Problem Statement (As Defined By The Client)

Client Requirement

- The Client, A Retail Chain, Wants To Evaluate And Visualize The Performance of its Inventory Prediction Model. The Client Has Noticed Discrepancies Between The Actual Inventory Levels And The Predicted Inventory Levels

- The Current Prediction Model is Not Accurately Reflecting Inventory Trends, Resulting in Significant Errors in Inventory Planning

- The Client Has Provided Historical Inventory Data, Which Includes Monthly Records of Actual Inventory Levels And The Inventory Levels Predicted By Their Existing Forecasting Model

- The Client Wishes To Understand if The Model is Biased And Whether The Predicted Values Consistently Deviate From The Actual Values in A Particular Direction

Specific Goals

1. Identify And Visualize The Bias Trend in The Prediction Model By Comparing The Actual And Predicted Inventory Values on A Monthly Basis
2. Quantify The Degree of Bias Using Appropriate Statistical Measures Like Mean Bias Error And Graphical Representations
3. Suggest Improvements To Reduce Bias And Improve The Accuracy of The Inventory Forecasting Model

Problem Statement (As Defined By The Data Scientist)

Title

Evaluating Bias in Inventory Forecasting Model Using Historical Inventory Data

Objective

- To Evaluate And Visualize The Bias in The Current Inventory Forecasting Model Using Historical Inventory Data

- The Project Aims To Identify Trends of Overestimation OR Underestimation By The Prediction Model And Suggest Methods To Correct The Bias For More Accurate Future Predictions

Problem Description

- The Client's Existing Inventory Prediction Model Appears To Overestimate OR Underestimate Actual Inventory Levels, Resulting in Suboptimal Inventory Management Decisions

- There is A Need To Evaluate if The Model Consistently Shows A High Bias OR Low Bias By Comparing Actual And Predicted Inventory Values

Remarks on The Current Model

- The Model Predictions Are Represented By The Predicted Inventory Values, And The Actual Inventory Levels Are Recorded Under Actual Inventory

- If Predicted Inventory is Consistently Higher Than Actual Inventory, it Indicates High Bias

- Conversely, If The Predicted Inventory is Consistently Lower, it Indicates A Low Bias

- The Model's Accuracy Needs To Be Visualized And Quantified Using Statistical And Graphical Methods To Clearly Identify The Presence And Extent of Bias

Approach

1. **Data Analysis**

   - Use The Provided Monthly Data For Actual And Predicted Inventory Levels

   - Calculate The Differences Between Actual And Predicted Values To Identify Bias Patterns

   - Measure The Mean Bias Error (MBE) To Quantify The Extent of Bias

2. **Data Visualization**

   - Create A Scatter Plot With Straight Lines And Markers To Visualize The Relationship Between Actual And Predicted Inventory Levels Over Time

   - Use A Line Chart To Highlight Deviations And Identify Trends in Overestimation OR Underestimation

3. **Bias Analysis**

   - Use Color Coding To Highlight Periods of Overestimation (High Bias) And Underestimation (Low Bias)

   - Calculate The Mean Absolute Percentage Error (MAPE) To Measure The Model's Prediction Accuracy

4. **Model Improvement Suggestions**

   - Provide Insights on Why The Current Model May Be Showing Bias (e.g., Not Accounting For Seasonality, Demand Spikes, etc.)

   - Suggest Modifications To The Existing Model, Such As Using More Complex Forecasting Techniques (e.g., Exponential Smoothing, ARIMA)

Expected Outcome

- A Clear Visualization of Bias in The Prediction Model, Showing How Far The Predictions Deviate From Actual Values

- Quantification of Bias Through Statistical Measures Such As Mean Bias Error (MBE) And Mean Absolute Percentage Error (MAPE)

- Recommendations on How To Refine The Model To Reduce Bias And Achieve More Accurate Inventory Predictions

Sample Data

Month	Actual Inventory	Predicted Inventory
January	120.00	150.00
February	130.00	145.00
March	110.00	140.00
April	150.00	155.00
May	140.00	130.00
June	160.00	150.00
July	170.00	160.00
August	165.00	155.00
September	180.00	170.00
October	175.00	165.00