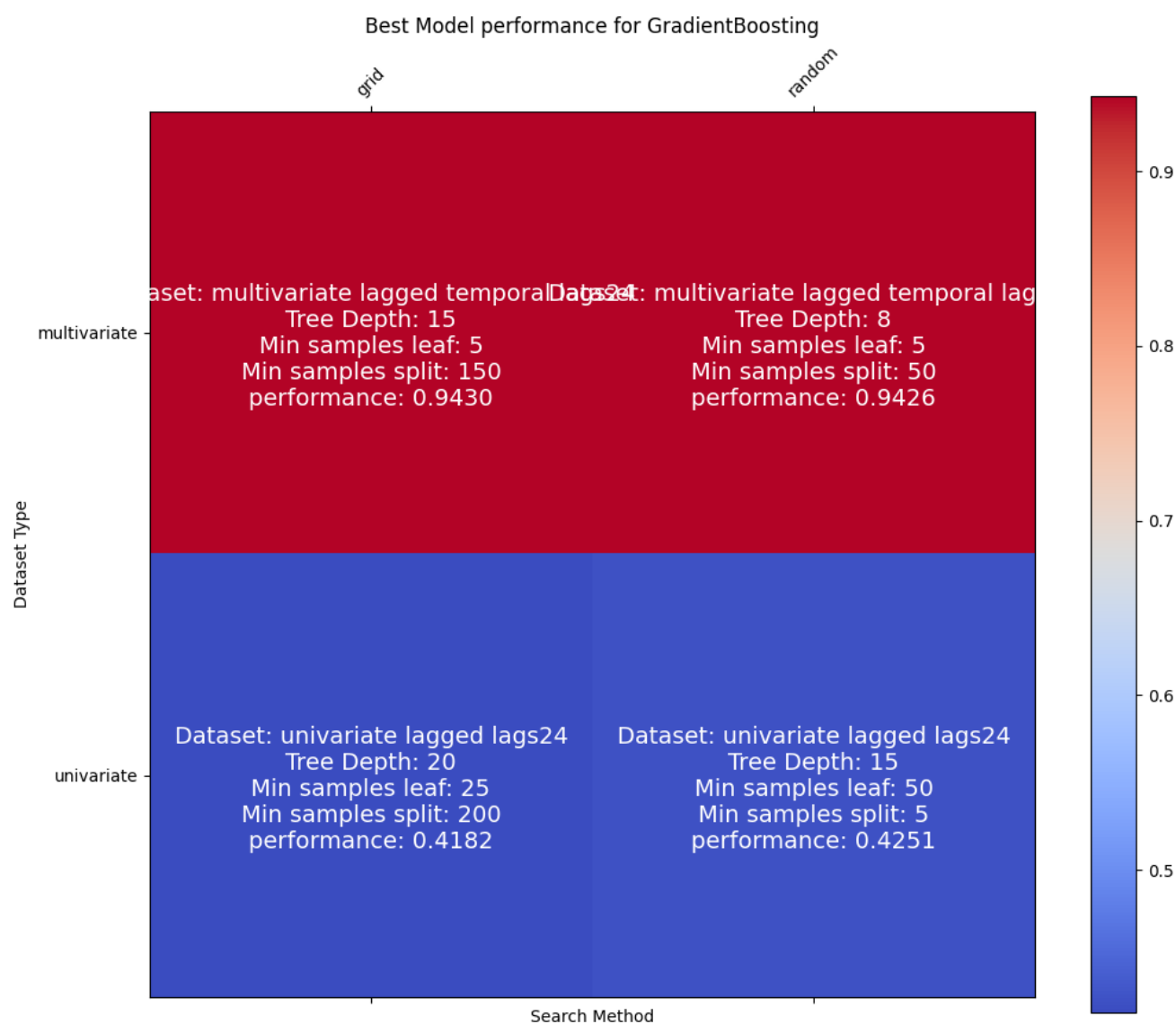


Multistep forecast for GradientBoosting\_multistep\_multivariate\_lagged\_temporal\_multistep\_lags24\_steps24, Traffic Volume, average performance 0.7093092946852239, step score 0.4099227007759745

