Identification And Prediction Of Drought Prone Areas In Uttar Pradesh Using Machine Learning

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Abstract

Drought is a recurring natural disaster in India, particularly in areas with low and erratic rainfall. It has severe socio-economic impacts on the country's population, particularly in rural areas where agriculture is the primary source of income. Drought conditions can lead to crop failures, livestock deaths, water shortages, and food insecurity. India has experienced several major droughts in the past, including in 2002, 2004, and 2015-2016, which have had significant impacts on the country's economy and society.

This project aims to identify drought-prone areas in the Indian state of Uttar Pradesh using machine learning techniques. Drought is a major problem in Uttar Pradesh.Traditional methods of drought assessment have limitations, including high costs, time-consuming processes, and a lack of accuracy.

This project proposes the use of machine learning algorithms to identify drought-prone areas in Uttar Pradesh. The project will use historical climate data such as (.....) to train the machine learning models. The models will be trained to identify patterns in the data that are associated with drought conditions. The models will then be used to predict future drought conditions in Uttar Pradesh.

The project's outcomes will be beneficial for farmers, policymakers, and other stakeholders who are concerned with the impact of drought on agriculture and the environment. The project's machine learning models will provide a more accurate and efficient method for identifying drought-prone areas in Uttar Pradesh.

1 Introduction

1.1 What:

This project is all about that how to use machine learning to identify drought-prone areas in Uttar Pradesh and predict future drought conditions in Uttar Pradesh. It provide information on drought conditions, allowing decision-makers to take appropriate action to mitigate its impact.

1.2 Why:

The project aims to predict and identify drought prone areas in Uttar Pradesh (UP), a state in northern India that faces recurrent natural disasters such as floods and droughts. The project will consider the following factors that influence drought occurrence and severity: geological features, climatological change, hydrological factors and human activity. The project will use remote sensing data, meteorological data, hydrological data and socio-economic data to analyze the spatial and temporal patterns of drought in UP. The project will also develop a drought index based on multiple indicators of drought conditions such as rainfall deficiency, soil moisture deficit, vegetation stress and crop failure. The project will map the drought prone areas in UP using GIS techniques and identify the most vulnerable regions and communities. The project will also assess the impacts of drought on agriculture, livestock, environment and human health. The project will provide valuable information for drought monitoring, early warning, mitigation and adaptation strategies in UP.
Objectives:
1.To analyze the geological features of UP and their impact on drought occurrence.
2.To study the climatic changes in UP and their influence on drought frequency and intensity.
3.To evaluate the hydrological factors in UP and their contribution to drought conditions.
4.To investigate human activities such as agriculture, urbanization, and deforestation that lead to droughts in UP.
5.To develop a predictive model for drought-prone areas in UP using the above factors.

1.3 How:

Machine learning algorithms are powerful tools for predicting and identifying drought prone areas in Uttar Pradesh (UP), India. Drought is a condition of water scarcity caused by low precipitation over a prolonged period of time. It affects the agricultural productivity, water availability and socio-economic conditions of the region. One way to assess drought is to use meteorological drought indices, such as the Standardized Precipitation Index (SPI), which measures the deviation of precipitation from its normal distribution . Machine learning algorithms can use historical data of precipitation and other climatic variables to train

models that can forecast SPI values for different time scales and locations in UP . These models can also identify the factors that influence drought occurrence and severity, such as temperature, soil moisture, evapotranspiration, etc.
Some machine learning algorithms that can be used for drought forecasting are 1.Support Vector Machine (SVM), 2.Decision Tree (DT), 3.Generalized Regression Neural Network (GRNN), 4.Genetic Algorithm-Adaptive Neuro-Fuzzy Inference System (GA-ANFIS), Lasso Regression(LR) and 5.Random Forest Regression (RF) Etc.These algorithms have different advantages and disadvantages in terms of accuracy, complexity, interpretability and computational efficiency. We can choose one of these algorithms depending upon the data availability, quality and characteristics, as well as the objective and scope of the study. Machine learning algorithms can help us to predict and identify drought prone areas in UP by providing timely and reliable information that can support decision making and planning for water management, crop production and disaster mitigation.

2 Proposed methodology

One proposed methodology for predicting and classifying drought-prone areas in Uttar Pradesh using Rainfall, soil moisture, irrigation, temperature, tree cover, geology, water body data etc:
1.Data Collection: Collecting data on Hydrological Factors(Ground Water,irrigation water,Presence of Water sources) aslo rainfall, soil moisture, , temperature, tree cover, geological datum in Uttar Pradesh. This data can be obtained from government agencies, satellite data, and ground-based sensors.
2.Data Preprocessing: Cleaning the data and remove any missing values or outliers. Normalize the data to ensure that all variables are on the same scale.
3.Feature Selection: Using statistical methods and domain knowledge to select the most relevant features for predicting and classifying drought-prone areas. This can include variables such as average rainfall, soil moisture content, irrigation intensity, temperature variability, tree cover density, geology type, and distance to water bodies.
4.Model Training: Train a machine learning algorithm on the selected features and historical drought data to predict drought-prone areas or a regression model on the selected features and historical drought data to predict drought-prone areas. This can include methods such as linear regression, multiple regression, or polynomial regression, decision trees, random forests, or neural networks etc.
5.Model Evaluation: Evaluating the model's performance using metrics such as accuracy, precision, recall, and F1 score, metrics such as mean squared error, mean absolute error, and R-squared value.We may Use cross-validation to ensure that the model is robust and can generalize to new data.
6.Classification: Using the trained model to classify different regions of Uttar Pradesh as either drought-prone or not. This can help policymakers and farmers to take proactive

measures to mitigate the impact of drought.
7.Visualization: We can visualize the predicted drought-prone areas on a map to aid in decision-making and resource allocation. This can include tools such as GIS or interactive dashboards.

Overall, this methodology can help to identify areas in Uttar Pradesh that are vulnerable to drought and provide actionable insights for mitigating the impact of drought on agriculture, water resources, and livelihoods.

3 Work plan and time line

To track changes and time line for our project work please follow This Link

4 Work plan division in your group

TASKS	ASSIGNEE	DEADLINE	STATUS
Data Collection	Both	March 21, 2023	Completed
Literature Review	Bidit Sadhukhan	March 21, 2023	Completed
Creating a Planning	Bidit Sadhukhan	March 20, 2023	Completed
Submit Project Proposal	Anirban Dey	March 21,2023	Completed
Reviewing literature for methodology	Bidit Sadhukhan	March 31,2023	Not Started
Data Filtering and cleaning	Anirban Dey	April 7,2023	Not Started
Feature Engineering	Bidit Sadhukhan	April 1, 2023	Not Started
Writing Code to train Data	Bidit Sadhukhan	April 15,2023	Not Started
Testing The Model Parameter with Validation	Anirban Dey	April 12,2023	Not Started
Finding a Suitable Model	Bidit Sadhukhan	April 21, 2023	Not Started
Prediction of Areas and Identification	Anirban Dey	May 6, 2023	Not Started
Writing the Final Report	Both	May 11, 2023	Not Started

Table 1: Work Plan Table (Updated)

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5 Appendix

All the codes and the datasets of our work can be accessed in the Github link.