**CLIMATE CHANGE IMPACT ANALYSIS**

**Submitted for**

**Statistical Machine Learning CSET211**

Submitted by:

**E23CSEU1811 AMAN KUMAR**

**E23CSEU1821 GUNJAN YADAV**

**E23CSEU1822 SHANTANU SINGH**

Submitted to

**AMIT SONI ARYA**

**July-Dec 2024**

**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING**

A close-up of a logo

Description automatically generated

**INDEX**

| **Sr. No** | **Content** | **Page No** |
| --- | --- | --- |
| 1 | Abstract |  |
| 2 | Introduction |  |
| 3 | Methodology |  |
| 4 | Hardware/Software Required |  |
| 5 | Experimental Results |  |
| 6 | Conclusions |  |
| 7 | Future Scope |  |
| 8 | GitHub Link |  |

**1. Abstract**

* This report presents an analysis of climate data from 1981 to 2022, focusing on temperature and rainfall trends, seasonal patterns, and anomaly detection.
* Advanced modeling techniques, including polynomial regression and ARIMA forecasting, are applied to derive insights into climate trends and predict future temperature variations.

**2. Introduction**

* This project aims to analyze climate patterns by studying temperature and rainfall data.
* The study involves data processing, visualizations, seasonal decomposition, anomaly detection, and time series forecasting.

**3. Methodology**

1. **Data Loading and Preprocessing**:
   * Import *Climate.csv*, rename columns, and separate temperature and rainfall data for ease of analysis.
2. **Annual Trend Analysis**:
   * Generate visualizations of annual temperature and rainfall trends.
3. **Seasonal Decomposition**:
   * Decompose monthly temperature and rainfall data to extract seasonal components.
4. **Anomaly Detection**:
   * Identify temperature and rainfall anomalies using standard deviation thresholds.
5. **Advanced Modeling**:
   * *Polynomial Regression*: Model the relationship between temperature and rainfall.
   * *ARIMA Forecasting*: Forecast future temperature trends with ARIMA applied to annual temperature data.

**4. Hardware/Software Required**

* **Hardware**: Standard computing hardware.
* **Software**: Python (pandas, numpy, matplotlib, seaborn, scikit-learn, statsmodels).

**5. Experimental Results**

1. **Annual Trend Analysis**:
   * Graphs display rising or falling trends in temperature and rainfall over time.
2. **Seasonal Decomposition**:
   * Revealed seasonal patterns, showing temperature and rainfall trends per month.
3. **Anomaly Detection**:
   * Identified specific years with temperature or rainfall anomalies.
4. **Polynomial Regression and ARIMA Modeling**:
   * Polynomial regression model’s MSE evaluated predictive accuracy, while ARIMA generated a temperature forecast.

**6. Conclusions**

* The analysis provides insights into climate changes, including warming patterns and rainfall shifts.
* The ARIMA forecast predicts potential temperature changes in the coming years, contributing to climate prediction.

**7. Future Scope**

* Further research may include exploring additional climate factors and using deep learning models for improved predictive accuracy.

**8. GitHub Link of Your Complete Project**

**Link:** [**Repo link**](https://github.com/Amanyadav7492/Climate_Change_Impact_Anylasis)