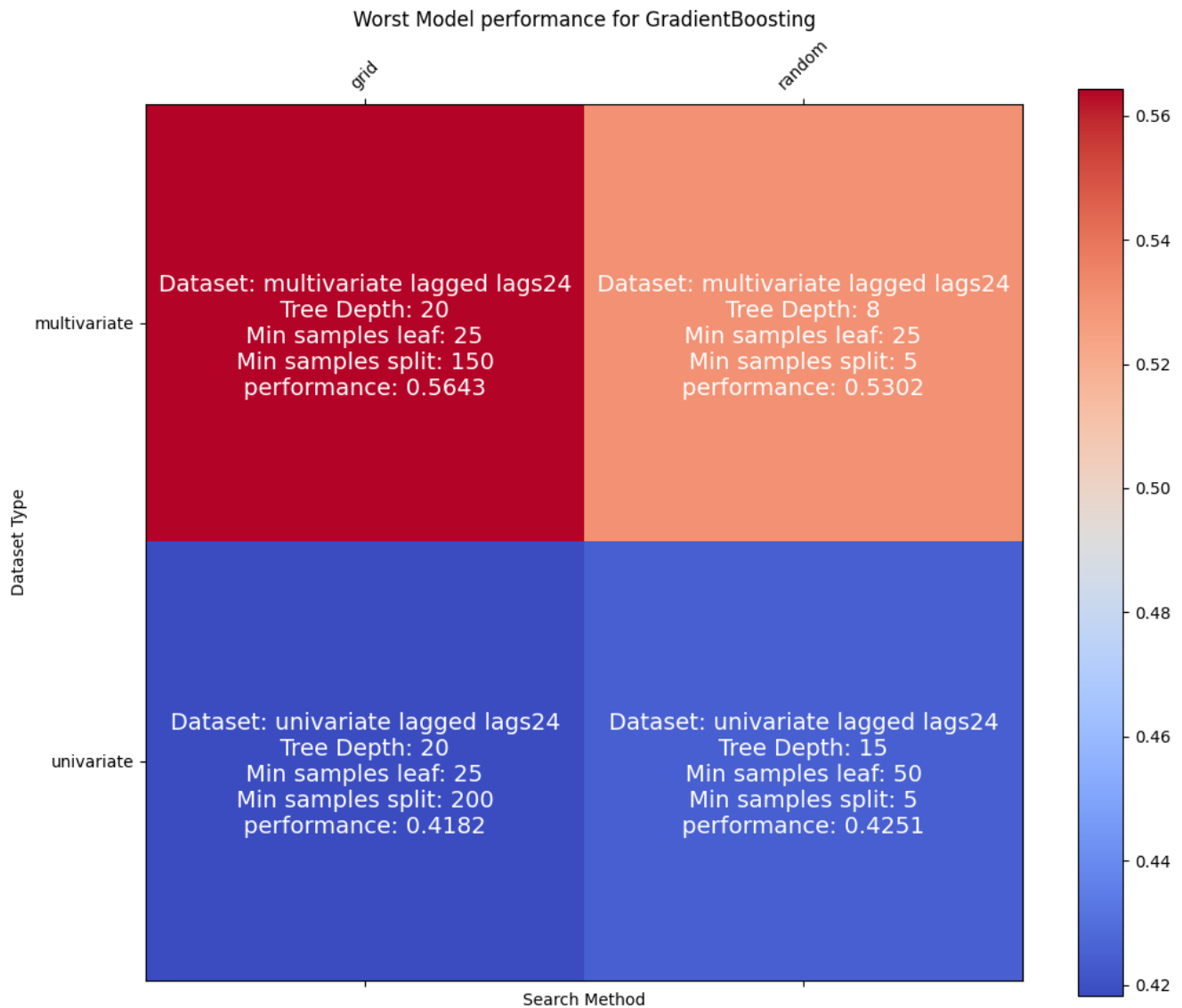


## Results for the recursive forecast.

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

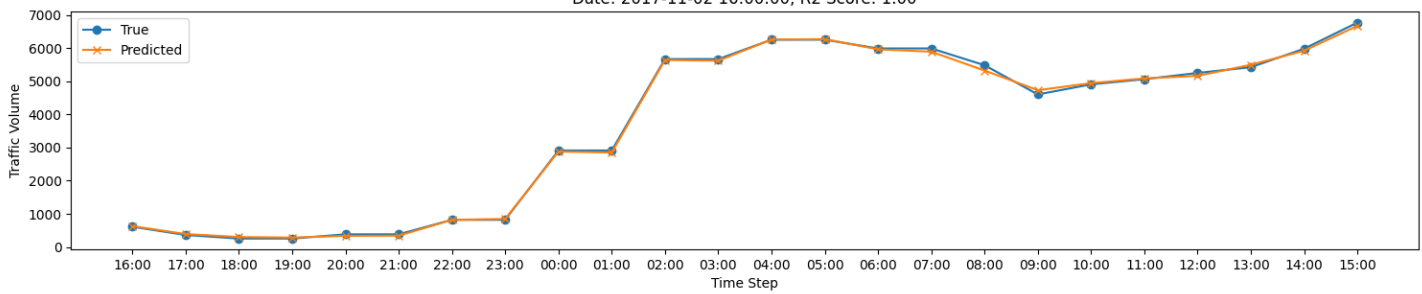


The worst results (recursive) for the