Automotive Stock Price Prediction

Group 8

Data Science Capstone Project
Launch Report

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Team Members:

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The System/Product

System/Product Name: *Stock Price Time Series Forecast*

Introduction:

Given the most recent election cycle, there has been a lot of discussion and controversy surrounding upcoming policies regarding trade and importing/exporting goods. The combination of global trade wars, domestic policies, and political involvement from important members in the industry makes the car industry a viable option for stock price analysis and predictions.

This project aims to learn about and implement a time series forecasting model to help predict the future stock prices of select car companies (i.e., Tesla, Ford, Toyota, and Volkswagen) using historical stock prices along with qualitative inputs such as Google Trends. Our group aims to learn about which factors are most influential towards a car company's stock price and how accurately machine learning techniques like time series forecasting can be used to make predictions.

Our analysis and predictions will be based on available stock prices and google trends over the past few years, to help us identify what are the most influential factors in determining stock prices. The final outcome of the project will be individualized predictions for each of the twelve automobile companies, as well as a general prediction on what the market will look like for each of the groups in our project.

The following are the car companies that will be used in this project, along with some information about their origin and current market standings.

Electric:

Tesla - TSLA

Tesla went public on June 29, 2010. The company is led by CEO Elon Musk, who has been at the helm since 2008. As of January 18, 2025, Tesla's stock price stands at $426.50, reflecting its strong market presence and investor confidence. Over the years, Tesla has sold more than 3 million vehicles globally, cementing its position as a leader in the electric vehicle industry.

Asian:

Toyota - ™

Founded in 1937, Toyota’s headquarters and several of its manufacturing plants are located in Toyota, Aichi, Japan. Formerly named “Koromo,” the close ties between the company

and the city resulted in it being renamed in 1959. Today, the company is the largest automobile manufacturer in the world, producing more than 10 million cars every year.

American:

Ford - F

The Ford Motor Company was founded in 1903 and named after its founder Henry Ford. Ford is recognized as one of America's most prominent automobile companies. Based out of Dearborn, Michigan, a suburb of Detroit, the Ford Motor company sells approximately 4 to 5 million vehicles per year.

European:

Volkswagen - VW

Founded in 1937 and headquartered in Wolfsburg, Germany, Volkswagen is one of the largest automobile manufacturers in the world. Known for its iconic models like the Beetle and Golf, Volkswagen produces over 10 million vehicles annually, catering to a wide range of consumers. The company is a cornerstone of the Volkswagen Group, which owns several other prominent brands, including Audi and Porsche.

The System/Product

System/Product Name:

Introduction:

[Describe the background information, motivation, and goals of your Data Science capstone project. What are the deliverables of your project?]

Highlighted Features:

1. **Time Series Forecasting**:
   The core of this project is to apply time series forecasting techniques, using historical stock price data and external factors like Google Trends, to predict future stock price movements. This involves using statistical models such as ARIMA, LSTM (Long Short-Term Memory), or Facebook Prophet to learn patterns from past data and forecast future trends.

2. **Multi-Country Focus**:
   The project will focus on four prominent automobile companies from different regions:

   - **Tesla (Electric)**: Represents the electric vehicle market.

- **Toyota (Asian)**: One of the largest global car manufacturers based in Japan.

- **Ford (American)**: A well-established American automobile company.

- **Volkswagen (European)**: A major player in the global automobile industry, based in Germany.
  This will allow a comparison across regions and give insight into how the automotive industry's stock performance varies across different markets.

3. **Market Trends Analysis**:
   To provide more accurate forecasts, the project will factor in significant global and political events, such as election cycles and tariff policies. For example, the potential impact of U.S. trade tariffs or Elon Musk's involvement with Tesla could significantly influence the stock prices of these companies. The model will look at how these external factors correlate with stock price fluctuations and use that data for better prediction accuracy.

4. **Group-Specific Predictions**:
   The project aims to generate predictions not only for each of the individual automobile companies but also for groups representing regions (e.g., American, Asian, Electric, European). By doing so, the project will offer insights into regional market trends and provide a comprehensive understanding of the automotive sector's financial landscape. This will allow stakeholders to understand both individual company performance and broader industry trends.

5. **Data Sources**:
   The analysis will be based on two primary data sources:

   - **Stock Price Data**: Historical stock prices of the companies will be used to observe past price movements and trends.

   - **Google Trends**: Google search trends related to these automobile companies and the automobile industry in general will help identify consumer sentiment and external factors influencing stock performance. Combining these data sources helps to capture both market behavior and public interest.

