Temperature Analysis Report

1. Overview

This report provides an analysis of temperature variations over time using recorded and predicted values. The data is sourced from the file `predicted_temperatures_2025-02-05_22-39-21.csv` and covers multiple years from 2013 to 2017.

2. Dataset Details

The dataset includes the following key variables:

- **Humidity**: The recorded humidity level.
- **Wind Speed**: The recorded wind speed.
- **Mean Pressure**: The atmospheric pressure.
- **Date (Numeric & Text Format)**: The recorded date.
- **Predicted Temperature**: The model-predicted temperature values.
- **Actual Mean Temperature**: The recorded mean temperature.

The dataset spans from **December 30, 2012, to March 26, 2017**, covering multiple years of weather observations.

3. Temperature Per Month Analysis

The **Temperature Per Month Bar Plot** visualizes the sum of actual mean temperatures aggregated by month and year. The data spans five years, with observations categorized into 12 months and broken further into weeks. The stacked bar chart representation highlights the variations and seasonal temperature trends across different years.

Key insights:

- The sum of actual mean temperatures ranges from **10.0 to 260.6**.
- Distinct seasonal patterns are visible, with temperature fluctuations aligning with expected climate variations.

4. Quarterly and Weekly Temperature Predictions

A detailed breakdown of actual mean temperature, humidity, and predicted temperatures is presented per quarter and week. The stacked bar chart uses color differentiation to highlight humidity and temperature variations over time.

Observations:

- The temperature variations are evident across different quarters.
- The dataset includes filters to segment the data based on months and weeks, providing refined insights into seasonal trends.

5. Temperature Classification: High vs. Low

A classification approach categorizes actual mean temperature as **High** or **Low**, using a threshold of **15 degrees Celsius**. A bar plot visualizes this classification across weeks and years.

Findings:

- Temperature classification helps in understanding extreme variations.
- The majority of weeks show a clear distinction between high and low-temperature weeks.

6. Forecasting Temperature and Humidity Trends

This visualization captures the **trends of actual and predicted temperature** along with humidity levels, segmented by year and week.

Highlights:

- A line plot presents the forecasted and actual values.
- The dataset includes a `Forecast Indicator` dimension, differentiating between actual and estimated values.
- Predicted temperature trends follow a smooth trajectory, showing the effectiveness of the forecasting model.

7. Predictions for 2016 and 2017

A bar plot specifically tracks predicted temperature trends for the years **2016 and 2017**. The dataset is filtered to include only these years, enabling a focused comparison with prior years.

Insights:

- Predicted temperatures range between **22.1 and 247.8**.
- Trends indicate whether the model effectively captures yearly variations.

8. Target Chart: Predicting Long-Term Trends

The final visualization tracks long-term predicted temperature trends using a **line chart**. This data-driven approach aids in identifying macro-level temperature patterns over multiple years.

Key takeaways:

- Predictions align with observed seasonal variations.
- The model provides a robust framework for understanding future temperature trends.

9. IoT Dataset for Visualization

For this analysis, we used the **Household Energy Consumption dataset**, which meets the following requirements:

- It is derived from an IoT system that tracks energy consumption in households.
- It includes machine learning predictions for power usage trends.
- It differs from the dataset used in the final project.
- A representative subset of the data was used for effective visualization.

10. IoT Dashboard Visualizations

To present insights effectively, the dashboard includes:

1. **Summary Visualization**: A bar chart showing total energy consumption over time, allowing users to see trends at a glance.
2. **Status Visualization**: A gauge chart displaying the current energy usage compared to expected values, providing real-time monitoring insights.
3. **Machine Learning Visualization**: A line chart depicting predicted vs. actual energy consumption over time, highlighting prediction accuracy.

11. Dashboard Layout Considerations

- **User-Friendly Design**: Visualizations were arranged logically, with labels and descriptions.
- **Color Consistency**: A consistent color scheme was applied for clarity.
- **Pre-Attentive Attributes**: Important data points were highlighted using contrasting colors and markers.
- **Interactive Components**: Charts interact dynamically, allowing users to filter by date range and consumption category.

12. Conclusion

The dataset and its visualizations provide significant insights into temperature trends and energy consumption. By integrating machine learning predictions and interactive dashboards, users can effectively analyze historical trends and make data-driven decisions. The IoT dataset enhances the report by incorporating real-world applications of predictive analytics in energy monitoring.