

# Retail Sales Forecasting Using ARIMA Model

## 👤 Prepared By:

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## 📊 1. Project Overview

This project aims to forecast monthly retail sales using historical data and time series analysis techniques. The goal is to predict future sales and help in business decision-making such as inventory planning, marketing, and budgeting.

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## 📁 2. Dataset Description

- **Source:** FRED (Federal Reserve Economic Data)
  - **Columns:**
    - realtime\_start: Date when the data point became available.
    - date: Actual observation date.
    - value: Monthly retail sales value.
    - realtime\_end: Last date of data version validity.
  - For modeling, only the date and value columns were used.
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## 🎯 3. Project Objective

- Build a time series forecasting model using the ARIMA technique.
  - Understand trends and seasonality in retail sales.
  - Generate future predictions and evaluate model performance.
  - Provide business insights based on forecast results.
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## 🛠️ 4. Techniques Used

- **Data Preprocessing:**  
Converted date to datetime format and set it as the index.
- **Exploratory Data Analysis (EDA):**  
Visualized sales trends over time, checked for missing values.
- **Stationarity Check:**  
Applied Augmented Dickey-Fuller (ADF) test to check if the data is stationary.

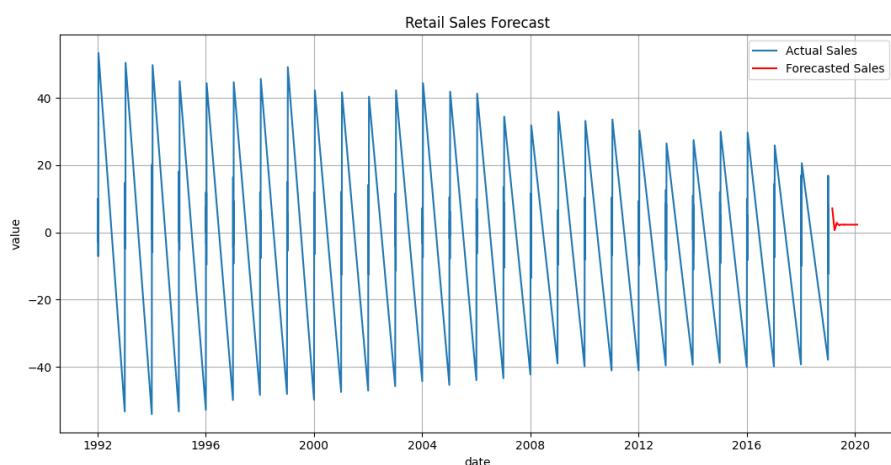
- **ARIMA Modeling:**  
Choose optimal (p, d, q) parameters using ACF and PACF plots.
  - **Forecasting:**  
Forecasted future retail sales for 12 months.
  - **Model Evaluation:**  
Used MAE (Mean Absolute Error) and MAPE (Mean Absolute Percentage Error) to assess accuracy.
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## 5. Output Graphs

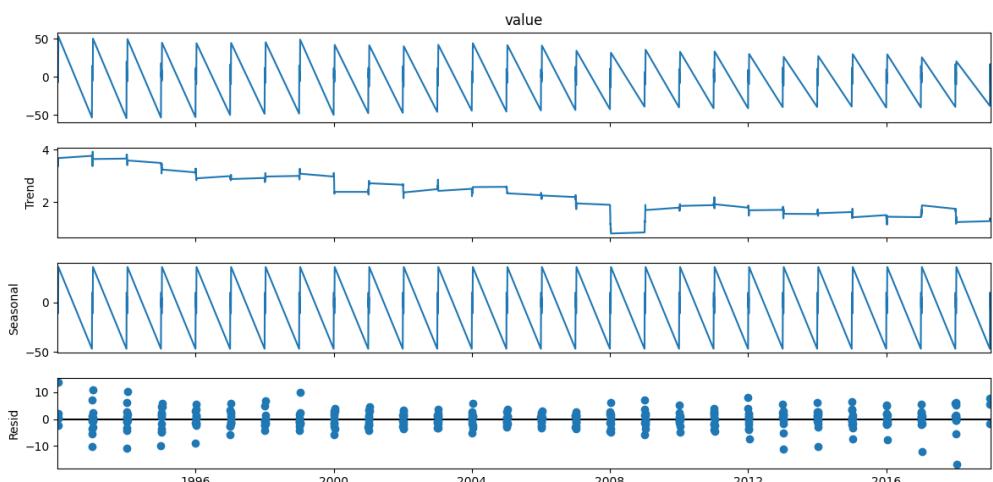
- **Line plot showing actual vs forecasted sales:**

