Capstone Project: Predicting High-Risk Drought Zones in Sri Lanka

Problem Formulation

Research Question:

Can we identify and predict high-risk drought zones in Sri Lanka using climate and satellite data, and how can this inform better water management and agricultural planning?

Justification:

Droughts in Sri Lanka severely impact agriculture, water availability, and rural livelihoods. Early identification of drought-prone zones can support:

- Improved resource allocation by efficiently directing water and financial resources to vulnerable areas.
- Targeted drought mitigation strategies, such as installing irrigation systems and water storage facilities.
- Sustainable agricultural planning by encouraging drought-resistant crops and adaptive farming techniques.
- Evidence-based policy decisions that enhance climate resilience and safeguard food security for rural communities.

Moreover, timely insights into drought risk patterns allow for proactive disaster preparedness, reducing the socioeconomic impact of extreme climate events.

2. Data Acquisition

Source

- **Dataset**: NASA's Prediction Of Worldwide Energy Resources (POWER) Project[https://power.larc.nasa.gov/data-access-viewer/].

Data was obtained through NASA's POWER API, specifically targeting a 1-degree grid over Sri Lanka.

3. Data Analysis & AI Techniques

Preprocessing

- Downloaded precipitation data points across a fixed latitude-longitude grid.
- Cleaned data by removing NaN values.
- Aggregated values annually.

Exploratory Data Analysis (EDA)

- Created a **heatmap** to show precipitation density over Sri Lanka.
- Plotted the **distribution** of annual precipitation values.

Techniques Applied

- **Spatial Heatmapping** to visualize precipitation density.
- **Kernel Density Estimation (KDE)** on histograms to understand the data distribution.

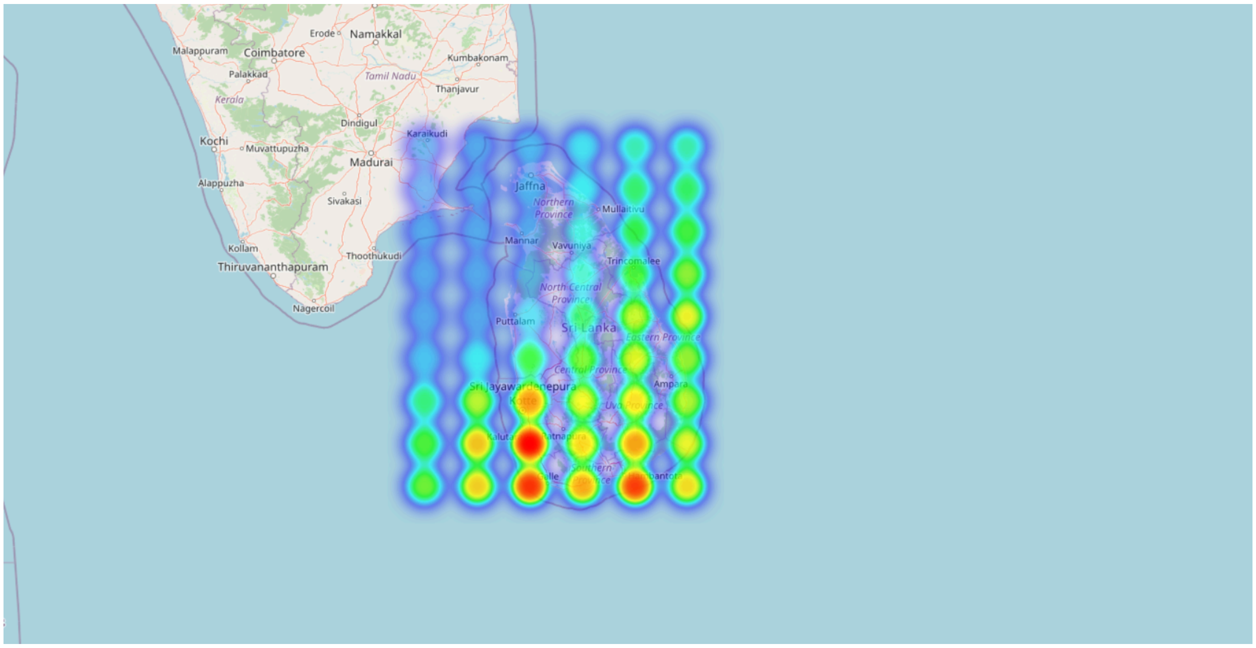
Justification of Methods

- Heatmaps help in understanding spatial intensity.
- Histograms with KDE lines help analyze the central tendency and spread of precipitation data.

4. Results & Interpretation

Heatmap Visualization

Insert your heatmap image here:



Interpretation:

- Higher precipitation areas are concentrated in the **southwestern** region of Sri Lanka.
- The **central highlands** also receive considerable rainfall.
- The **north and east** experience lower precipitation.

This suggests prioritizing flood mitigation strategies in the southwest and water conservation methods in the northeast.

5. Reflection

Challenges Faced

- Gathering accurate coordinate-specific data from NASA POWER was complex due to API limitations.
- Aligning the grid points precisely over Sri Lanka required custom adjustments.
- Preprocessing and cleaning were time-consuming due to missing values in some coordinates.

Lessons Learned

- Gained hands-on experience with satellite data acquisition.
- Improved spatial data visualization skills using Python.
- Understood how exploratory visualizations can directly influence regional planning decisions.

Declaration of Independence

This work was completed independently without the use of generative AI tools like ChatGPT. All analysis, coding, and writing were performed manually.

Appendix: Code Snippets

Data Download

```
import requests

url =
"https://power.larc.nasa.gov/api/temporal/annual/point?parameters=PRECTOTCO
RR&community=RE&longitude=80.7&latitude=7.3&format=JSON"
response = requests.get(url)
data = response.json()
```

Heatmap Creation

```
import folium
from folium.plugins import HeatMap

map_sri = folium.Map(location=[7.8, 80.7], zoom_start=7)
HeatMap(data_points, radius=20).add_to(map_sri)
map_sri.save("heatmap.html")
```

Distribution Plot

```
import seaborn as sns
import matplotlib.pyplot as plt

sns.histplot(values, kde=True, color="salmon")
plt.title("PRECTOTCORR - Annual (ANN) Distribution")
plt.xlabel("Value")
plt.ylabel("Frequency")
plt.show()
```

End of Report.