



YAWK

You Are Welcome Krakow

Introduction

Predicting future PM10 values for the Krakow by using Deep Neural Network to help Krakow to be better place to breathe...



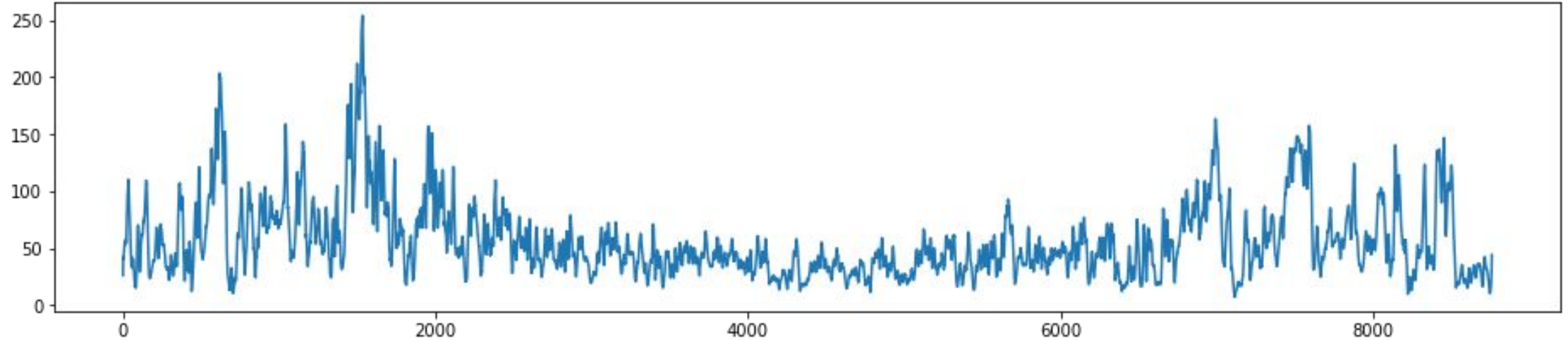
Hourly Predictions

Aim

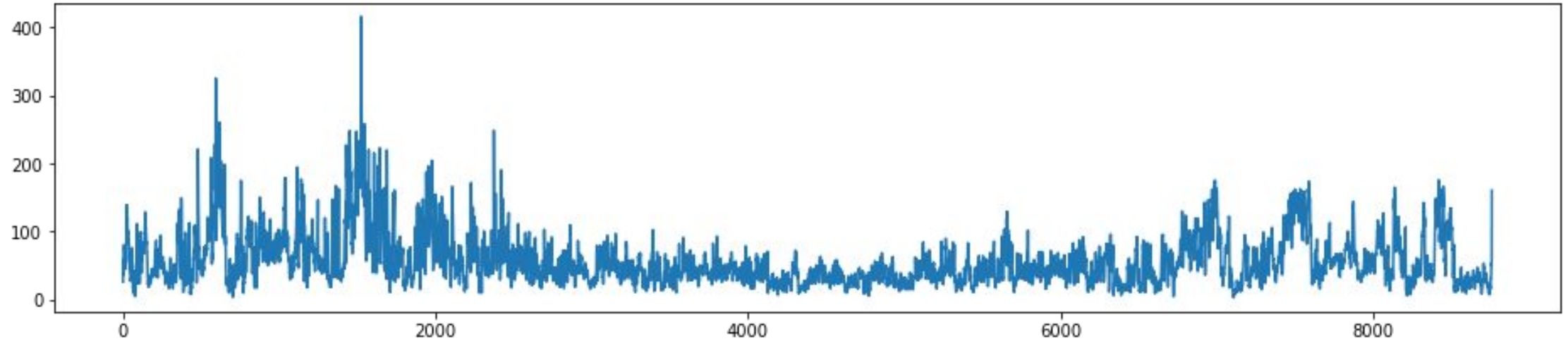
predict next hour based on set of previous time series

Data Visualization

moving average, one year



normal, one year



Data Pre-processing

- handling missing values -> impute values from other years
- moving average -> 12 hours for each frame
- preparation data as input for LSTM:
 - > framing 24 hours as base for prediction of next hour
 - > Input shape: (43795, 24, 1)
 - > Output shape: (43795,)

