CRYPNOSYS

Predicting Financial Asset Prices

A Five-Day Insight

CRYPNOSYS

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INTRODUCTION

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Given the significant reliance of the global economy on financial markets, accurate price prediction is crucial for investors and financial institutions. Time series forecasting tasks can leverage XGBoost, a specialized gradient boosting algorithm that excels in modeling sequential data. This presentation explores the application of XGBoost in predicting the five-day forecast for financial asset prices, highlighting its suitability for such tasks.

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OBJECTIVES

- Collect and clean historical financial data: Gather and preprocess pertinent historical financial data.
- Design XGBoost model: Develop a tailored XGBoost architecture for accurate forecasting.
- Train and validate: Partition the data, optimize parameters, and validate the XGBoost model for robust performance.
- Evaluate performance: Assess model accuracy through metrics such as MSE, MAE, and RMSE.
- Generate forecasts: Utilize XGBoost to predict asset prices for the next five days.
- User Interface: Create a user-friendly interface to enhance user convenience and accessibility.

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MOTIVATION

The intricacy and ever-changing dynamics of financial markets often surpass the capabilities of conventional financial forecasting methods. Our goal is to enhance the accuracy and reliability of predictions for financial asset prices by employing XGBoost, a powerful algorithm proficient at recognizing temporal dependencies in data. This innovative approach aims to enhance decision-making processes within the financial industry, offering a creative strategy to address market complexities.

WHY XGBOOST

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Using two distinct methods, LSTM and XGBoost, we have trained two models. Both strategies have produced results with good accuracy; however, XGBoost is more appropriate for our system,

```
print("Train data R2 score:", r2_score
print("Test data R2 score:", r2_score(
```

```
Train data R2 score: 0.9991392178495577
Test data R2 score: 0.9754577997861515
```

```
print("Train data R2 score:", r2_score
print("Test data R2 score:", r2_score(
```

```
Train data R2 score: 0.995418956089198
Test data R2 score: 0.9751877454380234
```

because it yields better accuracy and is 5-10 times faster than LSTM. As a result, the user can view the results in the User Interface more quickly, which increases the usability of XGBoost.

DATA COLLECTION AND PREPROCESSING

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In the initial phase of our data collection and preprocessing workflow, we retrieve financial data from Yahoofinance, a trusted source. Subsequently, we streamline the dataset by selectively retaining only the 'Close' column, narrowing our focus to the closing prices for analysis. To enhance the robustness of our dataset, we employ the MinMaxScaler, effectively normalizing the data and mitigating the impact of outliers. Taking a step further, we segment the dataset by creating a new set of samples, each comprising 200 consecutive values, with the 201st value serving as the corresponding label. This approach not only facilitates the formation of a structured input-output format for model training but also captures temporal patterns within the data. The final step involves training our model on this refined dataset, harnessing the power of the selected features to enable accurate and meaningful predictions in the realm of financial forecasting.

DATA COLLECTION AND PREPROCESSING

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```
import yfinance as yfin
import datetime as dt


yfin.pdr_override()
start='2013-02-15'
end=dt.datetime.now()
df = pdr.get_data_yahoo('BTC-USD', start, end)
```

Importing Yahoofinance for fetching the data rquired for the model.

Fetching the tabular data for training the model.

