Portfolio Optimizer 2.0

Capstone Project
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Objective

- Develop a portfolio optimization model tp recommend portfolio weights whilst aiming to maximize returns while managing risk, using LSTM networks and sentiment analysis
- Create user interface to allow for portfolio customization

Model Summary

- Long Short-Term Memory (**LSTM**) networks
- Historical prices
- Sentiment analysis data from **Alpha Vantage API**
- Portfolio optimization using Efficient Frontier (PyPortfolioOpt library)
- Notebooks:
  - LSTM_Model.ipynb
  - Sentiment.ipynb
  - Visualizations.ipynb
  - Data Retrieval.ipynb
  - Controller.ipynb
  - app.py (screen interface)

Model Implementation

LSTM Model

- Implements an LSTM neural network for predicting stock returns
- Uses Bayesian Optimization for hyperparameter tuning
- Employs walk-forward validation for model evaluation

Portfolio Optimization

- Calculates expected returns based on LSTM predictions
- Computes the covariance matrix using the Ledoit-Wolf shrinkage method
- Applies the Efficient Frontier algorithm to determine optimal portfolio weights

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Findings

Weight Distribution

- If a stock is not recommended, the portfolio optimizer will apply a 0% weight to said stock.

Optimization Algorithm

- Started with random search for hyperparameter tuning but later transitioned to Bayesian optimization, which proved to be more efficient for this application.

Hyperparameter Optimization

- Initially, k-fold cross-validation was attempted for model validation. However, it was discovered that walk-forward validation was more suitable for time series data in this context.

Optimization Algorithm

- Started with random search for hyperparameter tuning but later transitioned to Bayesian optimization, which proved to be more efficient for this application.

Challenges

Portfolio Optimization

- Considered the Black-Litterman model but chose the Efficient Frontier model for a simplified portfolio optimization.

Limitations

- 25 calls per day for the sentiment analysis.

Multi-Step Prediction

- Implementing the model to iteratively predict weekly returns over a 52-week period required careful consideration of the model architecture and prediction process.

Target Variable Selection

- Determining the most appropriate target variable for the LSTM model to predict was a significant challenge. The team had to carefully consider which financial metric would be most useful for portfolio optimization.

Implemented Solutions

Data Management

- Efficient storage and retrieval techniques (e.g., using pickle files) helped manage the large datasets.

User Interface

- Used streamlit to facilitate easy customization of desired portfolio for the user.

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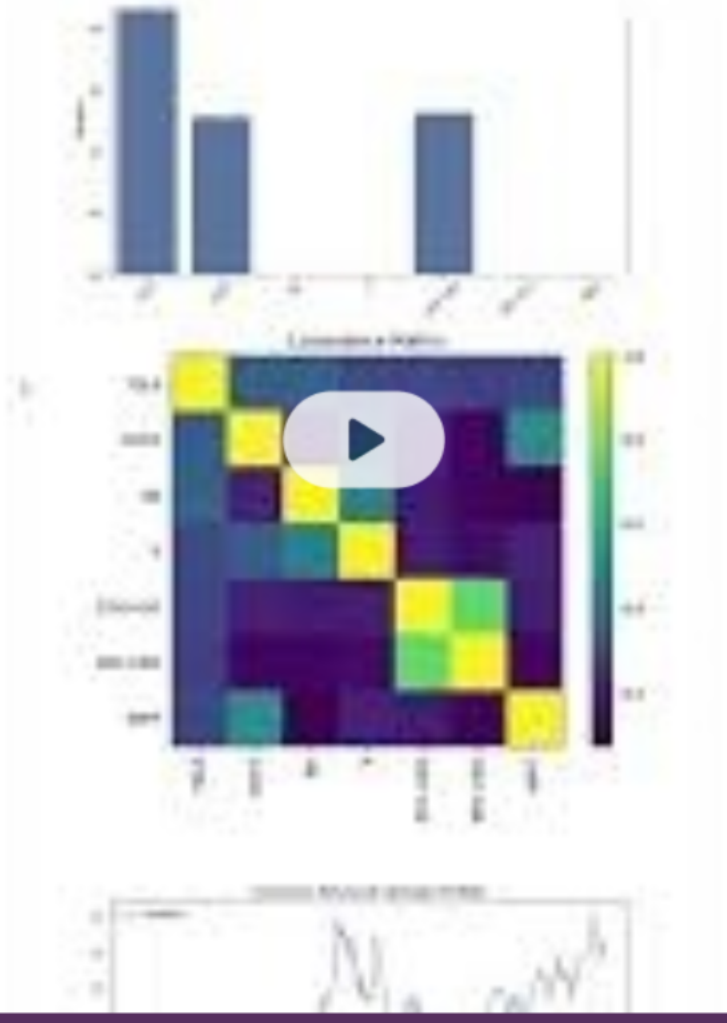

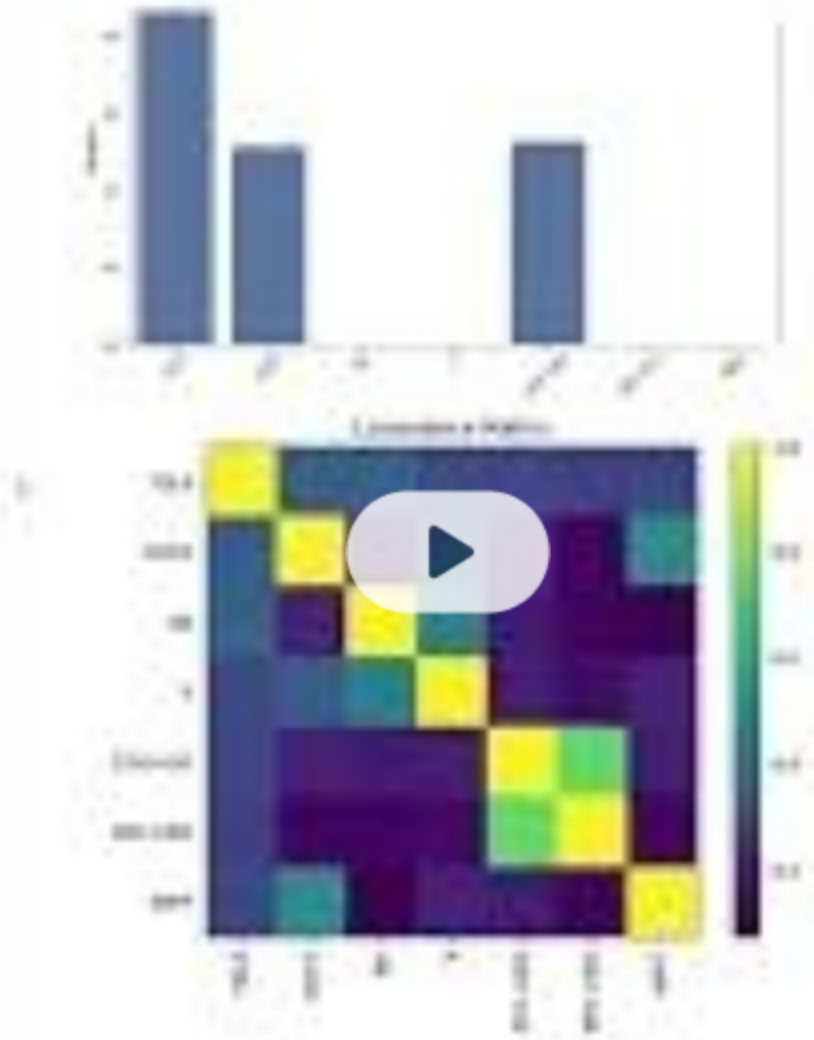

Questions?