Forecasting Flock

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Demand Forecasting Model for Inventory Management

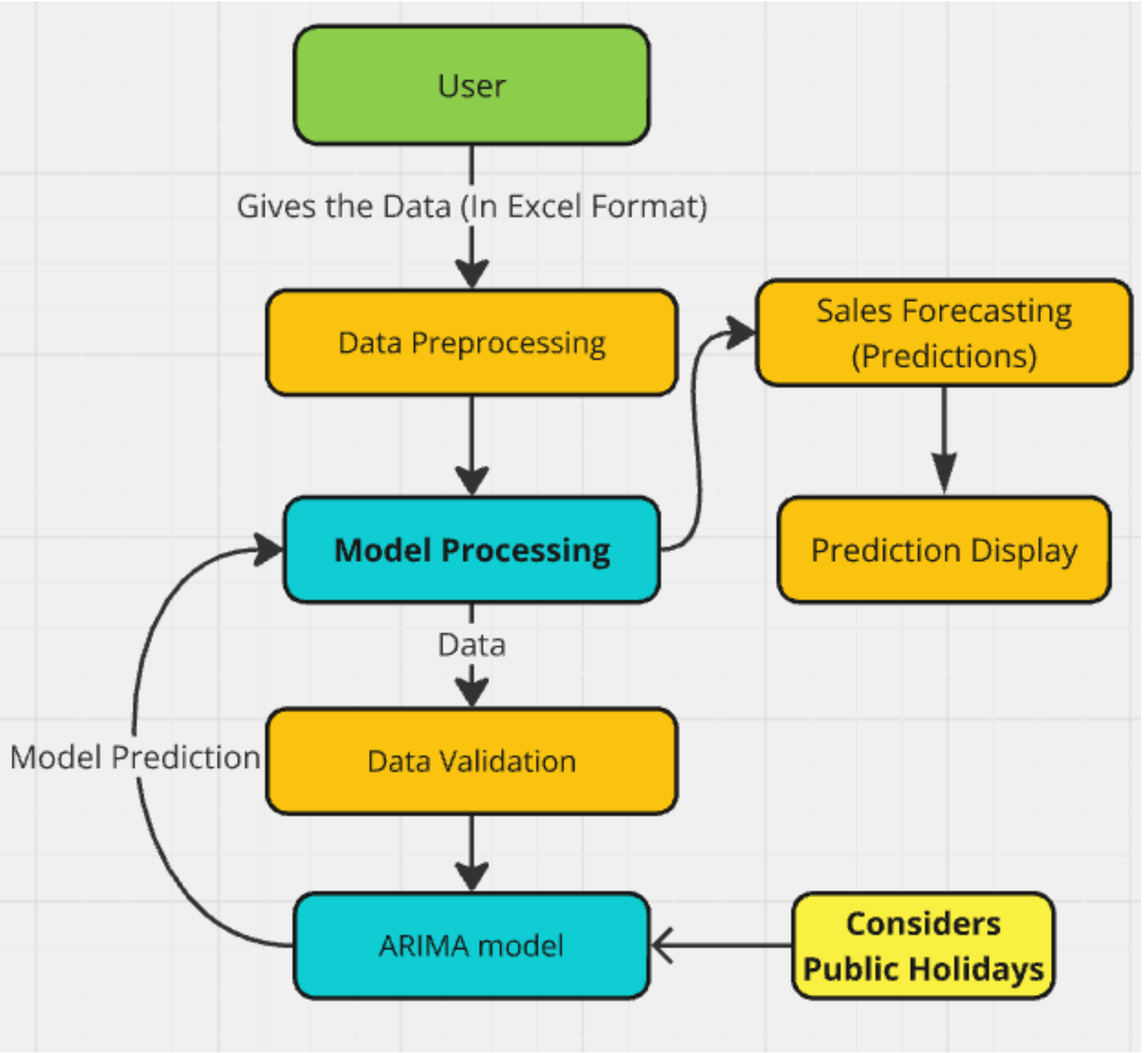
Problem Statement: Organizations in the retail sector face significant challenges in accurately forecasting demand. Inaccurate demand forecasting leads to two critical issues:

1. **Stockouts:** Insufficient inventory levels causing missed sales opportunities and decreased customer satisfaction.
2. **Excess Inventory:** Overestimating demand results in excess stock, leading to increased holding costs and potential wastage.

Objective

To develop effective forecasting models (univariate and multivariate) that utilize historical sales data and market trends to provide accurate demand forecasts. This will improve inventory management and production planning efficiency, minimizing stockouts and excess inventory.