Model

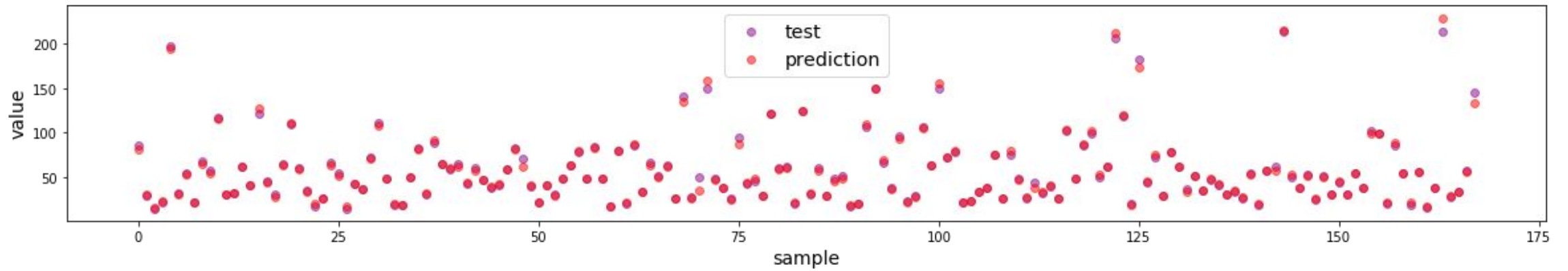
```
model = Sequential()

model.add(LSTM(20,activation='relu',return_sequences=True, input_shape=(frame_size, n_features)))
model.add(LSTM(20,activation='relu',return_sequences=False))

model.add(Dense(1))

adam = optimizers.Adam(lr=0.01, beta_1=0.9, beta_2=0.999, epsilon=1e-8, decay=0.0, amsgrad=False)

model.compile(optimizer=adam, loss="mse", metrics=None)|
```



