**WIDS Stock Market Analysis + Prediction using LSTM**

- The purpose of the research is to use a Long Short-Term Memory (LSTM) neural network model to forecast the closing price of the S&P 500 stock market index.

- Because it can simulate long-term relationships in time series data and avoid problems like vanishing gradients that other neural networks have, LSTM is a good fit for this purpose.

- To capture the various factors influencing the movement of stock prices, nine variables were chosen as input characteristics from three categories: fundamental, macroeconomic, and technical indicators.

- Wavelet transformation was used for denoising and min-max normalization to preprocess the data. The data was divided into test, validation, and train sets.

- Single- and multilayer LSTM models were created, and validation loss was used to adjust hyperparameters such as learning rate, batch size, neurons, etc.

- To compare the prediction performance of the models, the test set was evaluated using RMSE, MAPE, and correlation coefficient.

- The findings of the experiment demonstrated that the prediction accuracy of a single-layer LSTM with about 150 neurons was much higher than that of the multilayer models examined.

- Even in volatile market times like the 2020 COVID crash, the model was able to identify patterns in training data and generalize effectively to previously unseen test data.

- Additional analyses used boxplots to compare the performance of single and multilayer LSTM models. For single-layer models, all indicators' median scores were higher.

- Plots of actual versus estimated pricing and signals demonstrated how well the 150-neuron single-layer model fitted the training and test sets of data.

- The model demonstrated suitability for this time series prediction job by capturing underlying trends and exhibiting noise resistance without overfitting.

- Although more intricate multilayer models did not yield better outcomes, future research could incorporate news sources or other data sources, add attention to models, or use global optimizers.

- In summary, it was demonstrated that a frugal single-layer LSTM that included important market characteristics could reliably forecast stock index prices, which could be advantageous for traders, investors, and portfolio managers.