different setup combinations are as follows:

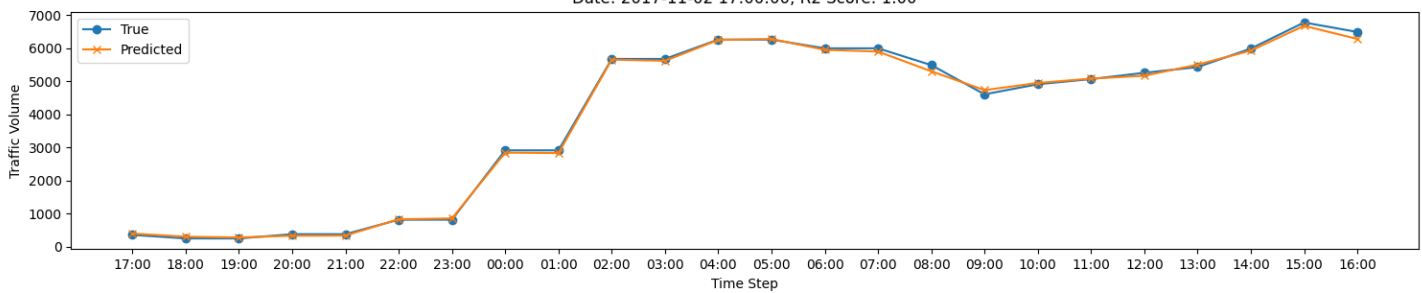


*Best predicted days for GradientBoosting.*

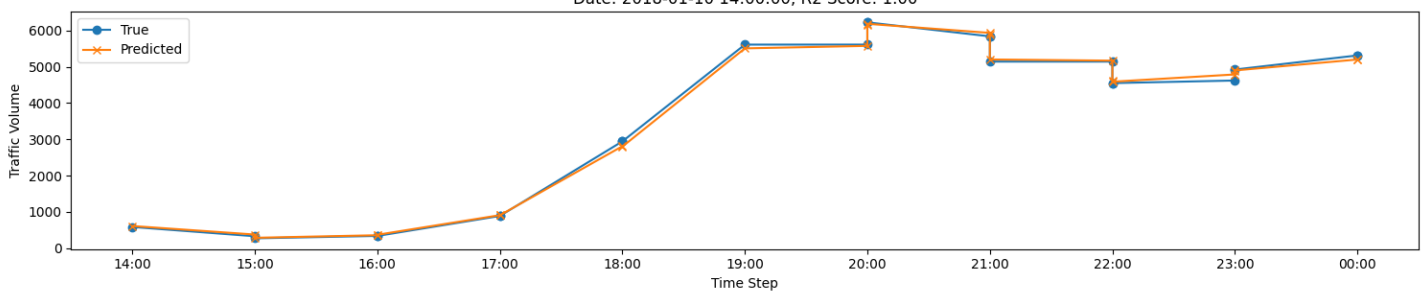
Date: 2017-11-02 16:00:00, R2 Score: 1.00



