

# Stock Advisory MLOps Platform

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**GitHub Repository:** <https://github.com/larrysangfake/dsba-platform-template.git>

## Introduction

This toolset supports a realistic financial use case where individuals—such as employees, executives, and founders—hold some company stock. This project aims to provide a simple, actionable toolset to help them manage their stock holdings effectively. The platform showcases MLOps workflows focused on automation, deployment and reproducibility.

## Solution Overview

We are building a toolset that includes a stock price prediction model, a risk assessment dashboard, and a sell/hold recommendation engine. The toolset will be deployed as a web app, making it easy for executives to access and use.

## Workflows Implemented

Workflow	Description
<b>Data Pipeline</b>	Fetch stock data using yfinance in Python, preprocess using pandas, calculate log returns, 50-day and 200-day average prices, store data locally for model construction
<b>Model Training</b>	Use GARCH, Monte Carlo Simulation and Random Forest for stock price forecasting
<b>Deployment</b>	Deploy model as REST API with FastAPI; package using Docker
<b>Monitoring</b>	Log predictions; prepare for future drift detection & retraining integration

## Functionality

The Diversification Advisor module provides personalized recommendations on whether the user should continue to hold, partially sell, or diversify their company stock holdings. It integrates insights from the stock price forecasting modules, performs portfolio concentration analysis, and simulates risk impact of diversification using Modern Portfolio Theory (MPT).

This module uses a rule-based logic engine that takes four main inputs:

1. Price Trend Forecast:
  - **Stock Price Prediction:** Train and deploy Monte Carlo Simulation, GARCH and Random Forest to predict stock price trends.
2. Recommendation Engine:
  - **Personalized Decision Support:** Compare Monte Carlo simulation results against user-defined thresholds.
  - **Generate actionable insights:**
    - Hold recommendation
    - Sell recommendation
    - Potential gain estimations
  - **Input Parameters:**
    - Stock ticker
    - Purchase cost/price
    - Total stock amount
    - Minimum desired gain.

### 3. Concentration Ratio:

Computed as:

$$\text{Concentration Ratio} = \frac{\text{Stock Value}}{\text{Total Portfolio Value}}$$

If the ratio exceeds 60%, the user is flagged as having high concentration risk.

### 4. Portfolio Volatility Simulation

If the user hypothetically sells 20% of the concentrated stock and reinvests into a benchmark ETF (e.g., SPY), the module compares the original vs. adjusted portfolio volatility using:

$$\sigma_p = \sqrt{(w_1\sigma_1)^2 + (w_2\sigma_2)^2 + 2w_1w_2\sigma_1\sigma_2\rho}$$

## Tools and Technologies

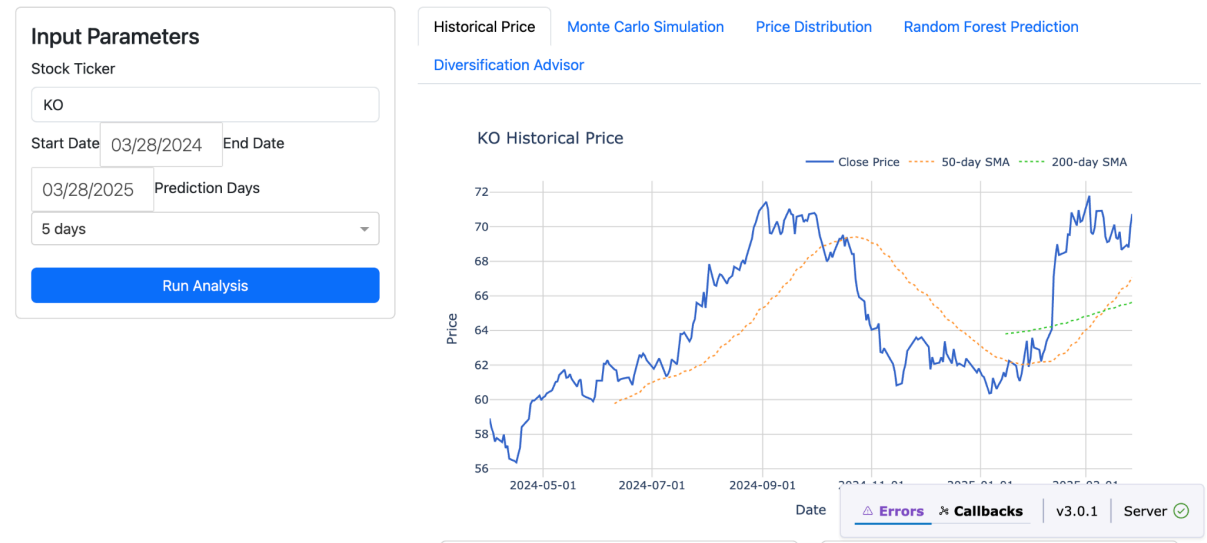
- **Data Collection:** yfinance, pandas, numpy
- **Modeling:** Random Forest, scikit-learn
- **Deployment:** FastAPI, Docker
- **Data Visualization:** dash, plotly

