

Predicting CPI and Unemployment Rate Using Machine Learning

This repository contains a comprehensive project focused on predicting the **Consumer Price Index (CPI)** and **Unemployment Rate (UNRATE)** using advanced machine learning techniques. The dataset comprises historical CPI and unemployment data, with engineered features to capture trends, seasonality, and lags in time-series data.

Project Features

- **Dataset:** Historical CPI and UNRATE data merged into a single time-series dataset.
- **Feature Engineering:**
 - Lagged features for up to 12 months to capture historical dependencies.
 - Moving averages for short-term trend smoothing.
 - Seasonal features like year and month indicators.
- **Models Implemented:**
 - XGBoost Regressor for robust, gradient-boosted prediction performance.
 - Feature selection with Lasso regularization to improve model interpretability.
 - Dimensionality reduction using Principal Component Analysis (PCA).
- **Hyperparameter Tuning:** Optimized model parameters using GridSearchCV to improve accuracy.
- **Evaluation Metrics:**
 - Mean Absolute Error (MAE) and Mean Squared Error (MSE) to assess prediction quality.

Key Results

- Optimized XGBoost achieved promising results for CPI and UNRATE predictions.
- Experimented with feature engineering techniques and model tuning to reduce prediction errors.

Usage

1. Clone the repository:

```
bash
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```
git clone https://github.com/yourusername/cpi-unrate-prediction.git  
cd cpi-unrate-prediction
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2. Install dependencies:

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pip install -r requirements.txt
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3. Run the feature engineering and modeling script:

bash

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python main.py
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4. Explore the results and model evaluation in the results folder.

Future Improvements

- Incorporating external economic indicators (e.g., GDP, inflation rates).
- Testing hybrid time-series models like ARIMA-XGBoost or Prophet for better seasonal trend capture.
- Further optimizing hyperparameters and exploring deep learning models for time-series forecasting.