Score & Conclusion

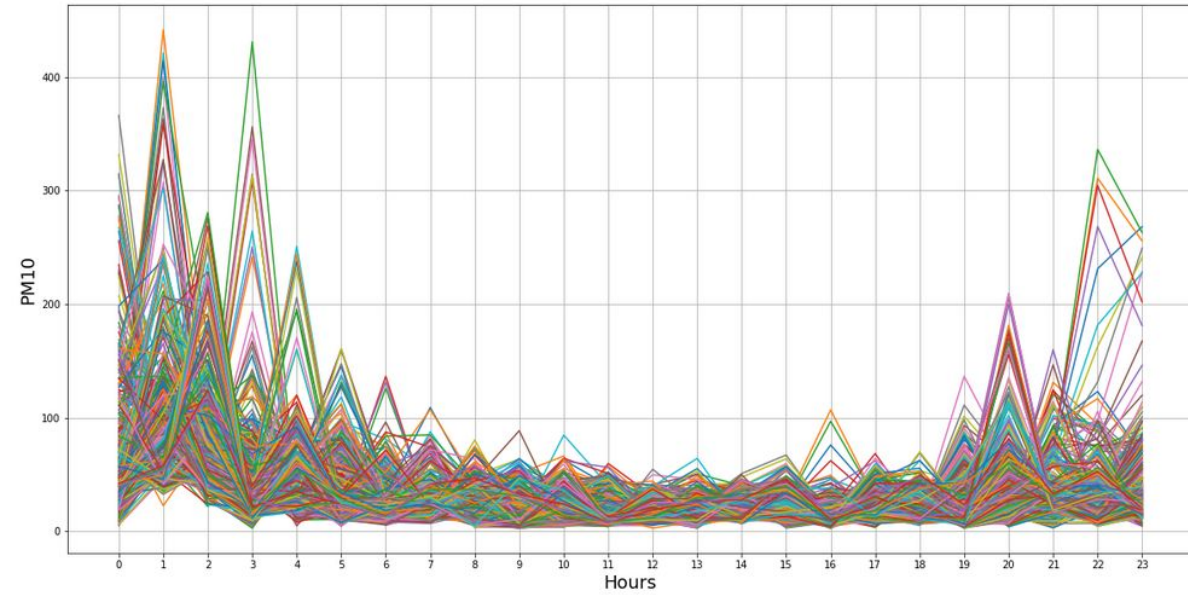
Final R2 Score = 0.99

Daily Predictions

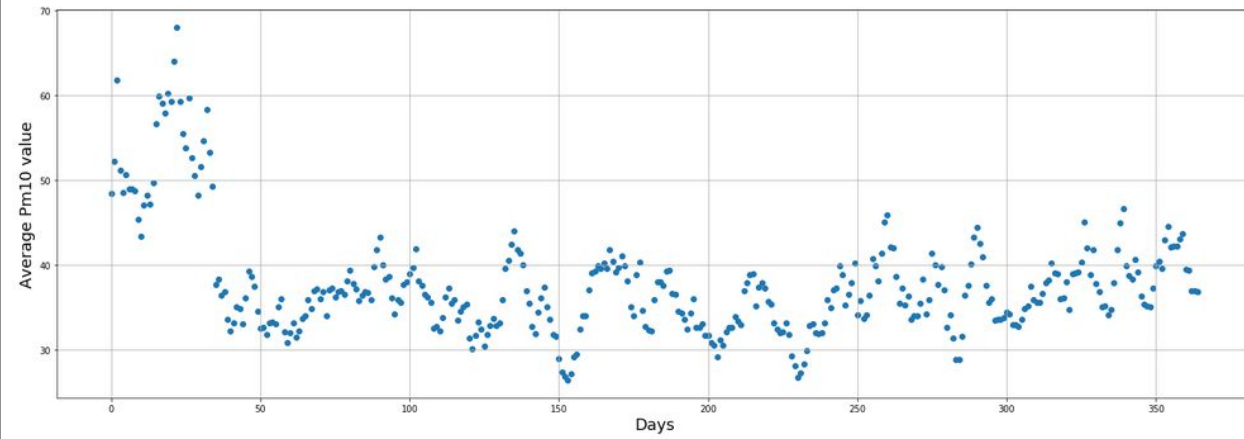
Aim

predict next day's PM10 value
based on last 20 days

PM10 for each day



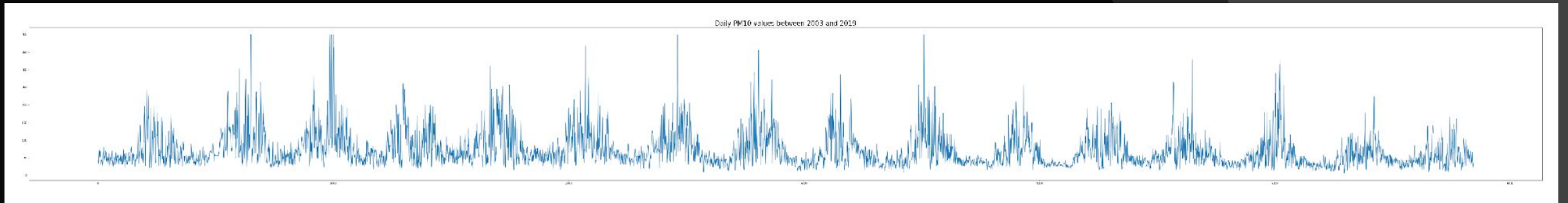
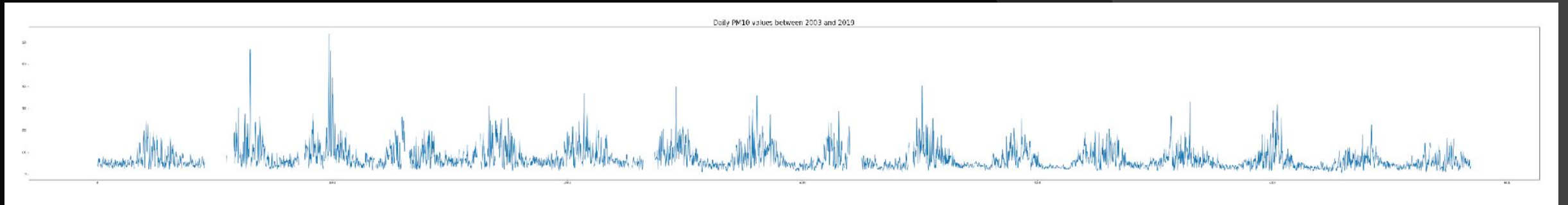
Daily Average PM10 Values over the Year



