FORECASTING WITH LSTM

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Introduction

In this document, I will present my findings on the implementation of LSTM on 1 year, 3 months, 1 month and 2 weeks of data. The data presents the hourly household consumption in Germany. In each training, 80% of the data is used for the training, 10% is used for the validation and the remaining 10% is used for the test. 50 Epochs are used for the training. The model is trained to predict the next 12 datapoints (hours) by referring to the last 36 datapoints except for 2 weeks of data (window size of 48 was used). The overall prediction graph and sample predictions will be displayed along with the error values.

The same LSTM architecture is used for all the variations. The LSTM architecture is shown below:

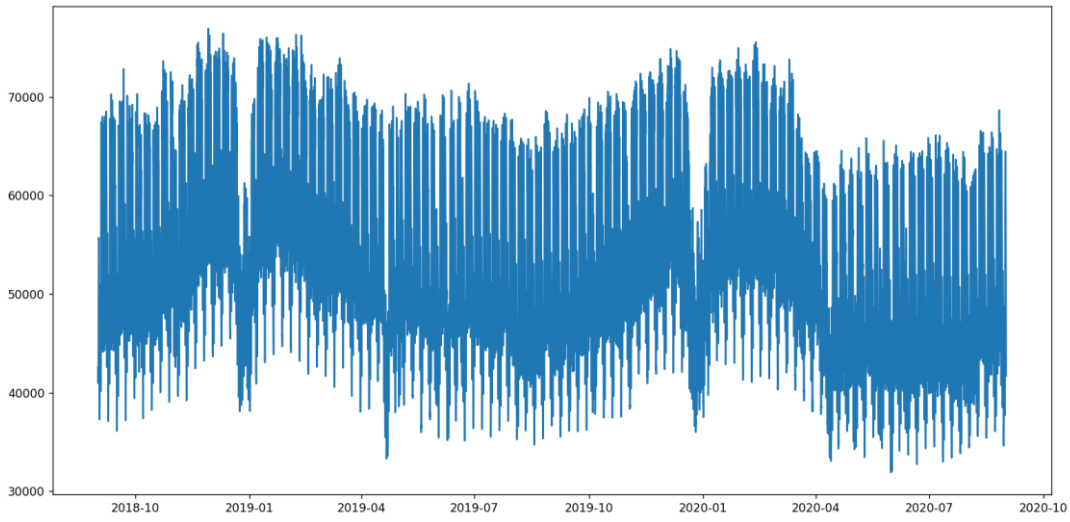
Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 64)	16896
dense (Dense)	(None, 32)	2080
dense_1 (Dense)	(None, 8)	264
dense_2 (Dense)	(None, 12)	108

Total params: 19,348
Trainable params: 19,348
Non-trainable params: 0

The architecture of this neural network includes two stacked LSTM layers and other hidden layers, which is complex enough to capture the patterns in the data.

1 Year of Data

This is how 1 year of data looks like in the graph:



It can be seen that the data follows a cyclic pattern and fairly predictable pattern, which could be captured by the LSTM model.

The error metrics of the trained machine learning model is shown below:

