Natural Disasters Intensity Analysis and Classification Using Artificial Intelligence

A Project report submitted in partial fulfilment of 7th semester in degree of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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ABSTRACT

This study examines the impact of natural disasters on market returns and on several industries that are likely to be affected by the disasters. We find that different natural disasters have different impacts on the returns of the market and on those of industries. Our evidence suggests that while earthquake, hurricane and tornado could negatively affect market returns several weeks after the events, other disasters such as flood, tsunami and volcanic eruption may have limited impact on market returns. We also find that construction and materials industry is positively affected by natural disasters but nonlife and travel industries are likely to suffer when a natural disaster strikes.Natural disasters are the result of a hazard overwhelming highly vulnerable community, often resulting in mortality and morbidity. Over the past decade, over 300 natural disasters occur yearly around the world affecting millions and cost billions. The disaster cycle is a framework used to base a coordinated plan to respond, recover, prevent, and prepare for a disaster. Access to clean water, proper sanitation, food/nutrition, shelter, and the threat of communicable diseases are concerns that have the potential to be detrimental to the management of a natural disaster, slowing the recovery process.

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PROJECT DOCUMENTATION

Natural Disasters Intensity Analysis and Classification Using Artificial Intelligence.

1.INTRODUCTION:

PROJECT OVERVIEW:

Natural Disasters are catastrophic events with atmospheric and historic origins (hurricanes, floods, tsunamis, earthquakes). That can cause fatalities, property damage and social environment disruption.

Natural disasters are the results of a hazard overwhelming highly vulnerable community, often resulting in mortality and morbidity. Over the past decade, over 300 natural disasters occur yearly around the world affecting millions and cost billions. The disaster cycle is a framework used to base a coordinated plan to respond, recover, prevent, and prepare for a disaster. Access to clean water, proper sanitation, food/nutrition, shelter, and the threat of communicable diseases are concerns that have potential to be detrimental to the management of a natural disaster, slowing the recovery process.

Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies and even lead to permanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, floods, and wildfires. Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems, but detection of natural disasters still faces issues due to the complex and imbalanced structures of images. To tackle this problem, we developed a multilayered deep convolutional neural network model that classifies the natural disaster and tells the intensity of disaster of natural The model uses an integrated webcam to capture the video frame and the video frame is compared with the Pre-trained model and the type of disaster is identified and showcased on the OpenCV window.

PURPOSE:

Basically the main objective of natural disaster management is to reduce the damage. However, there are several objectives that are integrated with it. Those are,

1. Identifying the hazard and its cause.

2. Reducing vulnerability and potential losses of hazard.

3. Assessing, reviewing and controlling the risk.

4. Applying efficient, effective, sustainable relief (food, shelter and money), medical and other facilities in disaster affected people thus they can survive.

5. Reducing the damage, death, sufferings and destruction of any natural and human induced disaster.

6. Giving protection to victims.

7. Increasing the strength among people to survive against disasters.

8. Building up capacity in every sector like- individual, social, economic, environmental, regional, national and international.

9. Ensuring the availability of local emergency equipment and transportation.

10.Promote the culture of disaster risk prevention and mitigation at all levels.

2. LITERATURE SURVEY:

EXISTING PROBLEM:

Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies and even lead to permanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, floods, and wildfires. Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems, but detection of natural disasters still faces issues due to the complex and imbalanced structures of images.

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PROBLEM STATEMENT DEFINITION:

The purpose of the problem statement is to identify the issue that is a concern and focus it in a way that allows it to be studied in a systematic way. It defines the problem and proposes a way to research a solution, or demonstrates why further information is needed in order for a solution to become possible.

Problem Statement is inclusive of below answers:

- Who does it affect/does not affect?
- What does it affect/does not affect?
- How does it affect/does not affect?
- When is it a problem/is not a problem.
- Where is it a problem/is not a problem.

Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies and even lead to permanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, floods, and wildfires. Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystems, but detection of natural disasters still faces issues due to the complex and imbalanced structures of images.

