GROUP ACTIVITY

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Company: Tesla, Inc. (TSLA)

Introduction:

Markov Chain is a mathematical model that is used to analyze the behavior of a system that transitions between different states. In the context of stock prices, Markov Chain can be used to predict the future behavior of a stock based on its past behavior. This report discusses the Markov Chain analysis of Tesla, Inc. (TSLA) stock prices and its long-term behavior.

Markov Chain for TSLA Stock Prices:
To create a Markov Chain for TSLA stock prices, we divided the historical prices of TSLA into discrete intervals or states. We used daily closing prices and divided them into intervals of $10. For example, if the stock price was $695, it would belong to the state $690-$700.

We then calculated the transition probabilities between states using historical data. For instance, if the current price of TSLA is $600, and the previous day's price was $610, the probability of the price dropping to $590 would be higher than the probability of it increasing to $610 again. The transition probabilities were then used to create a transition matrix that shows the probability of moving from one state to another.

Long-Term Behavior of TSLA Stock:

To analyze the long-term behavior of TSLA using the Markov Chain, we simulated the stock prices over a long period of time using the transition matrix. We assumed that the stock price has a 20% chance of decreasing by one state (i.e., $10) and a 20% chance of increasing by one state, with a 60% chance of staying in the same state.

However, it should be noted that this simulation is a simplistic example and does not take into account various factors that may affect the behavior of the TSLA stock in the long term, such as market trends, economic conditions, and company performance.

Objective:

The objective of this report is to use Markov Chain modeling to analyze the long-term behavior of Tesla's stock and provide insights for potential investors.

Problem Statement:

Tesla's stock has experienced significant fluctuations in the past, and it is essential to understand its long-term behavior to make informed investment decisions. We aim to use Markov Chain modeling to analyze the stock's long-term behavior and identify any patterns or trends that may be useful for investors.

Methodology:

We will use Python to build a Markov Chain model of Tesla's stock. We will use historical stock price data obtained from Yahoo Finance to build the model and generate predictions for future stock prices. The Markov Chain model is a probabilistic model that uses the current state of a system to predict future states. We will use the Monte Carlo simulation method to generate multiple simulations of the model and calculate the expected long-term behavior of Tesla's stock.

First, we need to import the necessary libraries and load the historical stock price data using pandas:

CODE IN PYTHON

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

# Load the historical stock price data
tesla = pd.read_csv('TSLA.csv', parse_dates=['Date'],
index_col='Date')

# Calculate daily returns
returns = tesla['Adj Close'].pct_change().dropna()
```

Next, we will create a function to simulate the Markov Chain model and generate the expected long-term behavior of Tesla's stock:

```
def simulate_mc_model(initial_state, transition_matrix,
n_years=10, n_sims=1000):
    # Set the initial state
    state = initial_state

    # Calculate the number of days in n_years
    n_days = n_years * 252

    # Create an empty array to store the simulated prices
    prices = np.zeros((n_days + 1, n_sims))
    prices[0] = state

    # Simulate the model using the Monte Carlo method
    for i in range(n_sims):
        for j in range(n_days):
            state = np.random.choice(transition_matrix.index.values,
p=transition_matrix.loc[state].values)
            prices[j+1][i] = prices[j][i] * (1 + state)

    # Calculate the mean and standard deviation of the
simulated prices
    mean_prices = np.mean(prices, axis=1)
    std_prices = np.std(prices, axis=1)

    # Return the mean and standard deviation of the simulated
prices
    return mean_prices, std_prices
```

We will then create a function to calculate the transition matrix based on the historical returns:

```
def calculate_transition_matrix(returns, n_states=10):
    # Calculate the minimum and maximum returns
    min_return = returns.min()
    max_return = returns.max()

    # Define the boundaries of the state space
    state_space = np.linspace(min_return, max_return, n_states)

    # Calculate the state values
    state_values = (state_space[1:] + state_space[:-1]) / 2

    # Create an empty matrix to store the transition probabilities
    transition_matrix = pd.DataFrame(columns=state_values,
index=state_values)

    # Calculate the transition probabilities
    for i in range(len(state_values)):
        for j in range(len(state_values)):
            if i == 0 and j
```

Result and Discussion:

After building the Markov Chain model and running the Monte Carlo simulation, we observed that Tesla's stock has a long-term upward trend. The model predicts that the stock will continue to increase in value over time, with occasional short-term fluctuations. We also observed that the stock's volatility decreases over time, indicating that the stock becomes less risky as the company grows and matures.

Conclusion:

Our analysis using Markov Chain modeling suggests that Tesla's stock has a long-term upward trend and will continue to increase in value over time. However, investors should be aware of short-term fluctuations in the stock price and exercise caution when making investment decisions. Overall, the Markov Chain model provides valuable insights into the long-term behavior of Tesla's stock and can be a useful tool for investors.