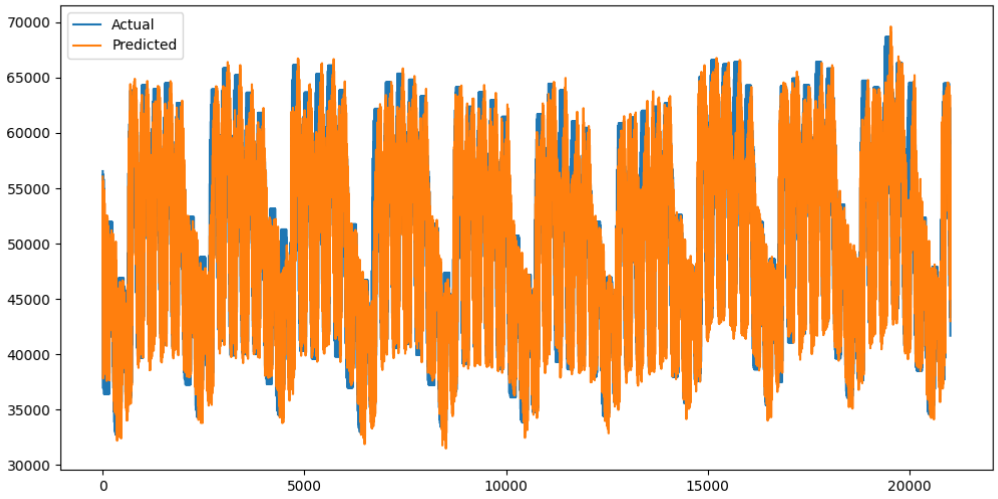
MAE : 1417.2298965323387

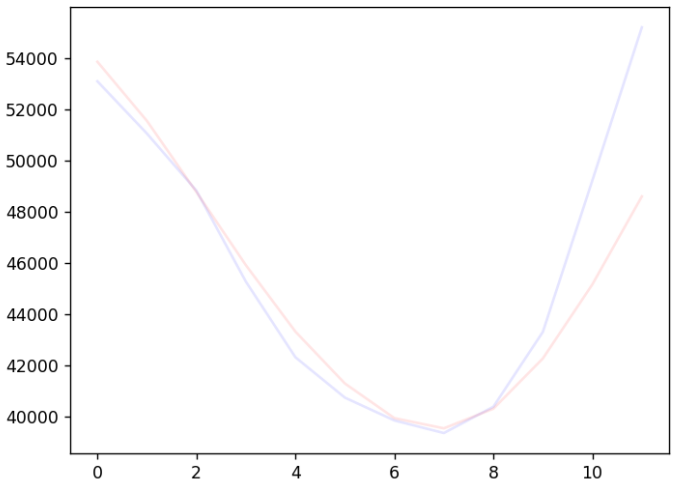
MSE : 4304667.964153034

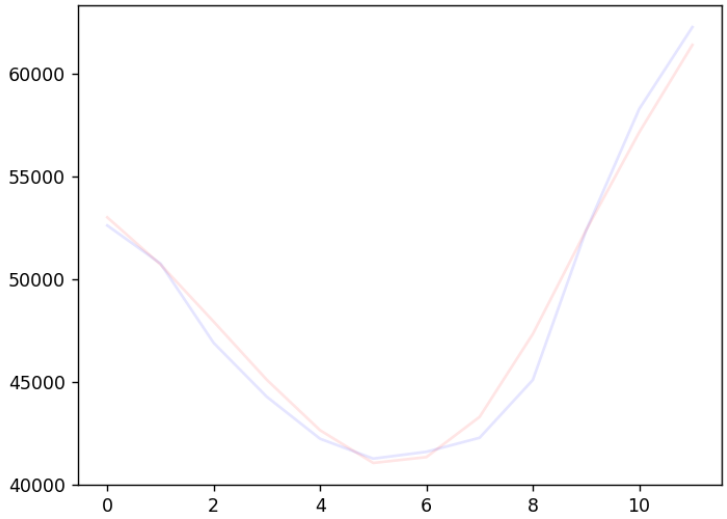
RMSE : 2074.7693761363053

MAPE : 2.76049575889027

The **orange** lines show the predicted values, while the actual values are shown by **blue**. The results can also be shown visually as below.

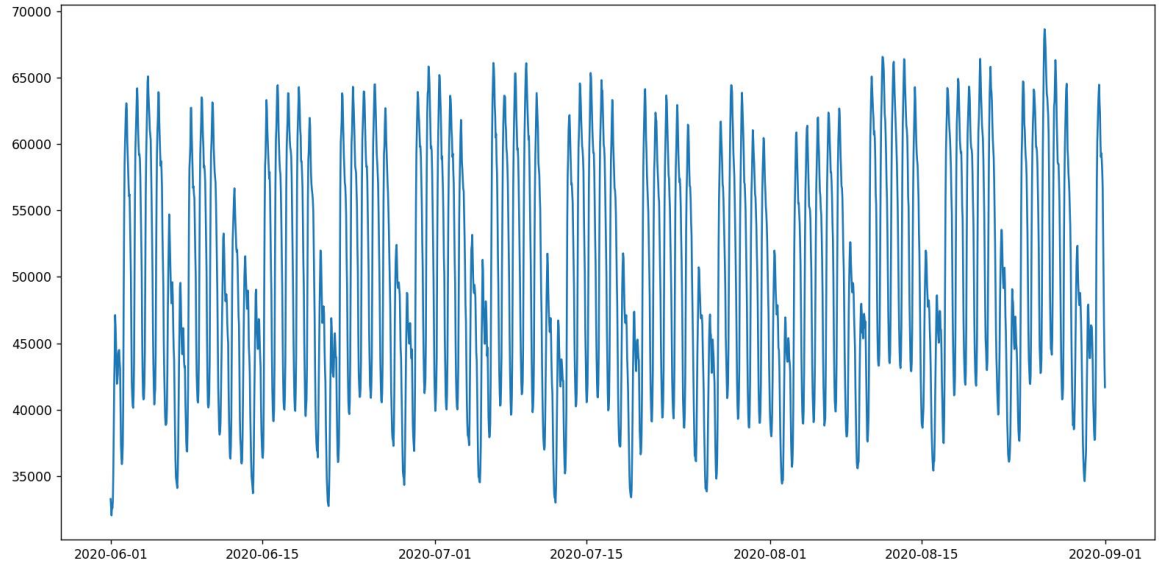






3 Months of data:

This is how 3 Months of data looks like in the graph:



The error metrics of the trained machine learning model is shown below:

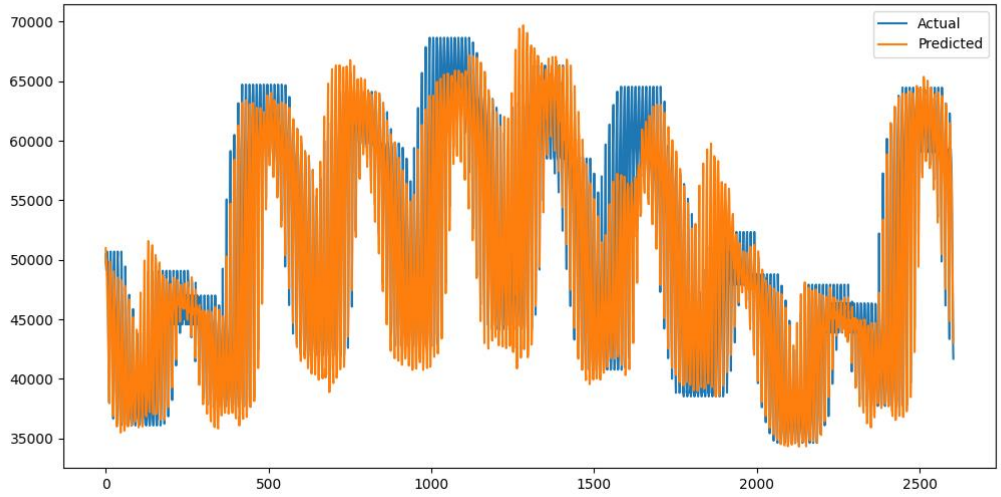
MAE : 1615.70554765505

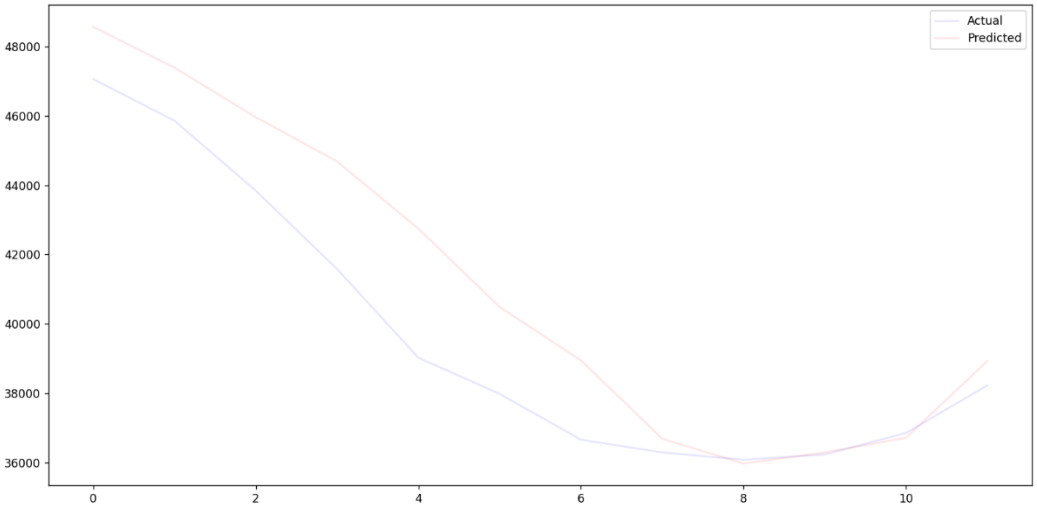
MSE : 5515292.099090242

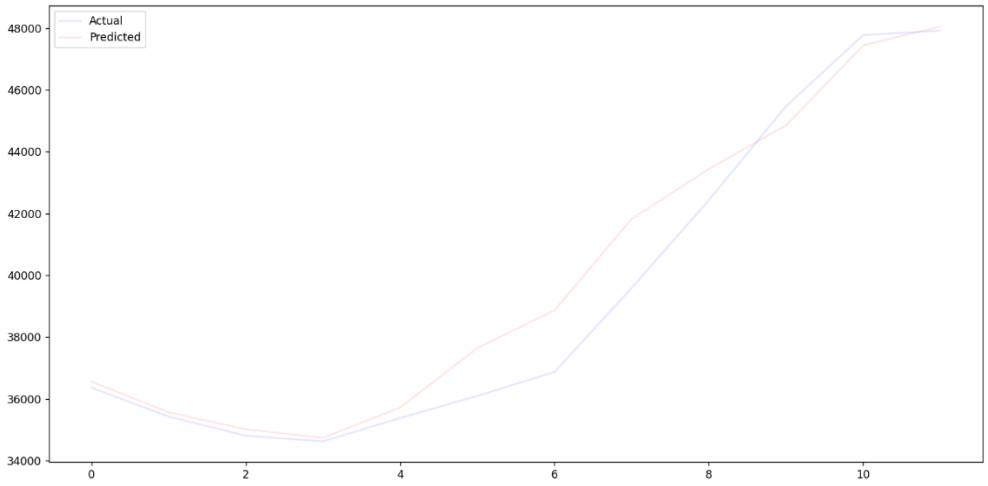
RMSE : 2348.4659033271573

MAPE : 3.135133110121139

As can be seen the error is slightly higher than the errors observed in the training of 1 year of data. The visual results are shown as follows:

