

Week 10 Documentation

Brent Oil Price Analysis - Change Point Detection & Forecasting

Project Overview

This project examines **Brent oil prices** over time, detecting major **change points** and correlating them with significant events such as **political decisions, economic policies, and global conflicts**. The goal is to provide **data-driven insights** for investors, policymakers, and analysts.

Project Structure

```
BrentOilPriceAnalysis/
├── backend/                # Flask API for data processing & ML models
│   ├── app.py              # Main API to serve results
│   ├── data_processing.py  # Data preprocessing functions
│   ├── models.py           # ARIMA, GARCH, LSTM implementations
│   └── requirements.txt    # Dependencies for backend
├── frontend/              # React Frontend Dashboard
│   ├── src/
│   │   ├── components/    # UI elements for charts, tables, etc.
│   │   ├── pages/         # Main dashboard pages
│   │   ├── services/      # API calls to backend
│   │   └── App.js          # Root component
│   └── package.json        # Frontend dependencies
├── notebooks/             # Jupyter Notebooks for analysis
│   ├── eda.ipynb           # Exploratory Data Analysis
│   ├── changepoint_detection.ipynb # Change point detection & visualization
│   └── model_training.ipynb # Time series forecasting
└── README.md               # Project documentation
```

Task 1: Data Analysis & Understanding

Workflow & Data Understanding

- **Dataset:** Historical Brent oil prices (May 1987 - Sept 2022).
- **Preprocessing:** Cleaned missing values and normalized date format.

- **Exploratory Data Analysis (EDA):**
 - Trends and seasonality examined.
 - Price distributions visualized.
- **Time Series Modeling:**
 - ARIMA (forecasting).
 - GARCH (volatility analysis).
 - LSTM (deep learning).

2 Understanding Models

- **ARIMA:** Captures trend and seasonality in time series.
 - **GARCH:** Detects price volatility and risk.
 - **LSTM:** Uses neural networks to model long-term dependencies.
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Task 2: Advanced Statistical Analysis & Machine Learning

1 Additional Models & Techniques

- **VAR (Vector Autoregression):** Multivariate time series analysis.
- **Markov-Switching ARIMA:** Identifies market condition shifts.
- **LSTM:** Captures non-linear dependencies in oil price movement.

2 External Influences on Oil Prices

- **Economic Indicators:** GDP, inflation, unemployment, exchange rates.
- **Technological Innovations:** Fracking, renewable energy impact.
- **Political & Regulatory Factors:** OPEC policies, trade sanctions.

3 Model Validation

- **Backtesting:** Assesses model accuracy on past data.
 - **Performance Metrics:** RMSE, MAE, R².
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Task 3: Interactive Dashboard Development

1 Backend (Flask)

- **API Endpoints:**
 - `/api/prices`: Serves historical price data.
 - `/api/events`: Provides significant global events.
 - `/api/forecast`: Returns future price predictions.

2 Frontend (React)

- **Visualizations:**
 - Interactive line charts for oil prices.
 - Event markers highlighting historical impacts.
 - **User Controls:**
 - Date range filters.
 - Event comparison tools.
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Installation & Execution

1 Prerequisites

- **Backend:** Python 3.8+, Flask, Pandas, Scikit-learn.
- **Frontend:** Node.js 14+, React, Recharts.

2 Running the Project

Backend

```
cd backend  
pip install -r requirements.txt  
python app.py
```

Frontend

```
cd frontend  
npm install  
npm start
```

Access Dashboard

Visit <http://localhost:3000>

Future Enhancements

- **Real-time Data Updates**
 - **Transformer-based Forecasting Models**
 - **User-customizable Dashboards**
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Contributors

- Data Analysis & ML Models
 - Backend API Development
 - Interactive Dashboard UI
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 Developed for 10 Academy AI Mastery Challenge | Brent Oil Price Analysis 