```
[1358]
df.head()
```

	Date	Open	High	Low	Close	Adj
0	2014-09-17	465.864014	468.174011	452.421997	457.334015	457.3
1	2014-09-18	456.859985	456.859985	413.104004	424.440002	424.4
2	2014-09-19	424.102997	427.834991	384.532013	394.795990	394.7
3	2014-09-20	394.673004	423.295990	389.882996	408.903992	408.9
4	2014-09-21	408.084991	412.425995	393.181000	398.821014	398.8

MODEL ARCHITECTURE

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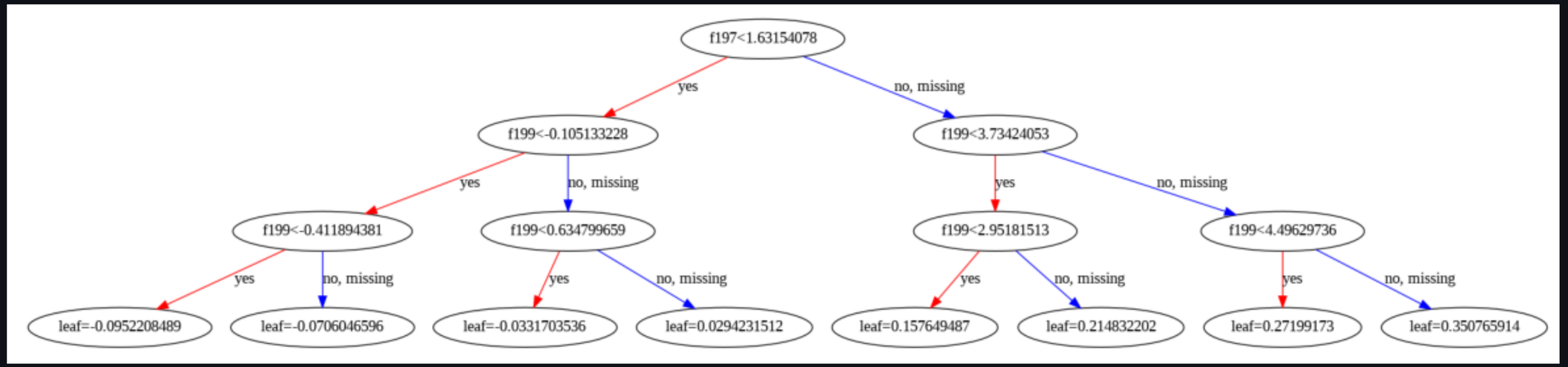
The XGBoost regression model is configured with the following hyperparameters:

Number of Trees (Boosting Rounds): 170

The model is composed of an ensemble of 170 decision trees, trained sequentially to improve predictive performance.

Each tree contributes to the final prediction, and the ensemble helps capture complex relationships within the data.



MODEL ARCHITECTURE

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Learning Rate: 0.04

The learning rate, set to 0.04, determines the step size at each iteration during the training process. A lower learning rate generally requires more boosting rounds but may result in better generalization and prevent overfitting.

Maximum Depth of Each Tree: 3

Each decision tree in the ensemble is constrained to a maximum depth of 3 levels. This limitation helps control the complexity of individual trees, making them "shallow" and reducing the risk of overfitting to the training data.

This configuration is aimed at achieving a balance between model complexity and generalization, with 170 trees, a moderate learning rate, and limited tree depth. The hyperparameters collectively define the architecture and behavior of the XGBoost regression model, making it a powerful tool for predictive modeling tasks.

TRAINING AND VALIDATION

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In this step, we partitioned the data into an 80% training set and a 20% testing set for our XGBoost model. The model was fine-tuned through hyperparameter optimization (n_estimators=170,learning_rate=0.04, max_depth=3) and architecture refinement. The absence of explicit back-testing or cross-validation indicates a reliance onXGBoost's assessing its performance on distinct subsets during training. Finally, the 20% testing set validates the XGBoost model's ability to generate accurate forecasts within this specified 80-20 split.

TRAINING AND VALIDATION

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```
import xgboost as xgb
XGB = xgb.XGBRegressor(n_estimators=170, learning_rate=0.04, max_depth=3)
x_train = x_train.reshape(x_train.shape[0], -1)
XGB.fit(x_train, y_train)
```

XGBRegressor

```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, device=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=0.04, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=3, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
             multi_strategy=None, n_estimators=170, n_jobs=None,
             num_parallel_tree=None, random_state=None, ...)
```

EVALUATION METRICS

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During this stage, we assess the effectiveness of the trained XGBoost model through key metrics, including Mean Squared Error (MSE), Mean Absolute Error (MAE), and R2 score. These metrics serve to quantify the accuracy and precision of our predictions, facilitating a comparative analysis of the model's performance across diverse financial instruments and timeframes. Through the examination of these metrics, we derive valuable insights into the efficacy of our forecasting approach and pinpoint potential areas for enhancement.