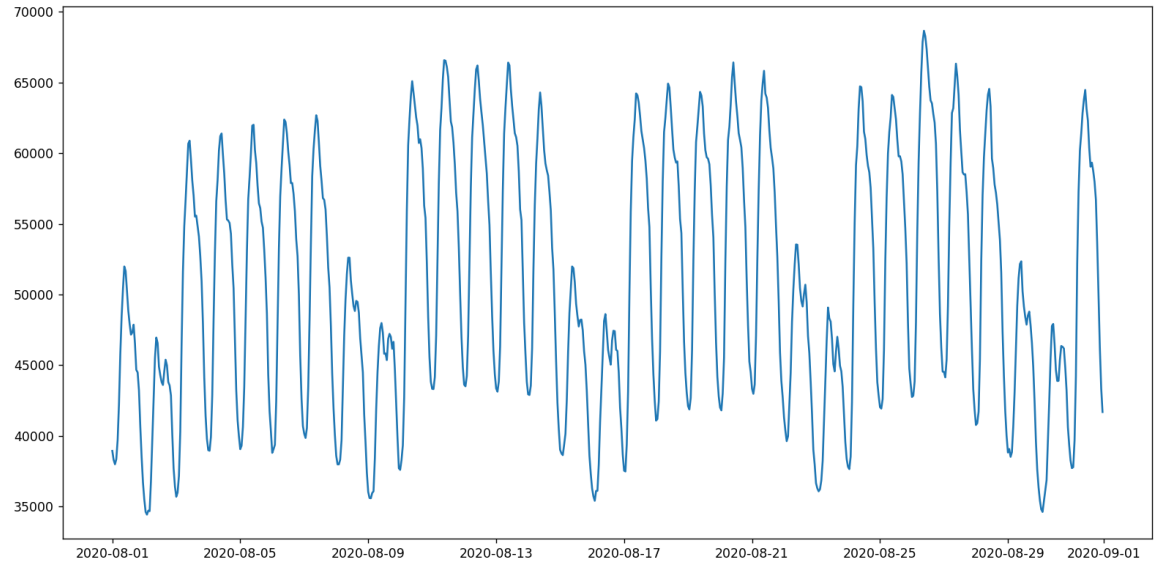

Actual
Predicted
70000
65000
60000
55000
50000
45000
40000
35000
0
500
1000
1500
2000
2500


Actual
Predicted
48000
46000
44000
42000
40000
38000
36000
0
2
4
6
8
10


Actual
Predicted
48000
46000
44000
42000
40000
38000
36000
34000
0
2
4
6
8
10

1 Month of data:

This is how 1 Month of data looks like in the graph:



The error metrics of the trained machine learning model is shown below:

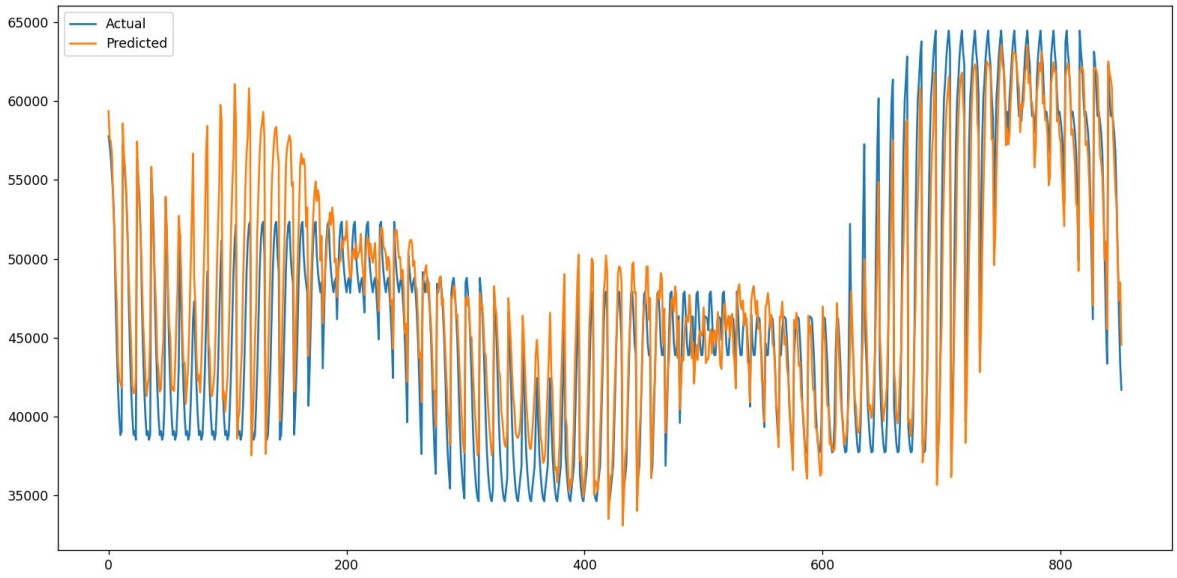
MAE : 1726.1905718163146

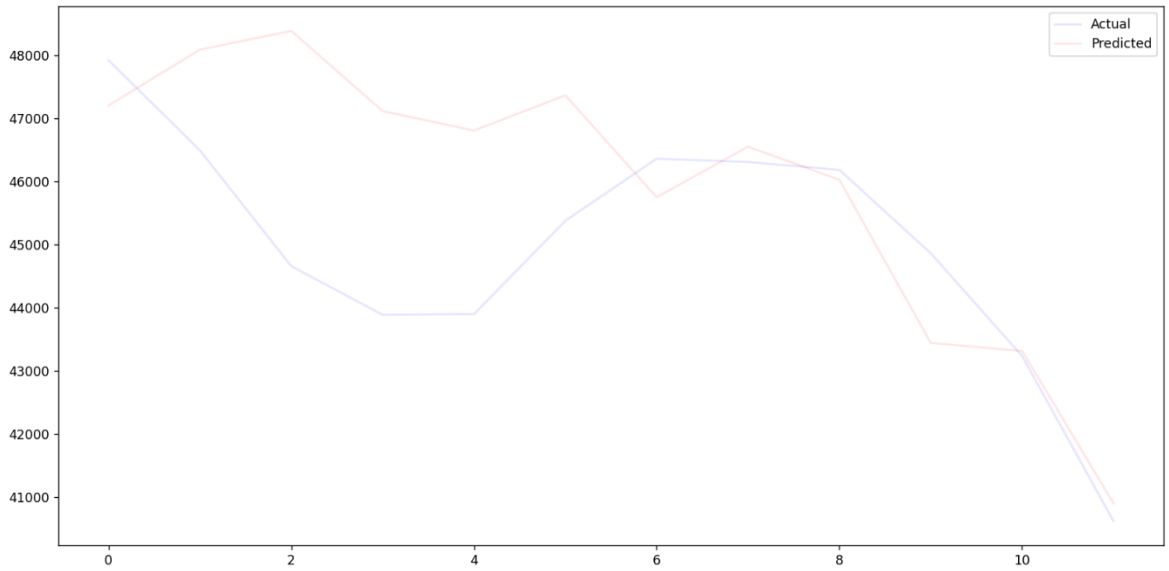
MSE : 6266861.203733704

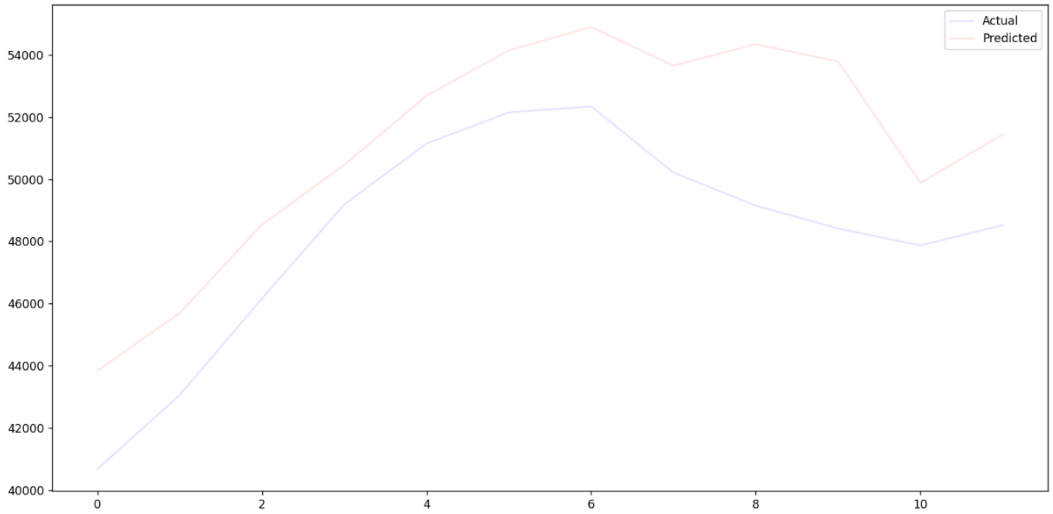
RMSE : 2503.3699694079787

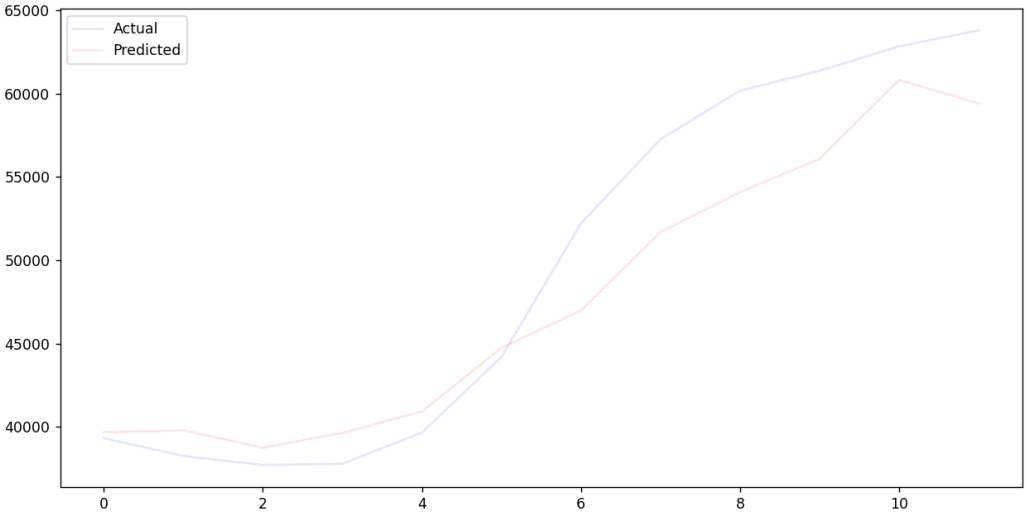
MAPE : 3.8115051722732147

As can be seen, the error values grow in size as the model trains on the smaller size of data. However, we could still say that the predictions made are