The natural disasters disturbs the ecosystem, both humans and animals.(WHO)

In a disaster, **you face the danger of death or physical injury**. You may also lose your home, possessions, and community. Such stressors place you at risk for emotional and physical health

problems. Stress reactions after a disaster look very much like the common reactions seen after any type of trauma.(WHAT)

Wildlife can be killed by the force of the disaster or impacted indirectly through changes in habitat and food availability. Endangered species are especially vulnerable when habitat is destroyed. Water quality is impacted when sewage treatment facilities flood or debris enters reservoirs and waterways.(HOW)

Natural disasters generally constitute an emergency since **they require immediate intervention due to their high impact on human health and safety**; they affect the normal functioning of working infrastructure, interrupting normal day activities and representing a risk for residents and workers in affected areas.(WHEN)

An area is defined as a hazard prone area **if the mortality risk is higher than a certain threshold**. A cyclone is defined as a wind storm with a maximum speed of more than 64 knots per hour. The definition includes typhoons and hurricanes. (WHERE)

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	Human(People)	Avoid the natural disaster	Due to natural disasters, there are droughts, economic crises, capital destruction etc.	Natural disasters are increasing because of population growth,Urbanisation(a lot of people in small places), alteration of the natural environment(man-made islands)	Natural disasters affect human life and destroy natural resources.

3 IDEATION & PROPOSED SOLUTION:

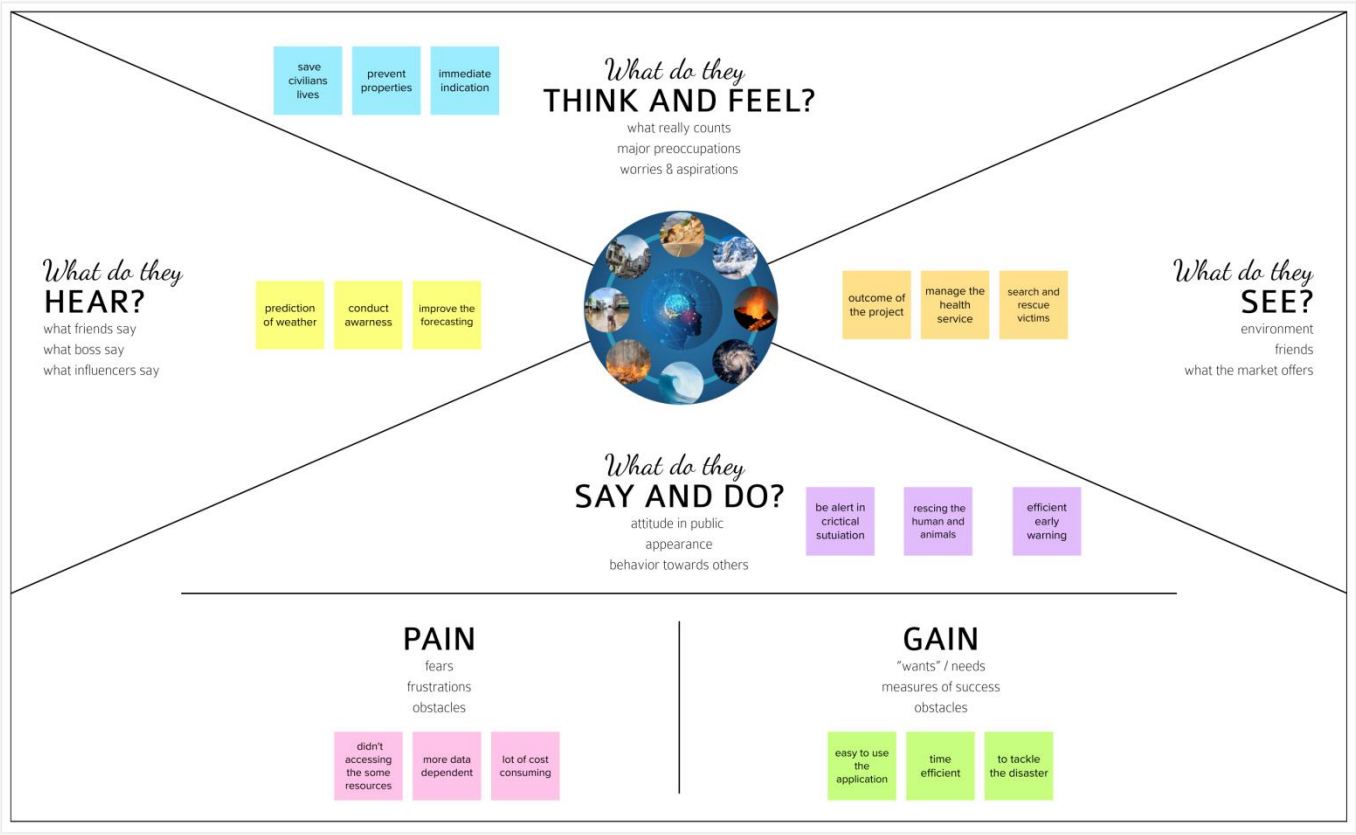
EMPATHY MAP CANVAS:

