Climate Change Impact Prediction

Ananda Mane, Harshvardhan Mohite, Ayush Jadhav, Girish Mohole
Guide: Mr. S.R. Kadam

HOD: Mr.A.N. Patil (Dept: CSE)

JAYWANT COLLEGE OF ENGINEERING & POLYTECHNIC, KILLE MACHINDRA GAD, SANGLI.

AFFILIATED TO DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE 2024 - 2025

Abstract - This project investigates climate variability across the districts of Maharashtra, India, focusing on key environmental indicators such as temperature, CO_2 emissions, rainfall, deforestation, urban growth, and an overall Climate Impact Index. The core objective is to examine whether these factors show significant differences between districts using statistical analysis through one-way ANOVA.
To enhance predictive capabilities, a machine learning model based on regression is developed using Python. The model is built with libraries such as Pandas, NumPy, and Joblib, and the environmental data is stored and managed in MongoDB to ensure efficient handling of large datasets. The outcome of this project provides valuable insights into localized climate trends, supporting targeted environmental strategies and district-level policy-making.

Key Words: one way ANOVA, Deforestation, Regression Model, CO_2 Emission, Urbanization.

1. INTRODUCTION *(Size 11, Times New roman)*

Understanding regional differences in climate variables is essential for effective environmental planning. This study explores district-level variations in key environmental factors—such as temperature, CO_2 levels, precipitation, deforestation, urbanization, and the Climate Impact Index—across Maharashtra, India.

Using one-way ANOVA, the project evaluates whether these factors significantly differ between districts. To enhance predictive analysis, a regression-based machine learning model is developed in Python, utilizing libraries like Pandas and NumPy. Data is stored in MongoDB, ensuring efficient handling of large datasets. This approach supports localized climate assessments and informs region-specific environmental policies.

2. Body of Paper

Methodology

The project follows a structured, multi-phase development cycle grounded in the Waterfall SDLC model. The initial phase involved collecting district-level environmental data for Maharashtra, focusing on variables such as temperature, precipitation, CO_2 levels, deforestation rate, urbanization, and a derived Climate Impact Index. This data was organized hierarchically by state, district, tahsil, village, and year for granular analysis.

Statistical Analysis

A one-way Analysis of Variance (ANOVA) was performed on each environmental factor to determine if significant mean differences exist across districts. This statistical method treats the district as the categorical independent variable, enabling insight into region-specific climate behavior. A p-value threshold of 0.05 was used to assess statistical significance.

System Architecture

The system was built using a three-tier architecture comprising:

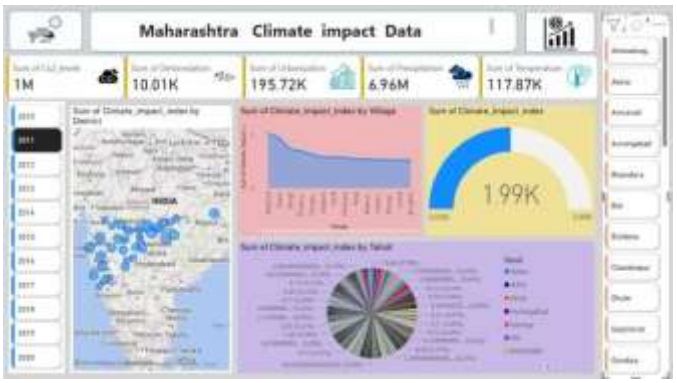
Frontend: HTML5, CSS3, JavaScript for user interaction.
Backend: Python-based logic handling user requests and model integration.
Database Layer: MongoDB for scalable data management.

Flow Chart :

Table -1: Sample Table format

Section	Details
Title	Climate Impact Prediction
Study Area	Districts of Maharashtra, India
Objective	To analyze and predict variations in climate-related variables across regions
Key Variables	Temperature, CO_2 levels, Precipitation, Deforestation, Urbanization, Impact Index
Statistical Method	One-Way ANOVA
ML Model	Regression-based model using Python
Technologies Used	Python, Pandas, NumPy, Scikit-learn, Joblib, MongoDB
Frontend Technologies	HTML5, CSS3, JavaScript
Data Storage	MongoDB (NoSQL)
Outcome	Climate impact predictions for district-level planning
Use Cases	Environmental monitoring, localized decision-making, policy support

Fig -1: Figure



Charts

3. CONCLUSIONS

This project demonstrates how machine learning can effectively model and predict district-level climate impacts using environmental indicators. Significant variation across regions highlights the need for localized policies. The system's scalable, user-friendly design supports informed decision-making and sets the stage for future advancements in climate intelligence.

ACKNOWLEDGEMENT

The successful completion of this project would not have been possible without the guidance, encouragement, and support of several individuals. We extend our heartfelt gratitude to our project guide, *Prof. S. R. Kadam*, whose expert insights and unwavering belief in our capabilities provided constant motivation throughout the journey.
We also sincerely thank *Prof. A. N. Patil*, Head of the Department of Computer Engineering, for his continued support and timely assistance. Our appreciation further extends to the faculty members, staff, and our peers, whose cooperation and encouragement greatly contributed to the development and realization of this project.

REFERENCES

Open-source datasets for machine learning and climate analytics.

Machine learning library used for regression modeling and predictive analytics.

Python library for data manipulation and analysis.
Core library for numerical computing in Python.
Backend database used for storing and retrieving climate data.
Web References :

https://climate.nasa.gov – NASA Climate Change and Global Warming

https://www.kaggle.com – Datasets for Machine Learning and Climate Analytics
https://vlist.in/state/27.html – Datasets of all District, Tehsil and Village of Maharashtra's

https://www.ipcc.ch – Intergovernmental Panel on Climate Change

https://www.epa.gov/climate-indicators – U.S. Environmental Protection Agency