fairly reliable. The below graphs show the predictions and actual values visually.



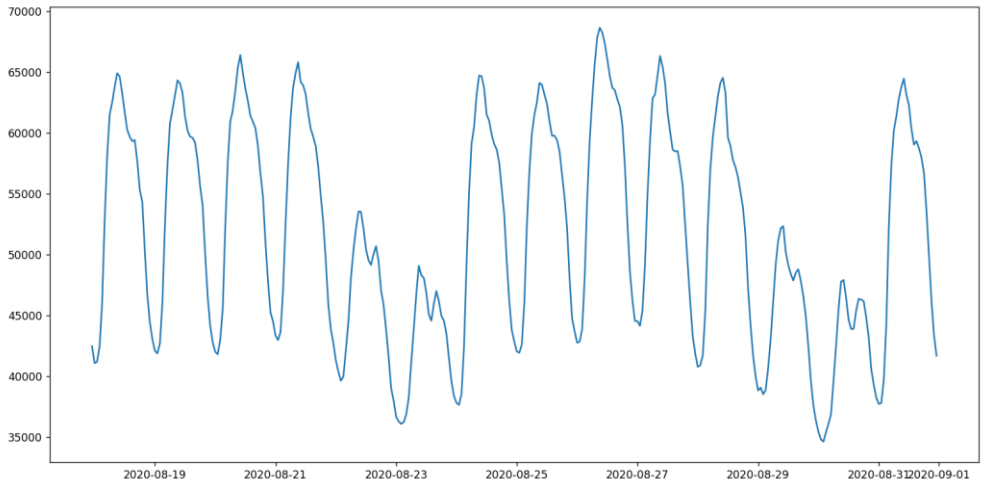

Actual
Predicted
48000
47000
46000
45000
44000
43000
42000
41000
0
2
4
6
8
10


Actual
Predicted
54000
52000
50000
48000
46000
44000
42000
40000
0
2
4
6
8
10


Actual
Predicted
65000
60000
55000
50000
45000
40000
0
2
4
6
8
10

2 weeks of data

2 weeks of data is shown in the following graph:



The error metrics of the trained machine learning model is shown below:

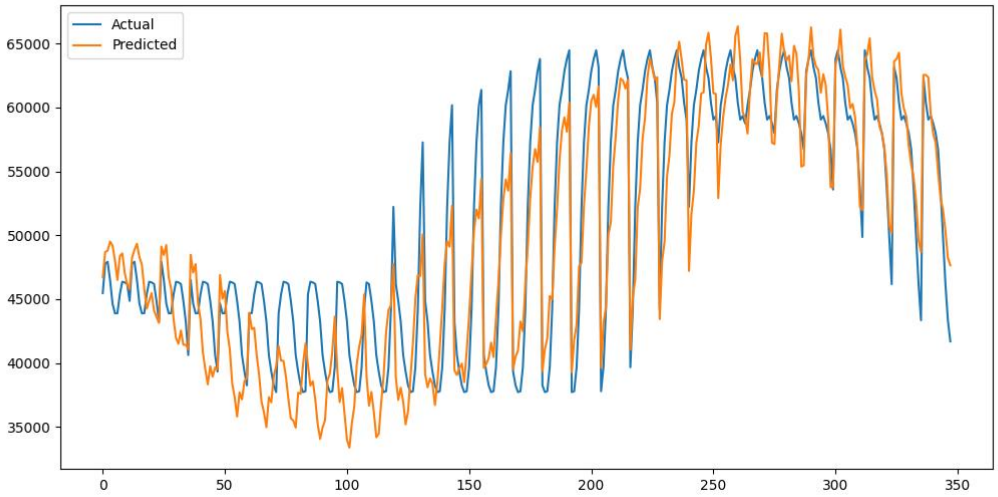
MAE : 3206.8116020114944

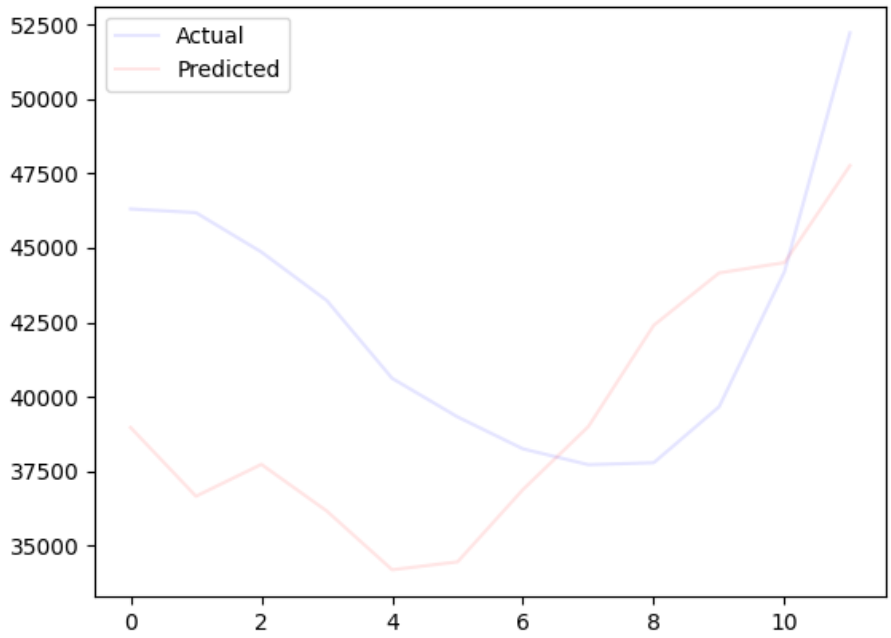
MSE : 16007863.25564847

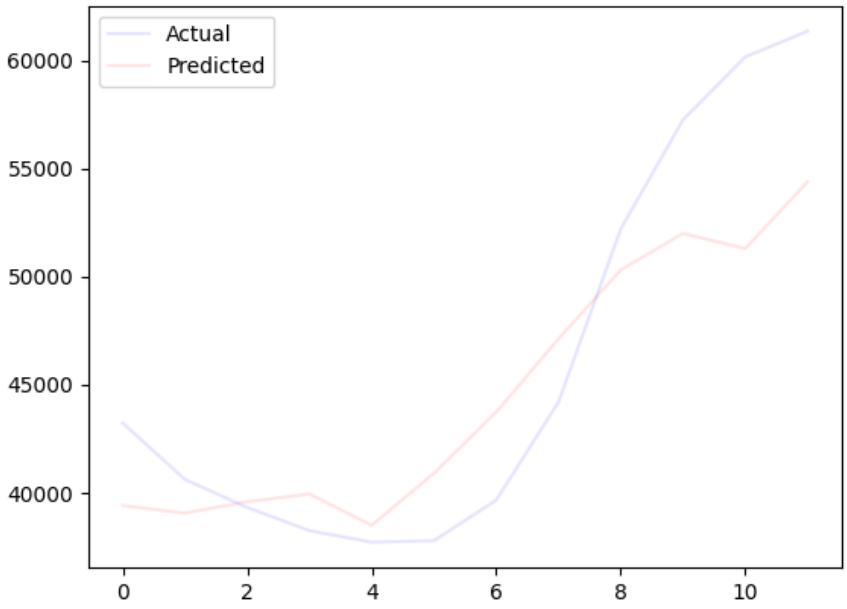
RMSE : 4000.982786222464

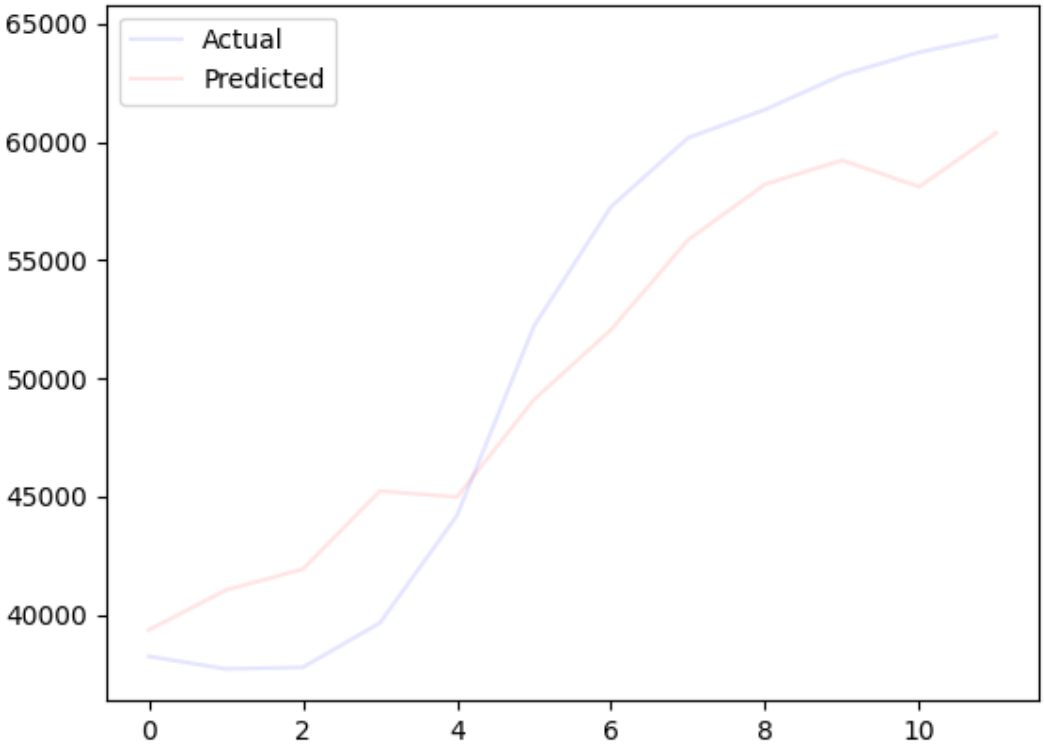
MAPE : 6.600039582054088

These values are the highest values observed so far. Two weeks of data do not lead to robust training for LSTM model that tries to predict the next 12 hours. The visual results are provided below:




Actual
Predicted
52500
50000
47500
45000
42500
40000
37500
35000
0
2
4
6
8
10


Actual
Predicted
60000
55000
50000
45000
40000
0
2
4
6
8
10



The Code can be found in the link below:

https://github.com/r4s1an/LSTM_example.git

Feel free to play with the data and code to support your learning!