EVALUATION METRICS

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```
import math
print("Train data RMSE: ", math.sqrt(mean_squared_error(y_train,y_predicted)))
print("Train data MSE: ", mean_squared_error(y_train,y_predicted))
print("Train data MAE: ", mean_absolute_error(y_train,y_predicted))
print("----------------------------------------------------------------------------------------")
print("Test data RMSE: ", math.sqrt(mean_squared_error(y_test,y_pred)))
print("Test data MSE: ", mean_squared_error(y_test,y_pred))
print("Test data MAE: ", mean_absolute_error(y_test,y_pred))
```

```
Train data RMSE:  917.2480763202965
Train data MSE:  841344.0335132844
Train data MAE:  481.14520360579377
----------------------------------------------------------------------------------------
Test data RMSE:  1530.7289112986161
Test data MSE:  2343130.9998854464
Test data MAE:  1123.982013212482
```

UI BASED SYSTEM

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We've developed a UI-based system, a web application hosted by Streamlit, featuring several components:

1. Asset Selector with five options: Crypto, Stock, Index, ETF, and Mutual Fund.
2. Data Table for comprehensive information.
3. Data Visualization displaying Open, Close, High, and Low values for a given day.
4. Closing Price vs Time Chart, available in Normal, 100 MA (Moving Average), and 200 MA options.
5. Live Data feed for real-time information.
6. Prediction module forecasting asset performance for the next five days.

UI BASED SYSTEM

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Select From The Below Shown List :

Cryptocurrency

Select Cryptocurrency Ticker:

Bitcoin USD (BTC-USD)

Select From The Below Shown List :

Cryptocurrency

- Cryptocurrency
- Stock
- Index
- ETF
- Mutual Fund

Select Cryptocurrency Ticker:

Bitcoin USD (BTC-USD)

- Bitcoin USD (BTC-USD)
- Ethereum USD (ETH-USD)
- Tether USDt USD (USDT-USD)
- BNB USD (BNB-USD)
- Solana USD (SOL-USD)
- Lido Staked ETH USD (STETH-USD
- XRP USD (XRP-USD)

Asset Selector

UI BASED SYSTEM

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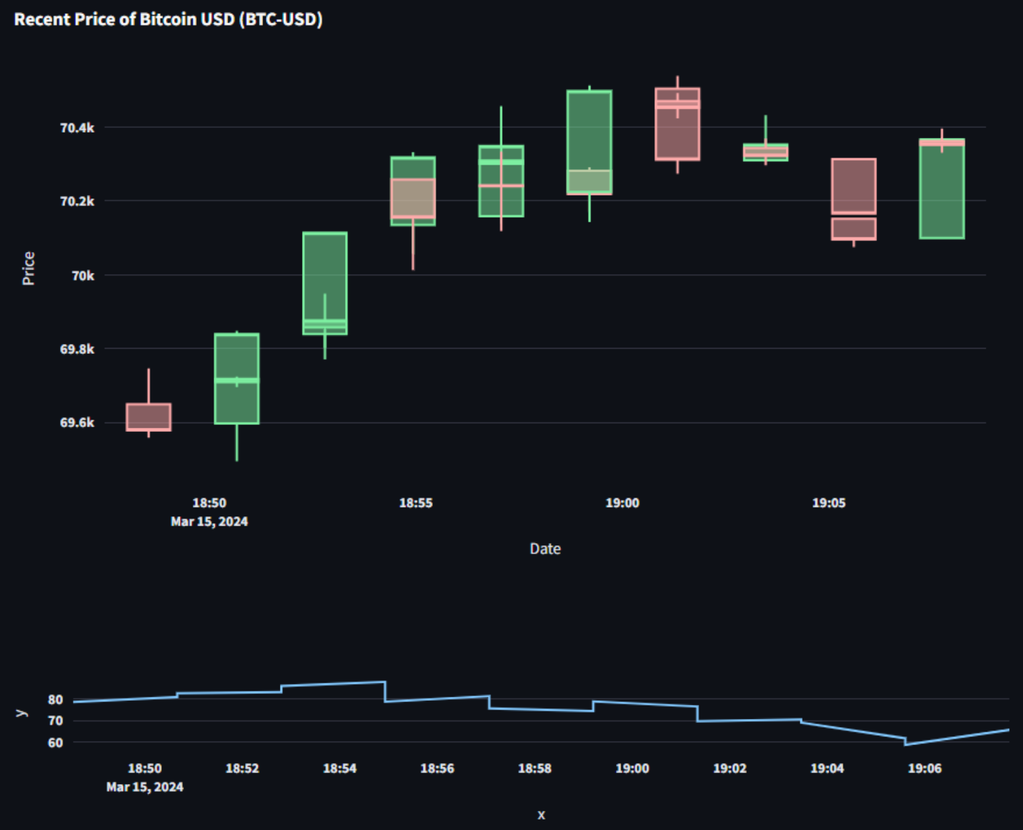
Data Visualization

Stream The Live Data



Data Visualization & Live Data

UI BASED SYSTEM

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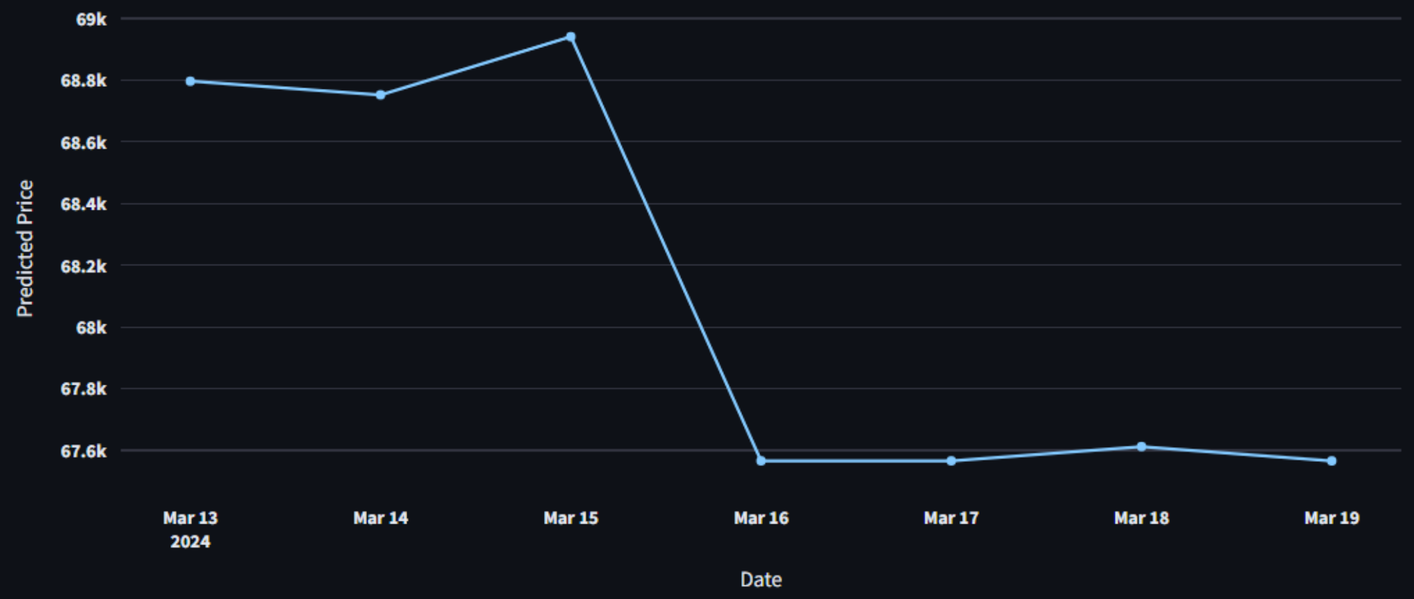
Prediction of the prices of Bitcoin USD (BTC-USD) in next 5 days



Crypnosys predicts these range of Price 67566.0703125 - 68941.03125 in Bitcoin USD (BTC-USD) for the next 5 days

CONCLUSION

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In conclusion, our project represents a significant advancement in financial forecasting by utilizing XGBoost model to predict asset prices with increased precision. We provide users with actionable insights to help them make wise investment decisions by integrating real-time data from Yahoo Finance. Our joint endeavor highlights how well machine learning can identify market trends. As we advance, we hope that our efforts will spur further financial innovations that will make it possible for investors to navigate the market with greater assurance and effectiveness.

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- GOT QUESTIONS?
- WANT TO GIVE SUGGESTIONS?

Reach out


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THANK YOU!!!