Wells Fargo Quantitative AI Hackathon

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# Some Insights from Exploratory Data Analysis

1. The implied volatility is lower when Strike price and Stock Price are nearer (moneyness is close to 1) and becomes higher when there is a higher difference between the strike price and stock price. This essentially explains the popular smile profile (Implied Volatility vs Moneyness)

2. There isn't any evident pattern between Implied Volatility and Tenor for a given time step and moneyness
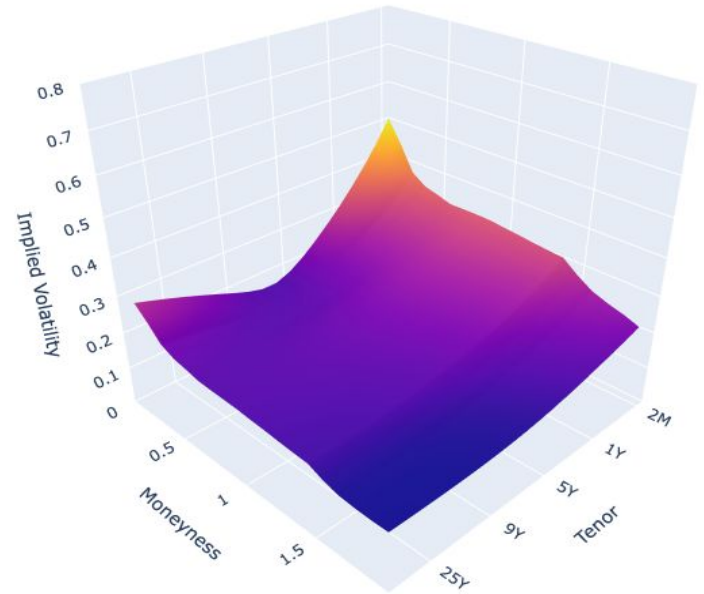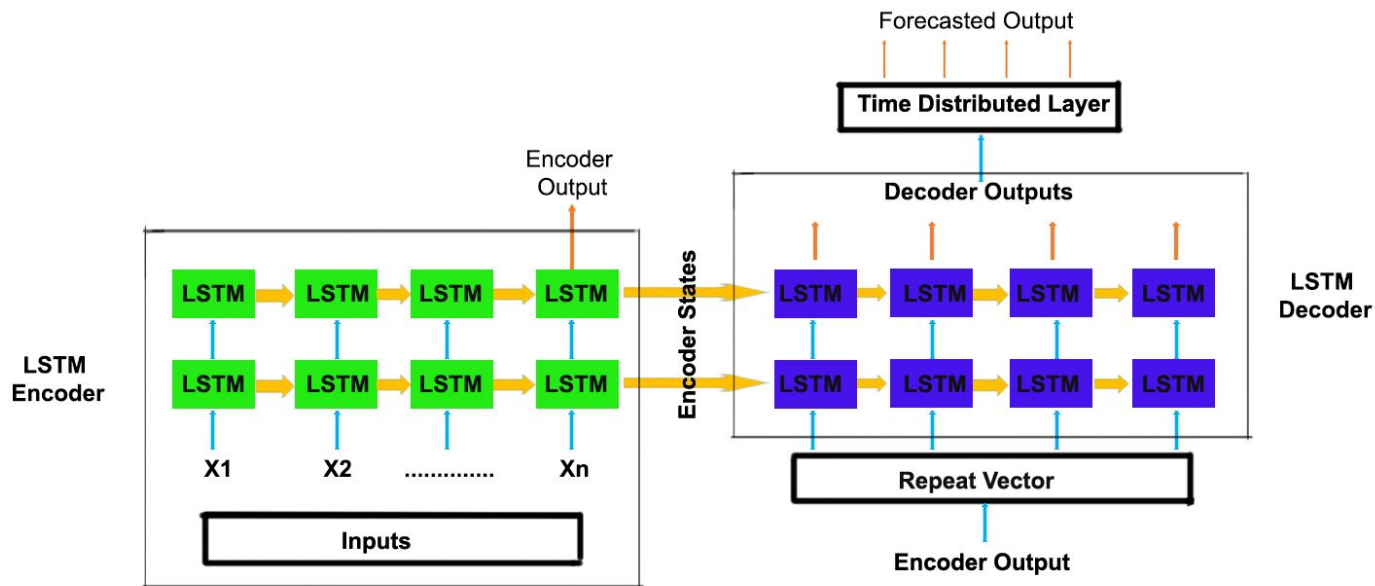
Forecasting Volatility - ARIMA

- In this approach, we used the popular ARIMA algorithm which stands for **AutoRegressive Integrated Moving Average.**
- In order to implement it, the volatility value for a given tenor and moneyness is considered to be independent from other tenor and moneyness values.
- Consequently, 1D time series for a given tenor and moneyness values was visualised and forecasted
- Variants of ARIMA like SARIMAX was also implemented

Tenor: 2M, Moneyness: 0.1
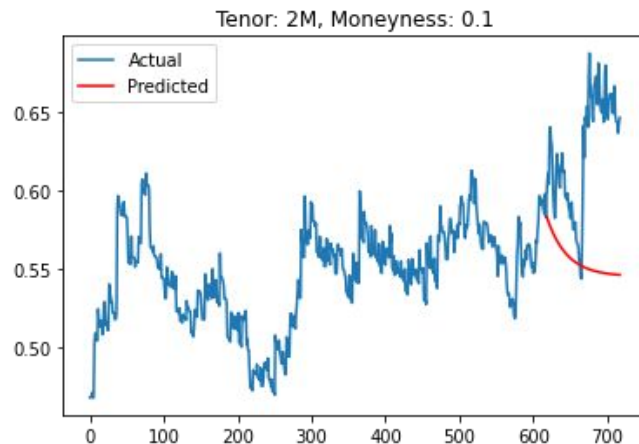
Forecasting Volatility - Stacked LSTM

Forecasting Volatility - Stacked LSTM

- In the previous approach, the individual points on the volatility surface was assumed to independent of the values of the surrounding points. However, this assumption did not have a strong justification. Therefore, we adopted a multivariate approach where the volatility series for each of the grid points (19x19=361) were assumed to be dependent and a multivariate time series forecasting was done.
- The algorithm used was a stacked LSTM with a autoencoder-decoder architecture.
- An rmse value of 0.028 was obtained
- The model can be improved with better hyperparameter tuning