Workflow



Approach Taken

1.Data Collection and preprocessing

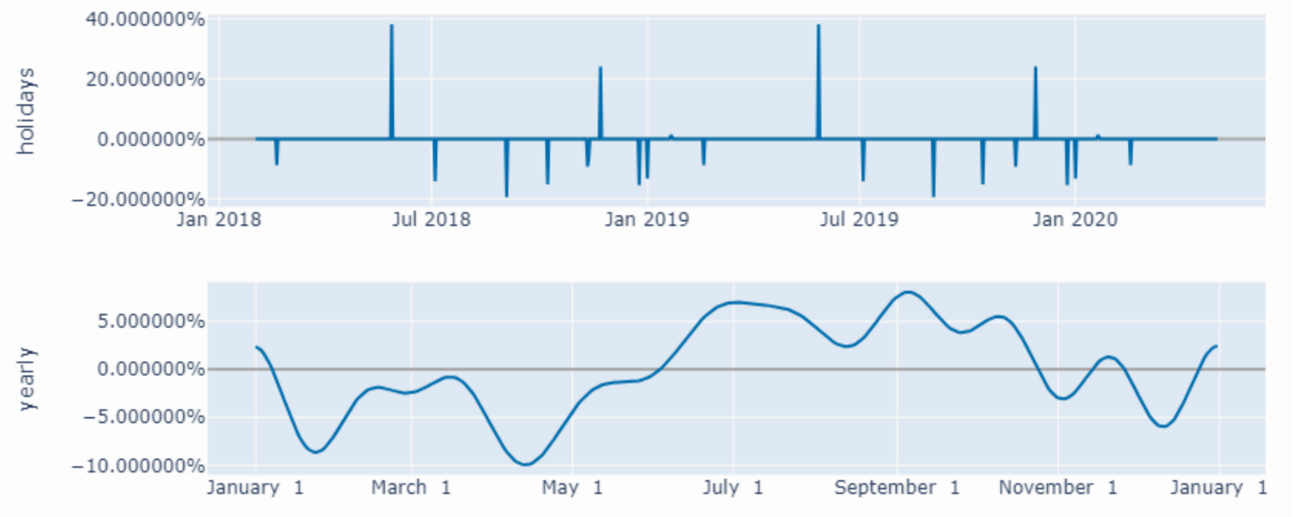
- **Data Collection:** Collecting historical data from the user in the form of excel file which will include sales volumes (monthly or daily), and timestamps.
- **Data Cleaning:** Handle missing values, remove duplicates, and correct data entry errors.
- **Feature Engineering:**
  - Time Features: Extract month, quarter, year, and holiday information.
  - Sales Trends: Calculate moving averages, seasonal decomposition, and trend components.

2.Model Selection

- **Model Choice:** Choose the ARIMA (AutoRegressive Integrated Moving Average) model for its robustness in handling time series data.
- **Multivariate Features:** Includes features such as holidays, promotions.

3.Model Training and evaluation

- **Training the Model:** Training the ARIMA model on historical sales data and validating using metrics Mean Absolute Percentage Error (MAPE).
- **Residual Analysis:** Check residuals to ensure they behave like white noise, indicating a good model fit.



4. **Forecasting and Interpretation**
   - **Sales Forecasting:** Use the trained ARIMA model to predict future sales.
   - **Trend Analysis:** Analyze predicted trends to understand seasonal patterns and demand fluctuations.

5. Advanced Data Visualization with Microsoft Power BI:

- **Interactive Dashboards:** Create dynamic dashboards to visualize historical sales data, forecasted demand, and inventory levels.
- **Custom Reports:** Develop custom reports tailored to specific business needs, allowing deeper insights into sales patterns and trends.

6.Web Application Integration

- **Interface Design:** A ReactJs web application allowing users to input monthly sales data for real-time forecasting.
- **Integration:** Integrate ARIMA model into the web application backend to compute and display predicted sales for the upcoming month.

Summary

Solution: ARIMA Machine Learning Model for Demand Forecasting

Overview: We propose an ARIMA (AutoRegressive Integrated Moving Average) model to accurately forecast demand in the retail sector.

Key Features:

1. Data Input: Users can input historical sales data in a sales vs. date format.
2. Model Training: The ARIMA model leverages this historical data to identify patterns and trends.
3. Demand Forecasting: The model generates precise sales/demand forecasts based on the input data.
4. User-Friendly Interface: Simplified data input and clear output presentation ensure ease of use.

Benefits:

- **Accurate Demand Forecasts:** Improved prediction accuracy reduces stockouts and excess inventory.
- **Optimized Inventory Management:** Better demand prediction enables efficient inventory planning and reduces holding costs.
- **Enhanced Production Planning:** Aligns production schedules with forecasted demand, improving operational efficiency.

Thank you