The Data

Data PreProcessing

- Handling the null values
- Framing the data for training



Simple LSTM model with only 4 hidden layers

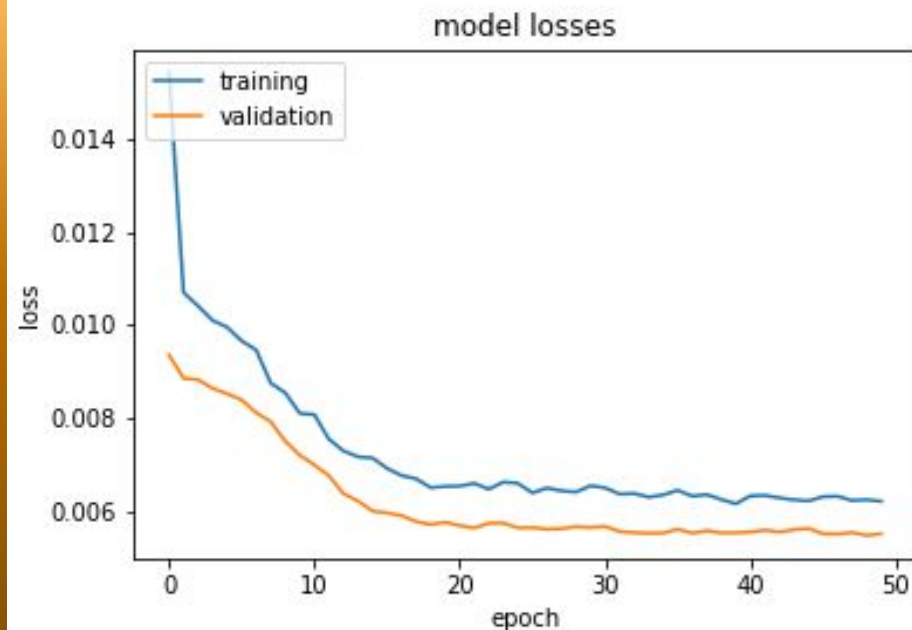
Layer 1: tanh LSTM with 24
neurons

Layer 2: 10% Dropout

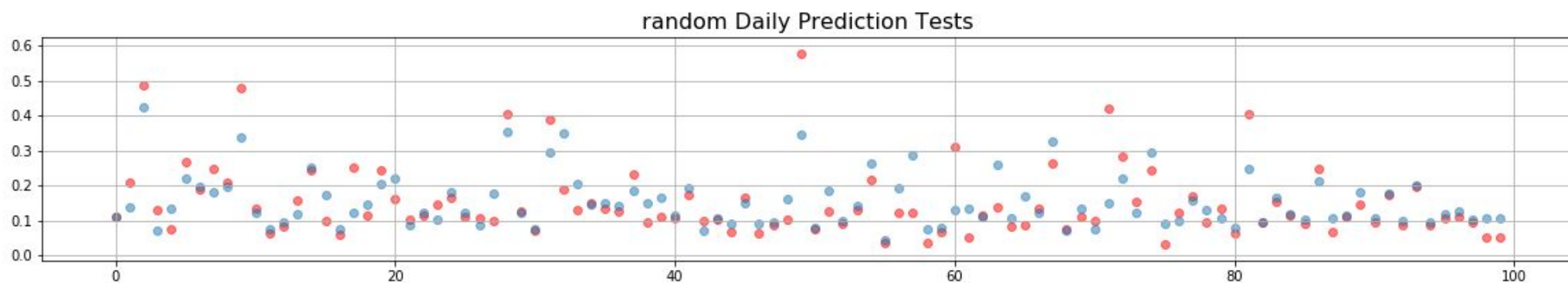
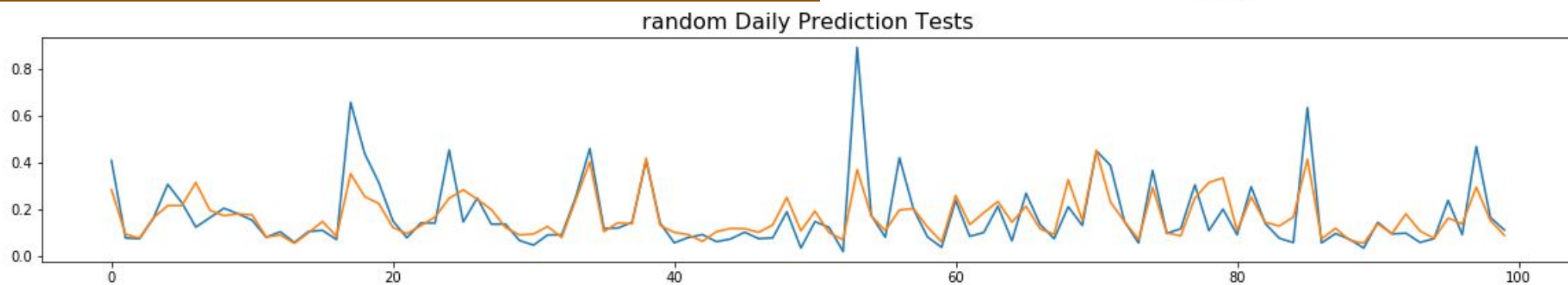
Layer 3: tanh LSTM with 16
neurons