## Expected Outcomes

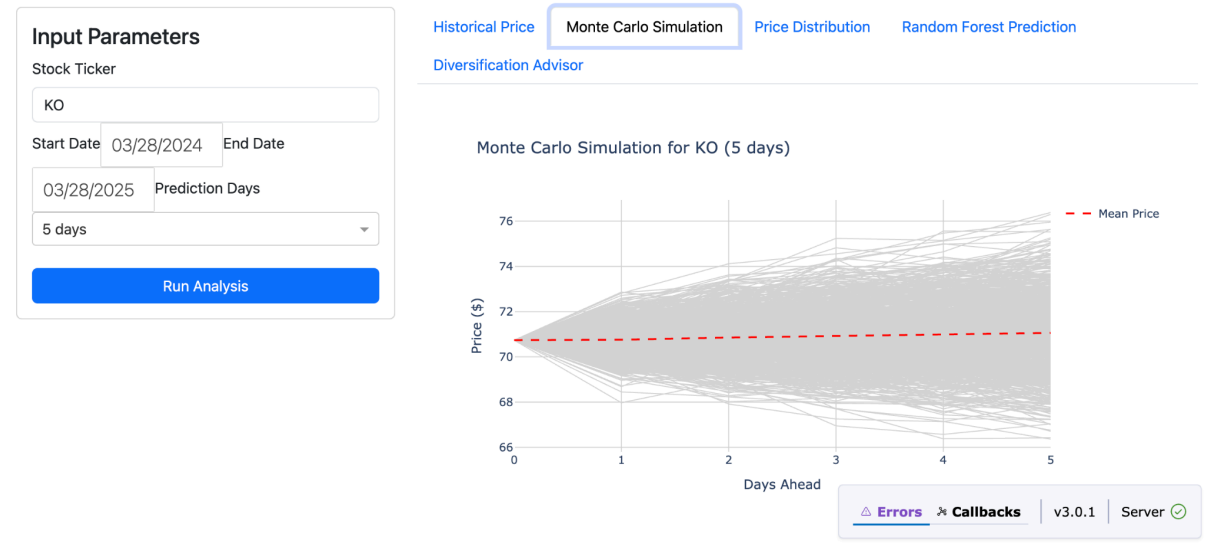
The toolset will help executives make informed decisions about their stock holdings, reducing risk and improving financial outcomes. It will also demonstrate the core skills of MLOps, including model deployment, monitoring, and automation.

Appendices

Stock Price Prediction Dashboard



Stock Price Prediction Dashboard



# Stock Price Prediction Dashboard

Input Parameters

Stock Ticker

KO

Start Date

03/28/2024

End Date

03/28/2025

Prediction Days

5 days

Run Analysis

Historical Price

Monte Carlo Simulation

Price Distribution

Random Forest Prediction

Diversification Advisor

Distribution of KO Price in 5 Days



Errors

Callbacks

v3.0.1

Server

# Stock Price Prediction Dashboard

Input Parameters

Stock Ticker

KO

Start Date

03/28/2024

End Date

03/28/2025

Prediction Days

5 days

Run Analysis

Historical Price

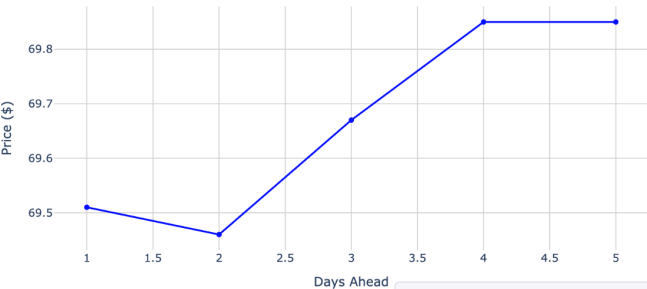
Monte Carlo Simulation

Price Distribution

Random Forest Prediction

Diversification Advisor

Random Forest Prediction for KO (5 days)



Errors

Callbacks

v3.0.1

Server

# Stock Price Prediction Dashboard

Input Parameters

Stock Ticker

KO

Start Date

03/28/2024

End Date

03/28/2025

Prediction Days

5 days

Run Analysis

Historical Price

Monte Carlo Simulation

Price Distribution

Random Forest Prediction

Diversification Advisor

## Monte Carlo-Based Advisor

The model predicts a stable price trend.  
High stock concentration detected. Consider diversifying.  
Diversification reduces overall portfolio risk.  
Recommendation: Sell 20% and reinvest in low-volatility assets like S&P 500 ETFs.