6. **Predictive Modeling**:
   Various predictive models will be implemented to forecast stock prices. For instance, time series models like ARIMA, machine learning models like Random Forest or XGBoost, and deep learning models like LSTM (Long Short-Term Memory networks) will be explored. The models will be trained on historical stock data to recognize patterns and predict future trends, providing a basis for investment or business decisions.

7. **Analysis of External Influences**:
   The project will analyze how external events such as elections, tariffs, and global political changes affect the automobile industry's stock prices. For example, if a new tariff is imposed on

foreign cars or a political leader makes statements that influence market sentiment, these events could lead to sharp movements in stock prices. This analysis will help in identifying which external factors are most influential for the companies involved.

8. **Visualization**:
   To make the findings easily understandable, interactive data visualizations will be used. These visualizations will include graphs and charts that show historical stock price trends, predicted future prices, and how various external factors impact the predictions. This makes it easier for stakeholders to interpret complex data and make informed decisions based on the analysis.

9. **Impact of CEO Influence**:
   The role of prominent figures like Elon Musk in shaping investor sentiment and stock prices will be closely examined. For example, any public statements, product launches, or business decisions by Musk could have a direct effect on Tesla's stock price. This analysis will explore whether such influence is temporary or has long-term effects, offering deeper insights into how leadership impacts company valuation.

10. **Comparative Analysis**:
    By comparing the stock performance of major global automobile manufacturers, the project aims to identify trends and performance differences across regions. This will provide an understanding of how the market views American, Asian, Electric, and European automobile companies differently, as well as the broader economic forces at play in the global automotive sector. This comparative analysis will help in identifying potential risks or opportunities in specific markets.

Issues:

Potential issues may arise from certain companies having more sources of data than others (i.e., a company may have more social media activity and/or more news articles written about them compared to other companies). To counter this, the team will focus on obtaining as much data as possible to ensure all four companies have the same amount of data to be used for the project.

The Team

Team Name: Group 8

Team Members and their specialties:

Each Team Member has been given a group of car companies for this project. Each group member will have their own creative freedom for data analysis and exploration. Once each member has filtered and evaluated their respective data, the team will convene and work on creating a time forecasting model and will implement it on all car companies in this project. Team members will coordinate with one another on any ideas or preferences for this project.

Uditi Shah: Masters in Data Science with skills Python, AI, Machine Learning, SQL. Recently worked as a data science intern at Dataing. In this project, I want to focus on data analysis and show ongoing trends, graphs, in the stock market.

Robert Lignowski: Masters in Data Science, with skills in Python and the OpenBB package. Recently worked as a data analyst with a professor in the Health Sciences department.

Ahmad Javed: Masters in Data Science with skills in Python, SQL, Microsoft Excel/ VBA, and Data visualization softwares such as Tableau and PowerBI. Currently working as a Data Analyst for a biotechnology company in the Northeast.

Steven Sullivan: Masters in Data Science with skills in Python, SQL, Java, and C, alongside experience in machine learning, time series forecasting, and data visualization.

Team Communication:

The team has created a discord group for immediate access to one another. The discord group is where the team will share insights, project related articles, videos and generally set up a time to discuss the project when everyone is available.

Team Issues:

We have only recently learned how to use the ARIMA model that we will primarily be using, so that will cause issues do to our inexperience; we will therefore be sure to double check all work done with ARIMA.

Plan

Week	Objective

1	• Kickoff project continuation, assign modeling roles, confirm data readiness
2	• Submit Launch Report
3-4	• Begin implementation of ARIMA and Prophet models • Implement XGBoost and LSTM models
5	• Record & Present Pitch Presentation (include model strategy, outline, steps)
6	• Begin hyperparameter tuning (ARIMA orders, XGBoost grid search, LSTM architecture)
7-8	• Evaluate tuned models; interpret results (feature importances, trend alignment) • Develop visual dashboard; finalize model selection
9	• Draft Predictive Modeling Report; integrate evaluation and visuals
10	• Submit Final Predictive Modeling Report and deliver final group presentation

Learning Outcomes:

- Understand and implement ARIMA and Prophet for classical time series forecasting
- Gain practical experience applying machine learning and deep learning models (XGBoost, LSTM)
- Evaluate model performance using MAPE and RMSE
- Interpret model predictions using feature importance and visualizations
- Build interactive dashboard to communicate findings effectively

Table of Contributions

The table below identifies contributors to various sections of this document.

	Section	Writing	Editing
1	**Project**	**All Members**	**All Members**
2	**Team**	**All Members**	**All Members**
3	**Plan**	**All Members**	**All Members**