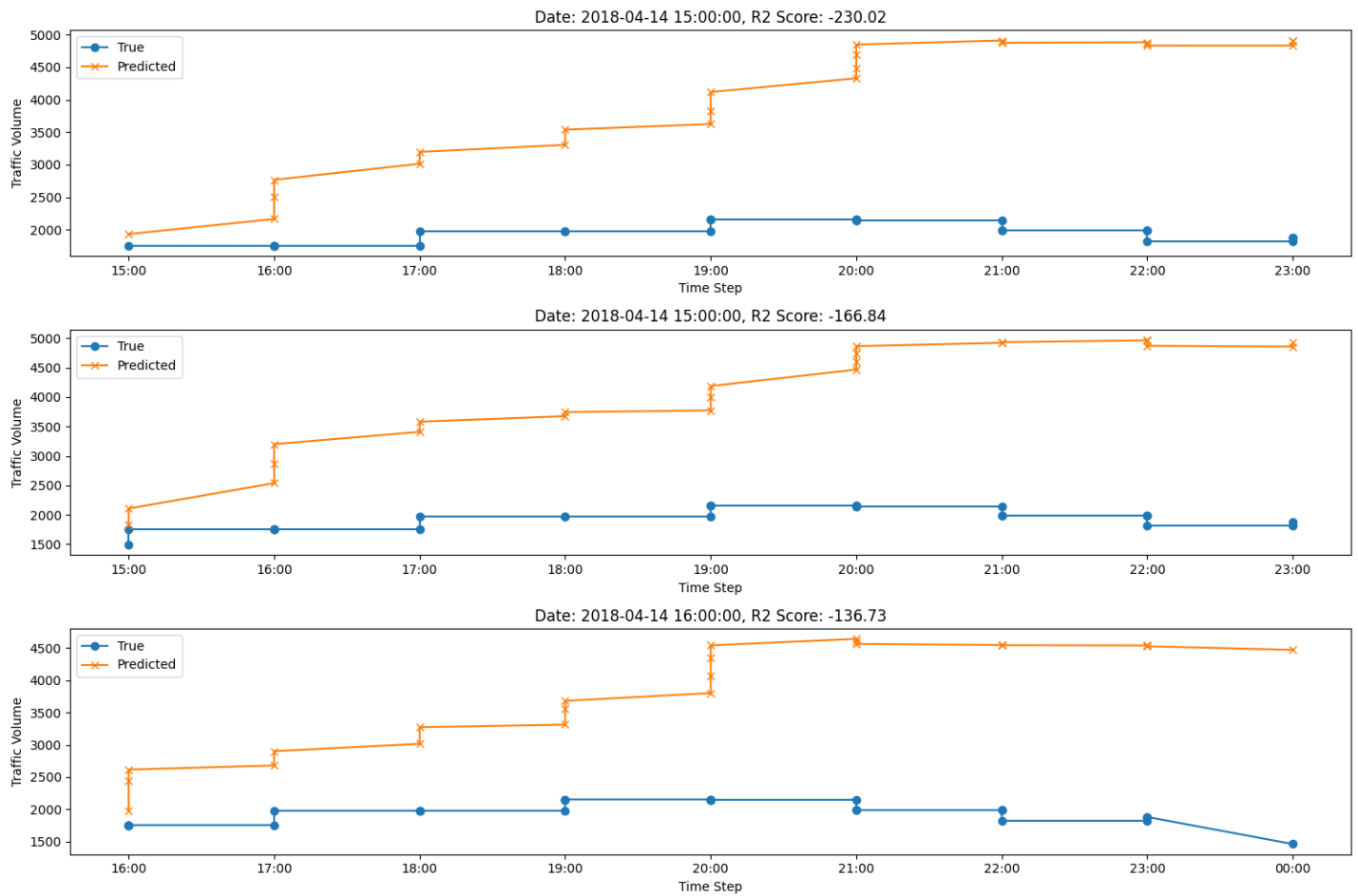
Date: 2017-11-02 17:00:00, R2 Score: 1.00