Layer 4: 10% Dropout

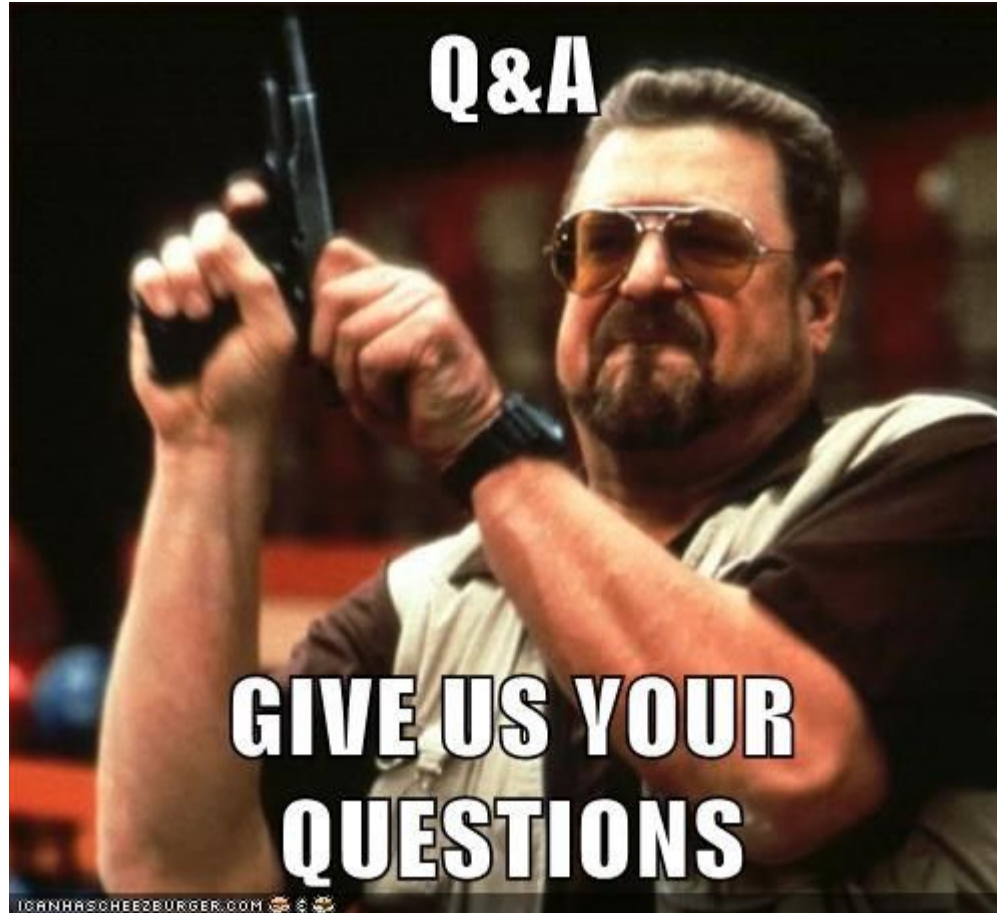
Score & Conclusion



```
[0.11556962] [0.10749682]  
[0.47397286] [0.77204574]  
[0.44480935] [0.41550191]  
[0.09997199] [0.09504447]  
[0.1746136 ] [0.1407878 ]  
[0.10287695] [0.15959339]  
[0.0678082 ] [0.07852605]  
[0.09065479] [0.04498094]  
[0.09886147] [0.0935197 ]  
[0.20338225] [0.36213469]  
[0.09906328] [0.06073698]  
[0.3864431 ] [0.25260483]  
[0.15011077] [0.1021601 ]  
[0.06944865] [0.04752224]  
[0.19712335] [0.2068615 ]  
[0.0794818 ] [0.06683609]  
[0.22805282] [0.28386277]  
[0.09568791] [0.06175349]  
[0.3301214 ] [0.31689962]  
[0.14238578] [0.10927573]
```



Thank you for your attention



- Efe Ergün
- Bartosz Tynski