# Tree Based Predictions and Forecast on Bitcoin Prices

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# Introduction

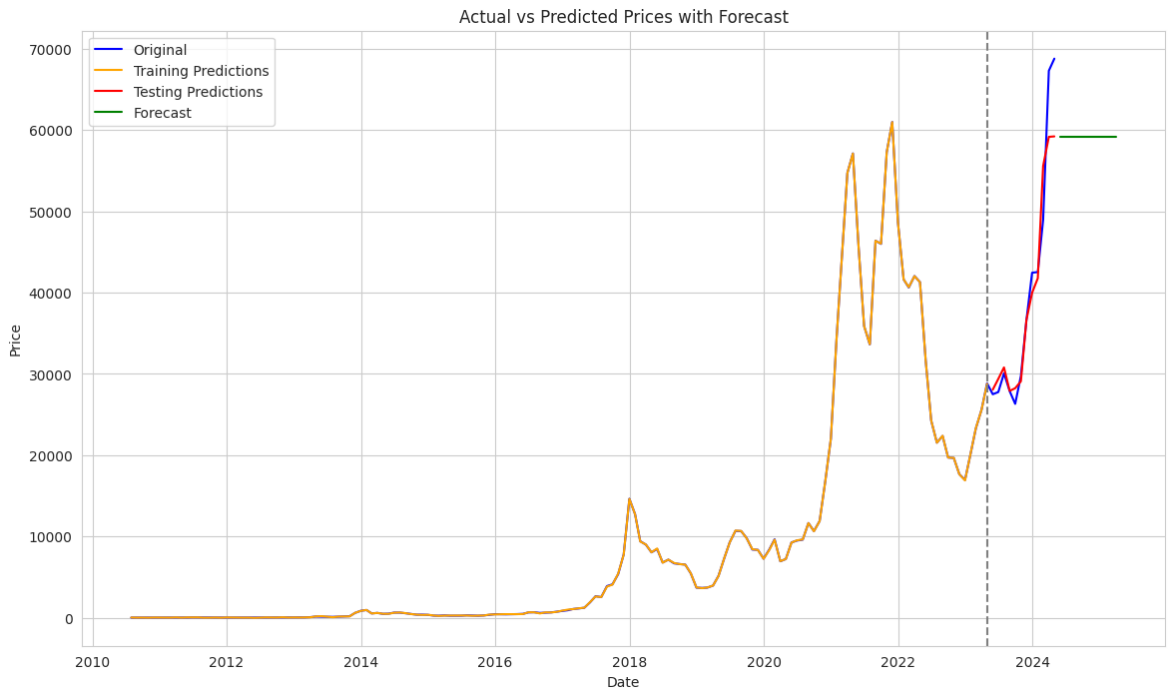
- Overview of the Problem Statement
  1. The accurate forecasting of Bitcoin prices is challenging due to its high volatility and complex patterns.
  2. Investors, economists, and policymakers need reliable models to make informed decisions and mitigate risks.
- Significance
  1. Enhances investment strategies by providing tools for better decision-making.
  2. Offers insights into market trends (bull or bear phases).
  3. Contributes to stabilizing cryptocurrency markets by reducing volatility.
  4. Advances methodological approaches in financial forecasting.

# Key Ideas and Approach

- Key Concepts and Methodologies
  1. Analysis of monthly Bitcoin price changes since June 2010.
  2. Utilization of one non-tree-based model (ARIMA) and six tree-based algorithms (Decision Tree, Random Forest, Gradient Boosting, LightGBM, CatBoost, AdaBoost).
  3. Evaluation metrics: Mean Absolute Scaled Error (MASE), Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE).
- Approach
  1. Application of ARIMA to capture temporal dependencies and seasonality.
  2. Comparison of tree-based algorithms to identify the best performing models.
  3. Creation of hybrid models using the top three performing algorithms.
  4. Evaluation of hybrid models against individual algorithms to determine the most effective forecasting approach.

# Outcomes and Results

- **Main Outcomes**
  1. Gradient Boosting, CatBoost, and Random Forest identified as the top-performing individual models.
  2. Hybrid models demonstrated enhanced accuracy over individual algorithms.
- **Significant Findings**
  1. Gradient Boosting, Random Forest, and CatBoost hybrid model achieved the best MASE results.
  2. The study provides evidence that hybrid models offer superior predictive accuracy.
  3. Indication that the cryptocurrency market is currently stable and not in a bull season.



# Challenges and Future Directions

- Challenges Encountered
  1. High volatility and unpredictability of Bitcoin prices posed significant modeling challenges.
  2. Ensuring data quality and handling missing values and anomalies in the dataset.
- Future Directions
  1. Further refinement of hybrid models to improve predictive accuracy.
  2. Exploration of additional machine learning techniques and their combinations.
  3. Extension of the study to other cryptocurrencies and financial assets.
  4. Continuous monitoring and updating of models to adapt to market changes and new data.