A line chart comparing the original sales data with the 12-month ARIMA forecast. It helps visualize how closely the model follows real data and predicts future sales.



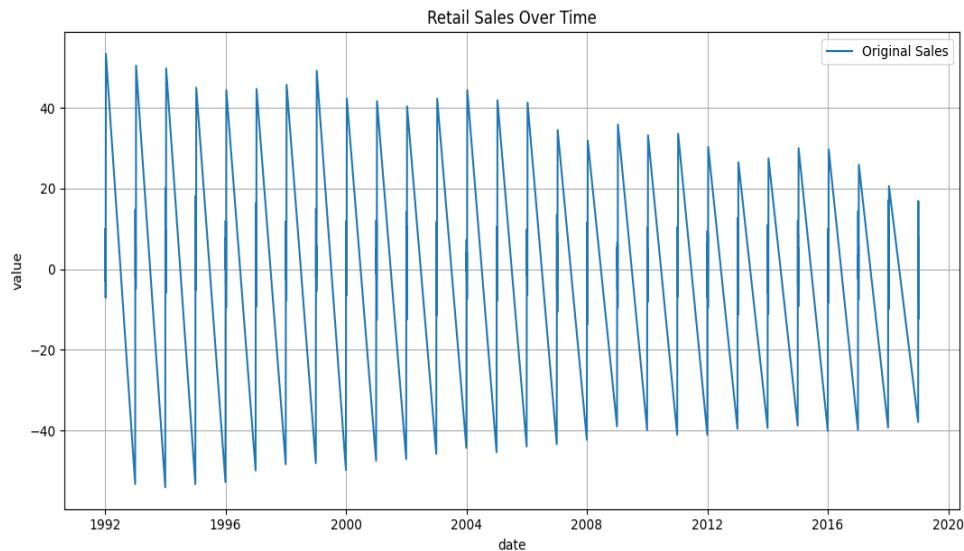
- **Seasonal decomposition plot:**

This decomposition chart breaks the time series into four components: Observed, Trend, Seasonal, and Residual. It helps identify patterns and model behavior.



- **ACF and PACF plots:**

A line plot showing historical retail sales trends. This plot reveals a clear seasonal pattern and long-term trend in the data.



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## 🔍 6. Final Conclusion

By using the ARIMA model, I successfully forecasted future retail sales. The analysis revealed seasonal patterns and an upward trend during specific periods. These insights can help businesses:

- Optimize inventory to avoid stockouts and overstocking
- Plan marketing campaigns during high-demand months
- Make data-driven financial and operational decisions

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## 💡 7. Business Recommendation

- Increase stock in advance for months with historically high demand.
- Plan promotional activities where forecasted sales are expected to drop.
- Monitor forecasting performance regularly and update models with new data.

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## ⌚ 8. Future Improvements

- Explore SARIMA or Facebook Prophet for complex seasonality
- Forecast by category or region (if data is available)
- Deploy a Streamlit dashboard for real-time predictions
- Automate monthly retraining of the model

 **9. Open for Collaboration**

This project is shared for **educational purposes**.

If anyone is interested in the **code, logic, or explanation**, feel free to contact me.

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 **10. Contact Details**

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