UTILIZING ADVANCED MACHINE LEARNING TECHNIQUES FOR PRECISE GOLD PRICE FORECASTING AND ANALYSIS

Advisor : Dr. Atiqur Rahman

Gazi Meraz Mehedi, Anjuman Ritu, Fairooz Nawar

Abstract

The 'UTILIZING ADVANCED MACHINE LEARNING TECHNIQUES FOR PRECISE GOLD PRICE FORECASTING AND ANALYSIS' project aims to predict gold prices based on previous year's data, helping investors decide when to buy or sell gold. In today's globalized economy, gold is one of the most vital assets that is used as an indicator of economic activity. Additionally, it also illustrates the country's financial stability. The objective is to determine the relationship between response variables including various independent variables such as Stock Market index, Silver price, Euro and USD ratio. In the project, we have developed some machine learning algorithms to predict the gold price using historical data. In order to predict the gold price various machine learning algorithms have been developed such as AdaBoost, Random Forest, XGBoost, Decision Tree, ExtraTrees, GradientBoost and Stacked Generalization, Support Vector etc.

Introduction

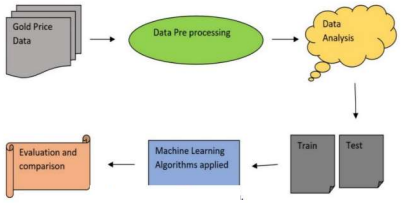
Gold is one of the major assets traded in the global economy that keeps its actual worth. It is considered to be a safe investment. Investing in gold has evolved over time. It can be purchased either in a traditional manner by buying jewelry or in a modern way by buying gold coins or bars. Many countries have utilized gold as a kind of currency in the past. It has also recently retained its worth and has been used to measure the financial health of nations. This value has caught the attention of major investors, who have put large sums in it. Due to its rising value and consequently wide range of applications, gold is yet another benefit that is becoming regarded as a gorgeous investment avenue by many investors.

Predicting daily fluctuations in gold prices can assist investors in choosing the best time to buy or sell this valuable asset. Investors view gold as a means of protecting themselves from market swings in alternative venues. The gold values measurement is usually directly connected to different resources. Due to unpredictability in the market risk, investors are on high alert. So, accurate gold price forecasting is necessary to predict market trends.

Methodology

The underlying concept of our project is the relationship between response and independent variables, with gold representing the outcome. Our project is based on historical data. We have used a total of 9 machine learning algorithms to predict the outcome.

This section describes the process of our work. To finish the entire process, there are multiple steps involved.



The data for this study was diligently acquired from a wide array of sources, spanning a considerable timeframe from **1980 to 2023**. This compilation yielded a substantial dataset comprising approximately 10,391 data points.

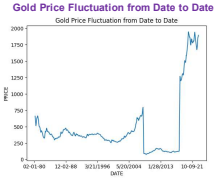
Dataset From 1980-2023

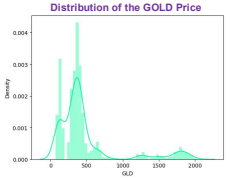
```
[ ] # print first 5 rows in the dataframe
gold_data.head()
```

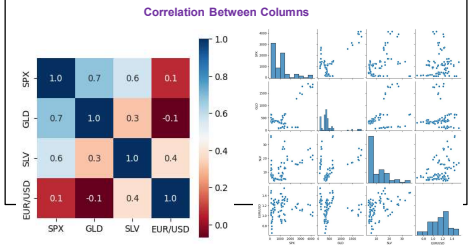
	Date	SPX	GLD	SLV	EUR/USD
0	02-01-80	105.76	559.5	39.95	1.5149
1	03-01-80	105.22	634.0	37.00	1.5177
2	04-01-80	106.52	588.0	32.75	1.5129
3	07-01-80	106.81	633.5	39.00	1.5168
4	08-01-80	108.95	610.0	33.52	1.5108

```
# print last 5 rows of the dataframe
gold_data.tail()
```

	Date	SPX	GLD	SLV	EUR/USD
10577	3/24/2023	3970.99	1978.2000	23.2204	1.0780
10578	3/27/2023	3977.53	1956.5783	23.0129	1.0799
10579	3/28/2023	3971.27	1971.9989	23.3344	1.0842
10580	3/29/2023	4027.81	1962.9123	23.3034	1.0845
10581	3/30/2023	4050.83	1978.4419	23.8752	1.0905

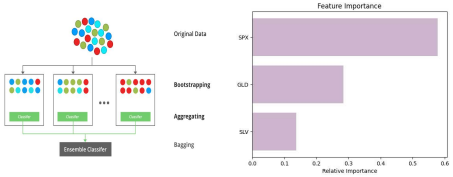


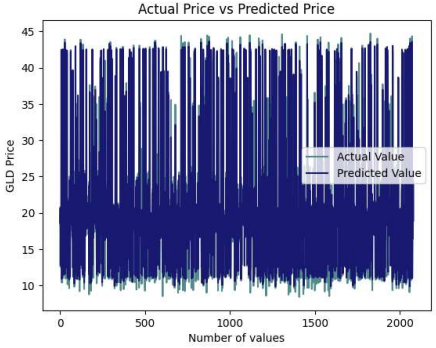


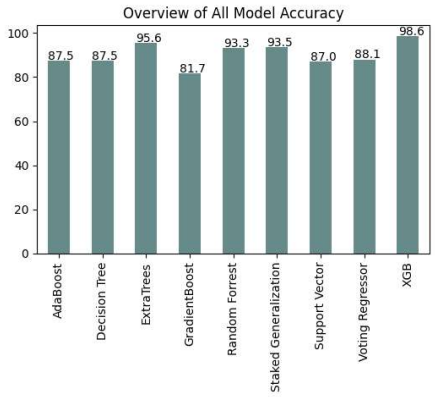


Results

A comparison of the model's performances based on the evaluation metrics has been listed below:







Real-Time Applications

Despite the challenges, there are several real-time applications of machine learning for gold price prediction. Some of the key applications include:

Investment Decision-Making: Machine learning algorithms offer insights into gold price trends, aiding investors in data-driven decision-making with real-time data and models.

Risk Management: Diverse data sources are analyzed to evaluate and manage risks, minimizing potential drawbacks for gold investments.

Trading Plans: Profitable trading strategies are developed by examining historical data and identifying patterns.

Forecasting: Accurate gold price forecasts are generated across various timeframes, using real-time data and sophisticated models for well-informed investment decisions.

Conclusion

In conclusion, the application of machine learning algorithms for gold price prediction has yielded promising results, with **XGBoost (XGB) achieving the highest accuracy at 98.6%.** While Alternative algorithms like Random Forest, Extra Trees, and Stacked Generalization have also demonstrated strong accuracy, XGBoost stands out as a robust choice for accurate and reliable gold price predictions. This project's success underscores the potential of machine learning in accurately forecasting gold prices, which can greatly benefit investors in making informed and profitable decisions in the dynamic gold market.

Acknowledgements

This is to certify that this project is our original work. No part of the work has been submitted elsewhere partially or fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

References

- K. Raza, "Prediction of Stock Market performance by using machine learning techniques", 2017 International Conference on Innovations in Electrical Engineering and Computational Technologies (ICIEECT)
- Ashish Sharma, Dinesh Bhuriya, Upendra Singh. "Survey of Stock Market Prediction Using Machine Learning Approach", ICECA
- https://www.investing.com/currencies/eur-usd-historical-data
- https://tradingeconomics.com/commodity/silver
- https://www.wsj.com/market-data/quotes/index/SPX/historical-prices