## Random Forest-Based Advisor

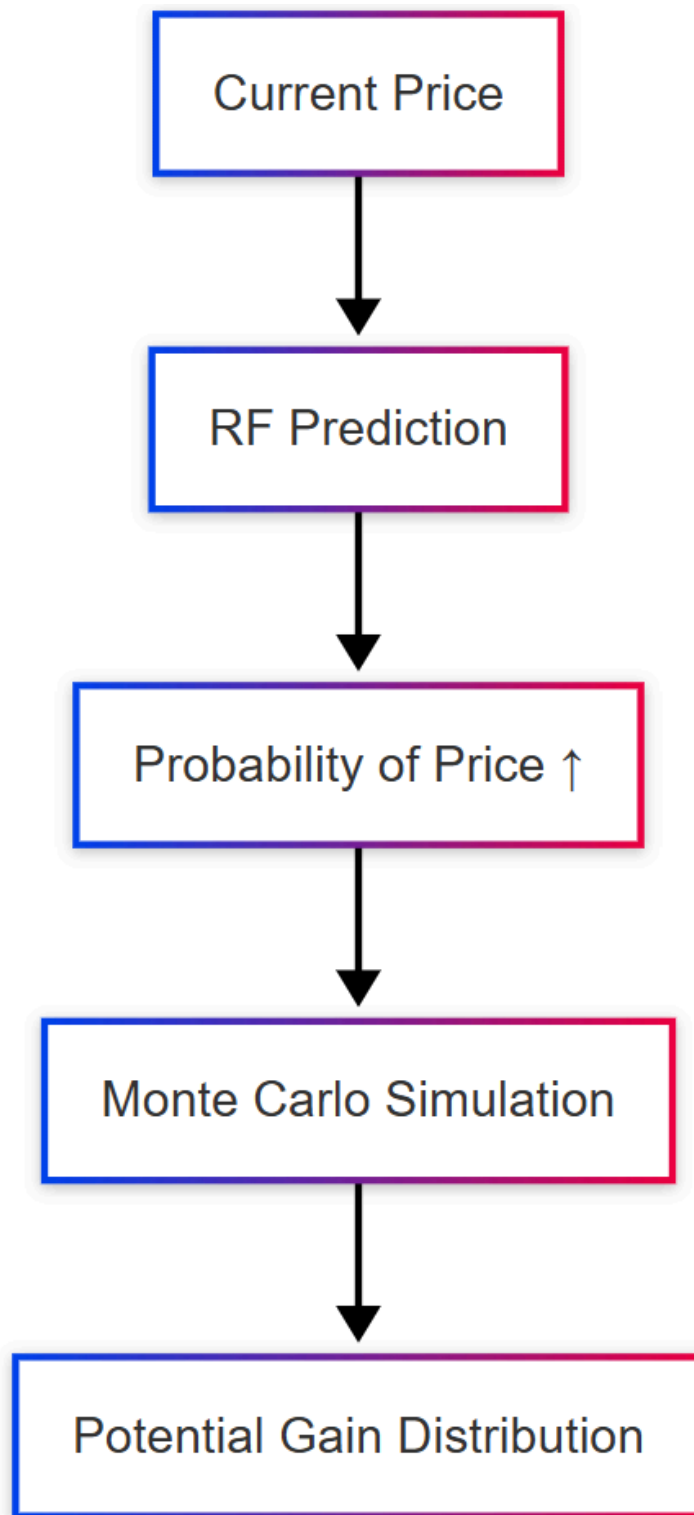
The model predicts a short-term decline. Please be cautious.  
High stock concentration detected. Consider diversifying.  
Diversification reduces overall portfolio risk.  
Recommendation: Sell 20% and reinvest in low-volatility assets like S&P 500 ETFs.

Errors

Callbacks

v3.0.1

Server



Recommendation Logic