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Yirmeyahu Kaminski, Ph.D.

Time Series Prediction
Shay Malkin, Nir Titelbom, Tal Ladijinsky

HiT
מכון טכנולוגי חולון
Holon Institute of Technology

Summary

work environment: Jupyter Notebook.
Programming language: Python 3.7
Libraries: Numpy, Pandas, OpenCV, Keras.
Target: using deep learning tools in order to efficiently predict time series data

General explanation

In this project we want to use deep learning techniques to predict EUR/USD gate in the year 2019. For this purpose we have developed different models who can predict effectively what will be the value in the near future. From all of the models we will use the one with the most accurate results.

Development steps

Step 1 – Artificial Neural Network Theory

❖ We researched the types of common neural networks today (FNN,CNN,RNN).
❖ We explored its components including the types of activation functions and the types of cost functions.
❖ We investigated the optimization process and error minimization which contains the SGD algorithm and BP process.
❖ We studied ways to improve the computational process such as using Encoder & Decoder, LSTM, GRU and Pooling.
❖ We searched for problems which may occur during the computational process such as gradients tends to 0 or ∞.

Step 2 – Time Series Theory

❖ We researched different types of Time Series and their components like cyclic movements, noise, seasonality and trend.
❖ We explored different methods of Time Series prediction using statistical models for instance ARMA, ARIMA and SARIMA.
❖ We explored different methods of Time Series prediction using Neural Network models for instance TLNN, SANN, LSTM and TDNN.

Step 3 – Implementation in Python

❖ We searched different libraries in Python which be our framework for the Implementation procedure like Keras and TensorFlow.
❖ We Implemented 2 different models the TLNN and LSTM models.
❖ We set our cost function to be MSE.
❖ We divided our data to train and test. The first 10 months are the train data and the last 2 months are the test data.

Results

Original data

Train data

Test data

Test data [:100]
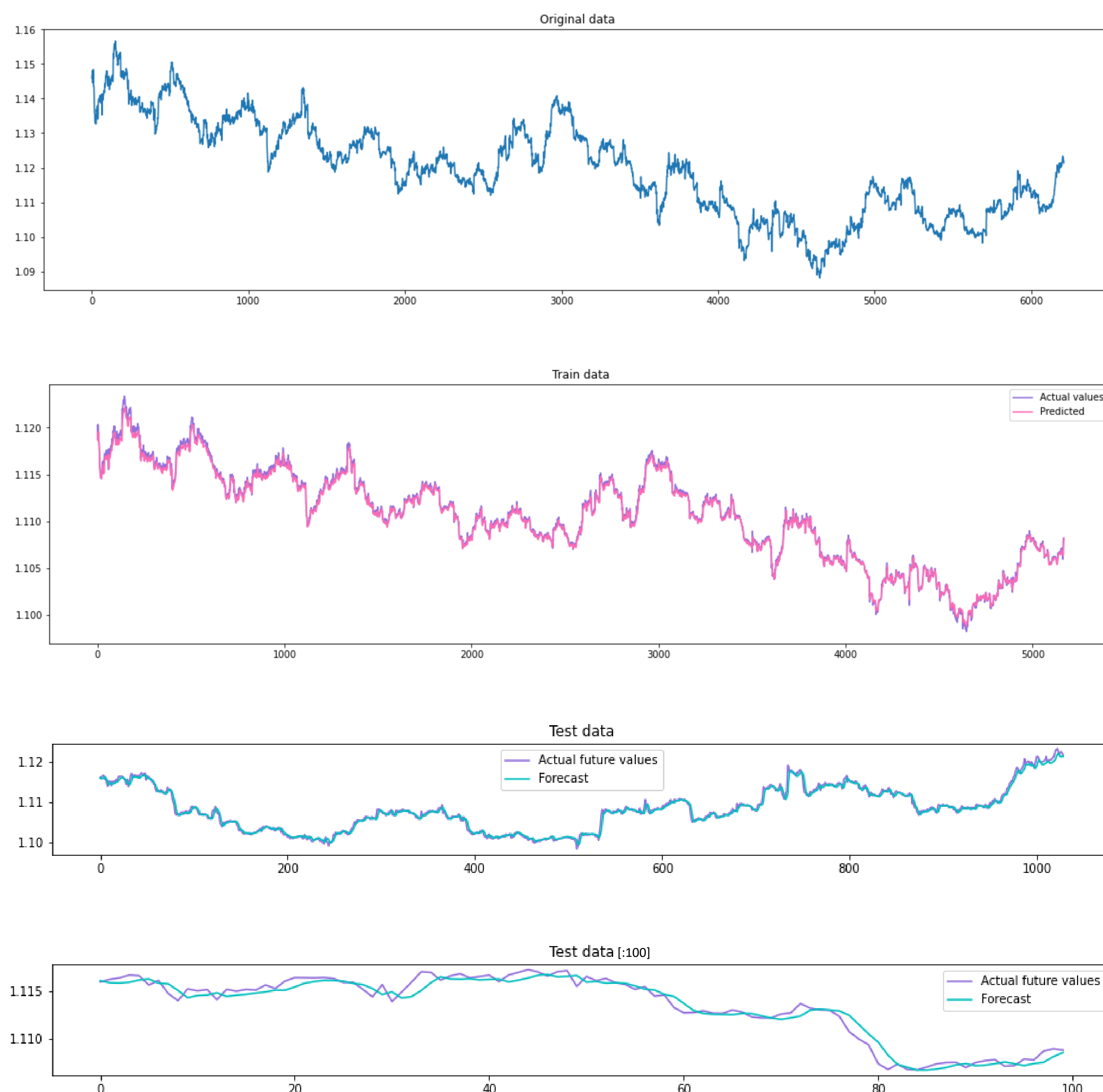
Conclusion

❖ LSTM is the chosen model. It gives the most accurate assessments after achieving $7x10^{-4}$ mean square error for a prediction on the next 1000 time steps with using 15 LSTM units and 5 time step look-back.
❖ LSTM can take into consideration each data and correlate it with his time period and handle the long-term dependencies within the time series data.
❖ TLNN can not evaluate time series when the difference within a pair of data points is too small.
❖ Time Series prediction is possible even without using statistical models oppose what is being done today in the industry.

Time series data:
EUR/USD gate in the year 2019 with 1 minute span
http://www.histdata.com/download-free-forex-historical-data/?/metatrader/1-minute-bar-quotes/eurusd/2019