Date: 2018-01-10 14:00:00, R2 Score: 1.00



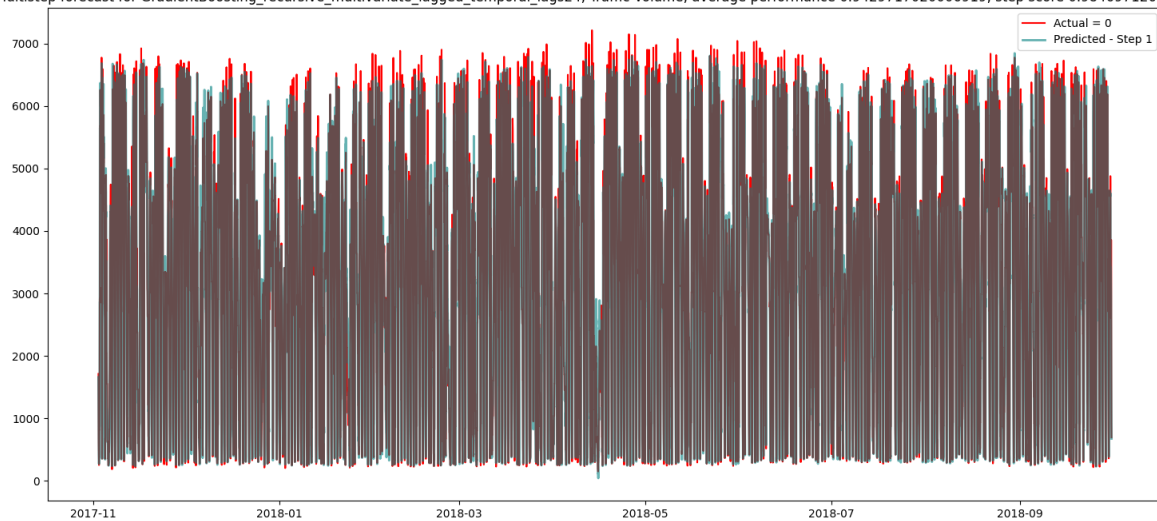
### Worst predicted days for GradientBoosting.



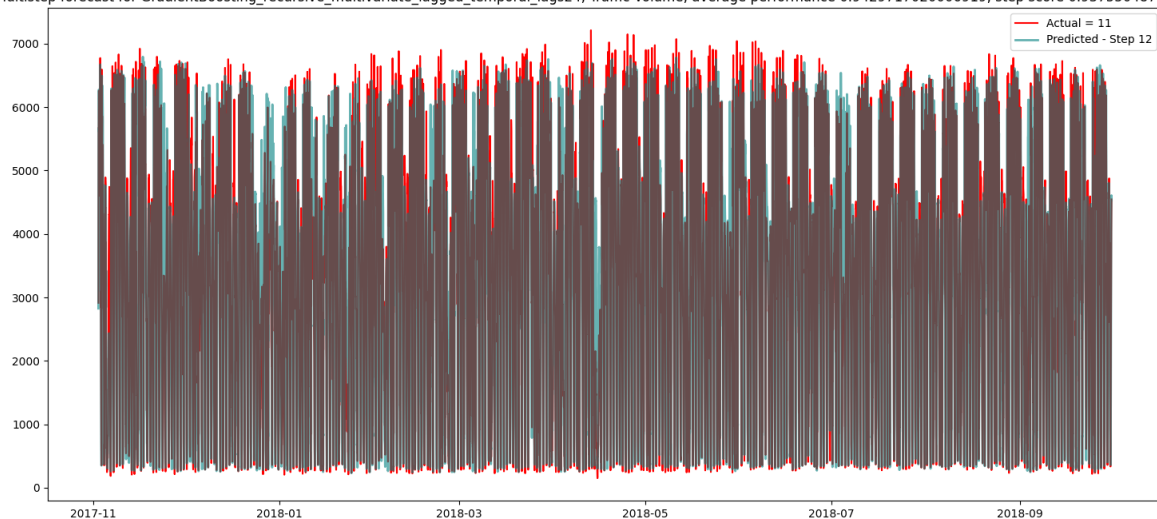


## Steps plots for GradientBoosting forecasts over time

Multistep forecast for GradientBoosting\_recursive\_multivariate\_lagged\_temporal\_lags24, Traffic Volume, average performance 0.9429717020006919, step score 0.9846971260982644



Multistep forecast for GradientBoosting\_recursive\_multivariate\_lagged\_temporal\_lags24, Traffic Volume, average performance 0.9429717020006919, step score 0.9375504871867928



Multistep forecast for GradientBoosting\_recursive\_multivariate\_lagged\_temporal\_lags24, Traffic Volume, average performance 0.9429717020006919, step score 0.9277567356785273

