Machine Learning Algorithms Accuracy for Time Series Prediction

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Introduction:

Time series data is a set of datapoints indexed in time order. Graphing this data can give an idea of what will happen in the future. This information is valuable to many businesses and organizations. There are many ways to forecast time series data, from visually following a trend or using a simple algorithm. In more recent times machine learning has been used to boost the accuracy of these predictions.

Algorithms:

The multi-layer perceptron (MLP) is an algorithm used in many scenarios for decades now. They take in a set number of inputs and multiply the input by a weight to give an output.

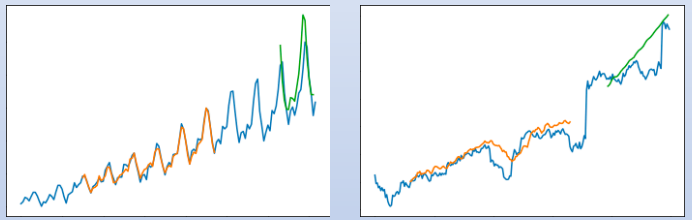
Long-short term memory is a modern algorithm designed for time series forecasting based off a recurrent neural network. Recurrent-neural networks use the output of the previous timestep as a feature in the current time step allowing for more accurate time series forecasting.

Ananlysis:

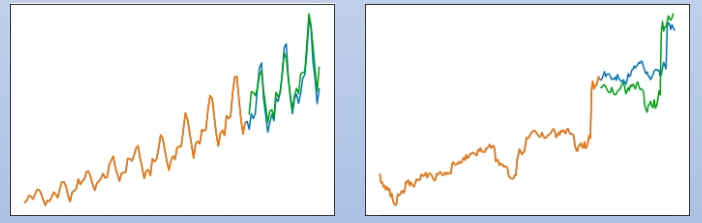
The first dataset used is of airline business. Not the predictable trend that this dataset has to it, this is because airports get busy around the same time of year. The second is of Target stock prices. This dataset has a much less predictable nature to it than the airport data. Stock market data tends to have an unpredictable nature to it because of how much can affect it.

Airline Data | Target Stock

The graphs on the right are The MLPs attempt at Forecasting. Airport data is learned much better than the stock market data



These graphs are the LSTMs go at forecasting. Notice how LSTM is far more accurate With the stock market data than MLP



From the graphs we can see that the MLP was able to learn the airline dataset almost as accurately as the LSTM. This is mainly to do with the predictable nature of the airline dataset. However the MLP couldn't learn the stock data nearly as well. Because of the unpredictable nature of the dataset the MLP was able to pick up on the basic trend, but not accurately portray the curve. The LSTM algorithm was able to capture the stock market curve with far better accuracy than MLP.

Results:

The LSTM algorithm is able to accurately forecast both datasets. The MLP struggles on the datasets that don't have as predictable a pattern to them. This is due to the nature of the algorithms and the way they were designed. Having said that accuracy isn't everything. LSTM was able to give the higher accuracy, but training takes much longer. With a predictable dataset MLP might be the better option.

Conclusion:

Machine learning can be used for countless problems with surprising accuracy. As time goes on these algorithms will only be improved upon and we will see machine learning used in a broader range of situations. This doesn't mean these older algorithms won't be used at all however, most algorithms will have their own strengths and weaknesses. Both of the algorithms used here are commonly used algorithms today, and MLP has been for years now.