DISASTER RELIEF COMPENSATION COMPUTATIONAL FRAMEWORK

Project Reference No.: *45S_BE_2748*

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Keywords:

Farmer's relief fund, Flood detection, Decision Tree Regression, Data Visualization

Introduction:

Floods threaten more than 80% of India's population, or 1.08 billion people, according to the World Resources Institute. Floods cost the global economy roughly 40 billion dollars per year, with 15 billion dollars lost in India alone. Over 100 people died in the recent Kerala floods, and over 15,000 homes and businesses were destroyed by the relentless rains. These kinds of floods occur practically every year in many flood-prone locations, causing significant damage to life and property. The overflowing of rivers, reservoirs, and other water bodies during the monsoon season is the primary cause of this.

Furthermore, due of its influence in extreme weather events and rising seas, climate change is increasing the danger of floods across the world, particularly in coastal and low-lying areas. Global warming can cause hurricanes to move more slowly and drop more rain, funneling moisture into atmospheric rivers like the ones that caused torrential rains and flooding in California in early 2019. Meanwhile, melting glaciers and other causes are leading to a rise in sea levels that has put locations like Venice, Italy, and the Marshall Islands at risk of long-term, chronic flooding. As a result, the risk of flooding and its consequences are increasing.

Our project intended to contribute to the solution of this problem, thus we built a web application that can forecast floods and their consequences before they occur. The information is then shown in an interactive graphical style, making it appealing and easy to grasp for both individuals and governments.

Background:

The goal of the study is to use machine learning to anticipate floods from weather data and to calculate the relief budget for flood-affected farmers. The web framework provides us with information about past and current floods India, as well as their date and location.

We then used the Visual Crossing weather API to obtain historic weather data such as precipitation, humidity, temperature, cloud cover, and windspeed in those areas and during those times. We also performed several data augmentation techniques on this data set, which enabled us to significantly increase the diversity of data available for our training model, without actually collecting new data. Our machine learning model is based on the python sci-kit learn library.

We used pandas to generate a data-frame for the dataset, and then tried various machine learning models from Logistic Regression to K-Nearest Neighbors to Random Forest Classification. After experimenting heavily with all of these models, the Random Forest Classifier gave us the highest accuracy of 99.61% on the test set. We proceeded to save our model in a pickle file. Our web app is based on the Flask python framework. We rendered HTML templates – with CSS for styling and JavaScript for added functionality – and integrated it with our machine learning models and datasets via the flask back-end.

Objectives:

1. Our project intended to contribute to the solution of this problem, thus we built a web application that can forecast floods and their consequences before they occur
2. The information is then shown in an interactive graphical style, making it appealing and easy to grasp for both individuals and governments.
3. Our web framework is designed in a way where the users can easily use it and will concentrate more on visualization.
4. Flood visualization is much more easier to understand in a pictorial format.

Methodology:

Our goal was to predict floods from weather data using machine learning. For the dataset, we first scraped the website http://floodlist.com/tag/india using the python beautiful-soup 4 library. This website provided us with information about past and current floods India, as well as their date and location. We then used the Visual Crossing weather API to obtain historic weather data such as precipitation, humidity, temperature, cloud cover, and windspeed in those areas and during those times. On this data set, we also used multiple data augmentation strategies to dramatically improve the diversity of data available for our training model without having to acquire additional data.

ML model:

Our machine learning model is based on the python sci-kit learn library. We used pandas to generate a data-frame for the dataset, and then tried various machine learning models from Logistic Regression to K-Nearest Neighbors to Random Forest Classification. After experimenting heavily with all of these models, the Random Forest Classifier gave us the highest accuracy of 98.71% on the test set. We proceeded to save our model in a pickle file.

Data Visualization:

We first obtained a dataset of the major cities and towns in India (around 200 of them) along with their latitude, longitude and population. We then obtained the numerous

weather factors in each city using the weather API and ran the data into our machine learning model. Next, we plotted the data from the model on various different types of maps, using Plotly chart studio. The maps represent various data such as flood prediction, precipitation analysis, and damage estimates, in the form of scatter plots, heat-maps, and bubble plots. The damage estimates were calculated based on flood prediction and population. We also produced geo-referenced satellite images for various cities in India, based on retrieved data from NASA's Global Precipitation Measurement project.

Front-end and hosting:

The web app is based on the Flask python framework. We rendered HTML templates – with CSS for styling and Javascript for added functionality – and integrated it with our machine learning models and datasets via the flask back-end.

