Lab Assignment: Weather Data Visualizer

This document completes the Lab Assignment: **Data Analysis and Visualization with Real-World Weather Data**. It outlines the approach, key steps performed, sample code snippets, and the list of output files generated for submission.

Task 1: Data Acquisition and Loading

- Downloaded a CSV weather dataset (sample structure included in /data/).
- Loaded dataset into pandas DataFrame, inspected using head(), info(), describe().
- Ensured date column parsed to datetime.

Task 2: Data Cleaning and Processing

- Handled missing values by imputing or dropping as appropriate.
- Converted date columns to datetime and set as index for resampling.
- Filtered relevant columns: temperature, rainfall, humidity.

Task 3: Statistical Analysis with NumPy

- Calculated daily, monthly, yearly statistics: mean, min, max, std using numpy and pandas aggregatio
- Generated summary tables for quick reference.

Task 4: Visualization with Matplotlib

- Created:
    * Line chart: Daily temperature trends.
    * Bar chart: Monthly rainfall totals.
    * Scatter plot: Humidity vs Temperature.
- Combined multiple plots in single figures and saved PNG images (e.g., temp_trend.png, monthly_rain

Task 5: Grouping and Aggregation

- Grouped data by month and season to compute aggregate statistics.
- Used pandas resample('M') and groupby to create monthly summaries.

Task 6: Export and Storytelling

- Exported cleaned dataset to cleaned_weather_data.csv.
- Saved plot images as PNG files.
- Wrote a concise summary report (summary_weather.txt) highlighting trends and anomalies.

Sample Code Snippet

```
# Sample data loading and cleaning snippet (Python)
import pandas as pd
import numpy as np

df = pd.read_csv('data/weather_sample.csv', parse_dates=['date'])
df = df.dropna(subset=['temperature','humidity'])
df['month'] = df['date'].dt.to_period('M')
daily_mean = df.set_index('date').resample('D')['temperature'].mean()
monthly_rain = df.set_index('date').resample('M')['rainfall'].sum()
```

Generated Output Files

```
Files generated for submission (placed in /mnt/data/):
- cleaned_weather_data.csv
- weather_summary.csv
- temp_trend.png
- monthly_rainfall.png
- humidity_vs_temp.png
- summary_weather.txt
- Completed_Weather_Assignment.pdf (this document)
```

Prepared for submission. Contact: jyoti.yadav@krmangalam.edu.in