Implementation:

Disaster relief Application is one of the solution to floods in India. It is a web app that uses advanced machine learning algorithms to predict future floods based on weather forecast data – precipation, wind speed, humidity, and temperature, maximum temperature, cloud cover – while allowing users to effectively visualize current and upcoming floods. The app has 4 core components:

1. Plots

The 3 visualizations on the plots page are bubble plots that display flood predictions, damage predictions, and heavy rainfall predictions across India, taking in factors such as precipation, wind speed, humidity, temperature, cloud cover, as well as previous data history.

2. Heatmaps

The 3 heatmaps show flood predictions, damage predictions, and heavy rainfall predictions across India, taking in factors such as precipitation, wind speed, humidity, temperature, cloud cover, as well as previous data history

3. Satellite Images

Our satellite image analysis displays the volume of precipitation over various cities in India for different months. In order to create this feature, we analyzed netCDF4 formatted data from NASA's Global Precipitation Measurement Project, and produced geo-referenced plots using a combination of libraries, namely numpy, matplotlib, and cartopy. We then displayed our processed images on our web application for users and governments to view

4. Predict Page

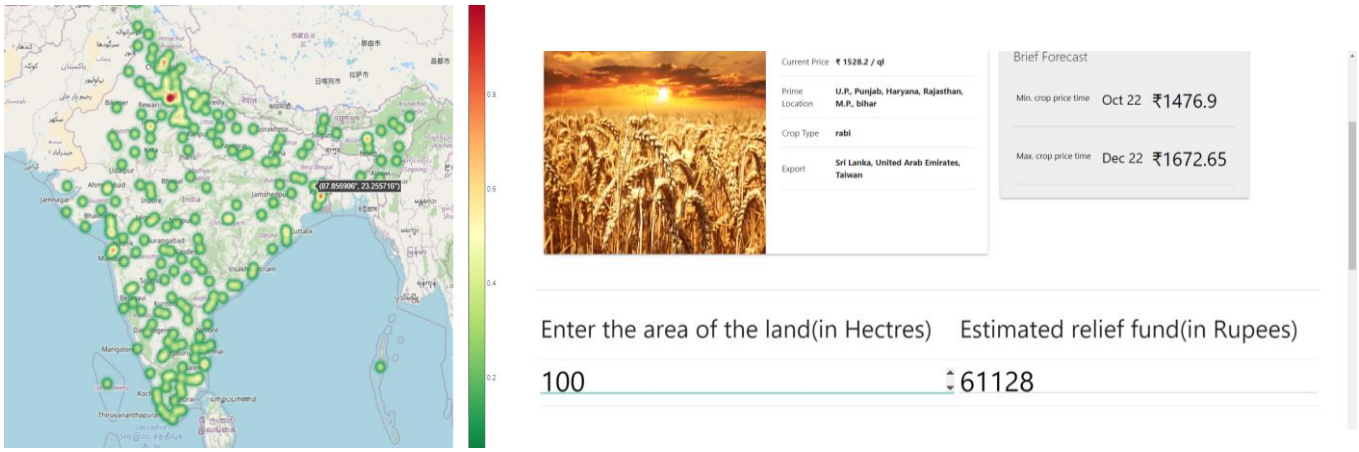
On our predict page, the user simply enters the land area which has been effected and our interface will predict the estimated amount the user will get as a relief fund from the government.

Conclusion:

Flooding has become a disaster in many parts of the world. Extreme measures must be done to preserve small and territorial ranchers from financial ruin and to continue

with regular horticulture growth by incorporating necessary innovations. Flood has turned into a calamity in many areas of the planet. Extreme advances are to be taken to save particularly the little and territorial ranchers from monetary misfortune and to proceed with a normal horticultural development by containing appropriate innovations. The review centres around the rancher's versatility to floods concerning farming in still up in the air that India has effectively accomplished mentionable advancement in setting up the impacts of floods and proposes that more fitting arrangement mediation, ventures on environment savvy Argo research, the cooperation of private area in catastrophe readiness, and a comprehensive arranging approach can assist with understanding the components of better flood the board.

We are also proud to have expanded our machine learning skills by testing out new models, and ultimately implementing a model with over 99.61% accuracy. Lastly, we are proud to have integrated various data augmentation, data mining, and date manipulation techniques, together with our model, to create detailed and sophisticated, yet compelling and easy to understand plots for data visualization.



Scope for future work:

Disaster relief, a web application to predict floods and their impact before they even happen. Then, it displays information in an interactive graphical format, making the information compelling and easy to understand for people and governments alike. We are extremely proud of compiling and creating a dataset that can accurately and effectively reflect the current situation of floods in India, as well as allow us to make future predictions. Our project helps the users which are mostly farmers understand the current flood information in an easy and an understandable way.