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

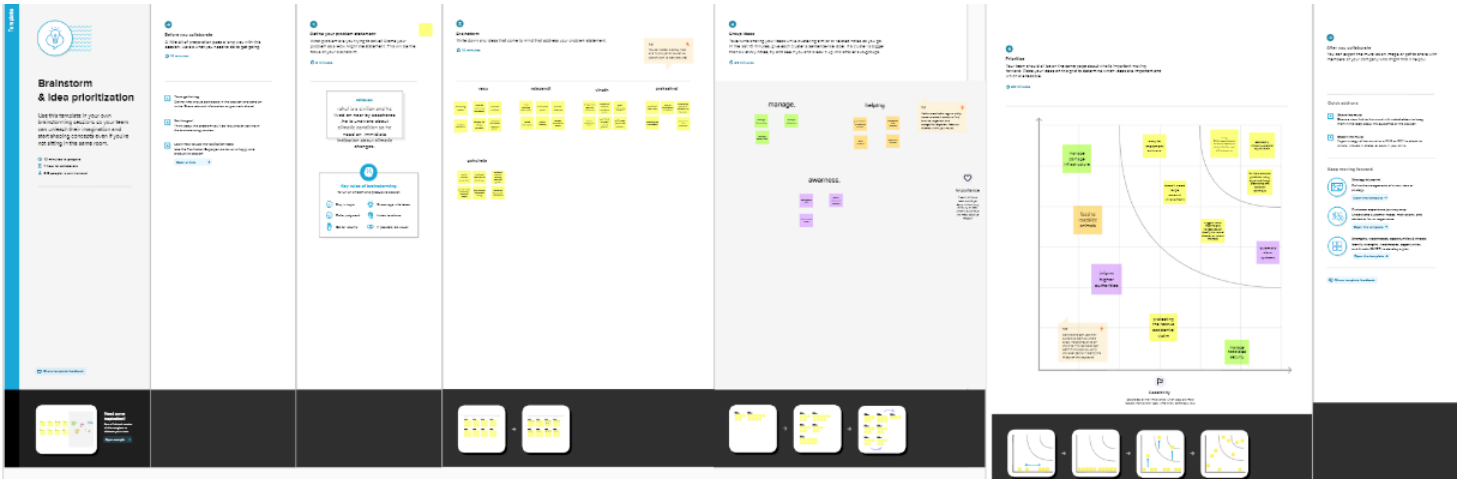
1

Build empathy and keep your focus on the user by putting yourself in their shoes.



Share your feedback

IDEATION & BRAINSTORMING:



CYCLONE INTENSITY EVALUATION:

An application of state-of-art neuro evolution method can be developed for prediction of wind-intensity for tropical cyclones in the South Pacific region. The method employed data from cyclone wind-intensity taken for the last three decades. This employs Cooperative Coevolution method for training Elman recurrent neural networks for the prediction.

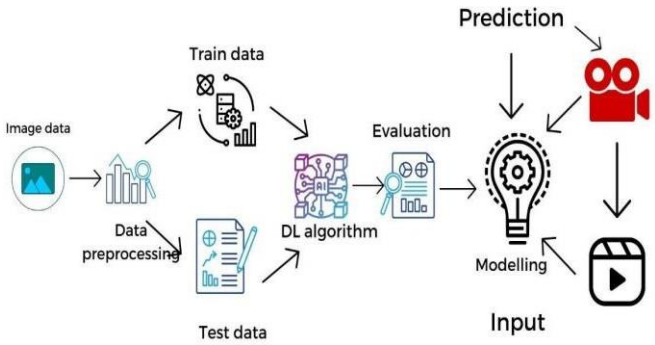
FLOOD INTENSITY EVALUATION:

A hybrid deep-learning based flood forecasting can be developed. This approach has been made use of daily lagged IF and precipitation time series data to determine flood situations at multiple forecast horizons. The practicality of the model can be tested using datasets from nine locations in Fiji.

STORM INTENSITY EVALUATION:

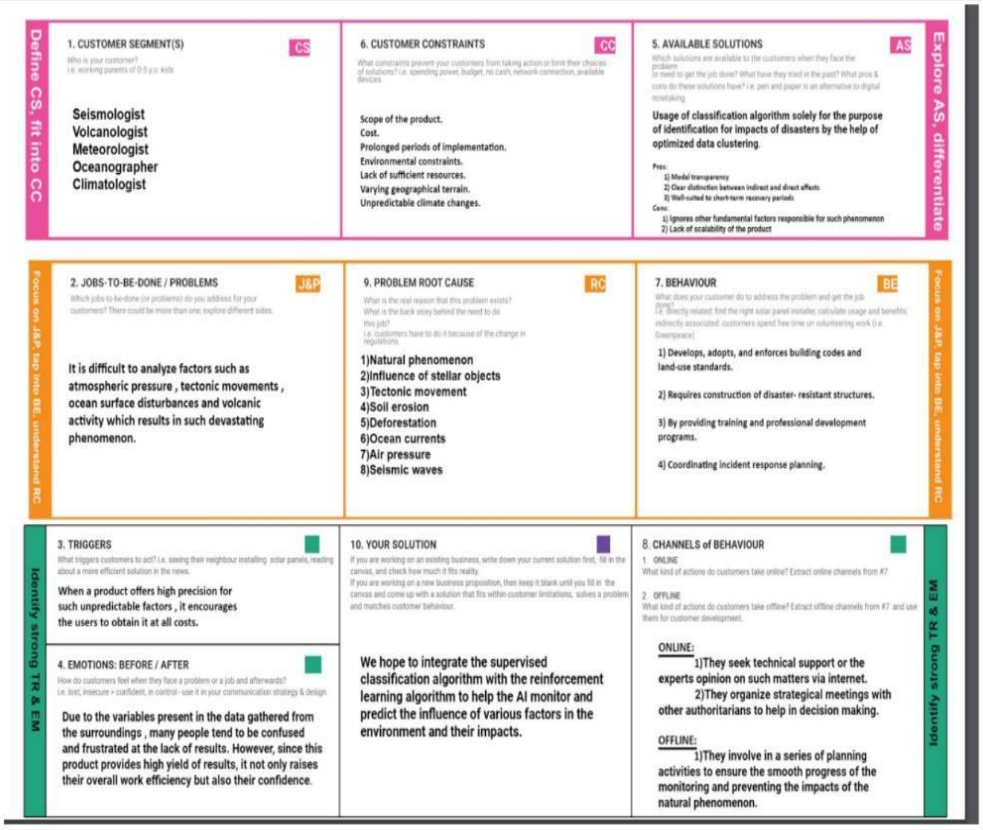
a storm scale ensemble post-processing system based on ensemble machine learning algorithms, radar mosaic verification, and ensemble variable statistics can provide improved precipitation forecasts. multiple machine learning models of varying complexity were applied to forecasts. probabilistic, deterministic, and interval forecasts of 1-hour precipitation accumulation were created with the different models. verification statistics showed that random forests, multiple logistic regression, and mars provided significant improvements for probabilistic and continuous forecasts by both increasing the range of precipitation and probabilistic values predicted and by increasing the areal coverage of the precipitation forecasts.

PROPOSED SOLUTION:

S.NO.	PARAMETER	DESCRIPTION
1.	Problem statement(Problem to be solved)	A natural disaster is the negative impact following an actual occurrence of natural hazard in the event that it significantly harms a community. A natural disaster can cause loss of life or damage property, and typically leaves some economic damage in its wake. Thus this involves finding and classifying the natural disaster and analyzing its intensity.
2.	Idea/Solution description	The main purpose of this model is to detect and classify the type of disaster with high accuracy. To tackle this problem, we developed a multilayered deep convolutional neural network model that classifies the natural disaster and tells the intensity of disaster of natural The model uses an integrated webcam to capture the video frame and the video frame is compared with the Pre-trained model and the type of disaster is identified and showcased on the OpenCV window.
3.	Novelty/Uniqueness	The detection of natural disasters by using deep learning still faces various issues due to imbalance problems. Hear the proposed model provides an effective solution. The solution provides high accuracy and provides better performance.
4.	Social Impact/Customer Satisfaction	Disaster alerts could be done prior so as to avoid unpredictable changes in the environment.Disasters take many shapes,during and immediately after an emergency, disaster management focuses on delivering help and interventions that can save lives of the people, safeguard health, and protect buildings, animals, and community property.
5.	Business Model(Revenue Model)	

6.	Scalability of the Solution	The analysis of the natural disaster and classification helps in making effective decisions on preventing the loss of lives and helps in preparation for the upcoming inevitable disaster which could be handled in the future.

PROPOSED SOLUTION FIT



4. REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENT:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	● Registering via Google Accounts ● Registering via Product's own user management system
FR-2	**User Authentication**	• Verification through OTP • Verification through Email Link
FR-3	**Designation of Region**	• Ease of selection of necessary areas to be monitored • Versatile and Flexible operations an designated areas
FR-4	**Analysis of Required Phenomenon**	• Simple and easy analysis on the specific phenomenon to be observed
FR-5	**Accumulation of required Data**	• Fast and Efficient data gathering capabilities regarding past event analysis and future prediction
FR-6	**Organizing Unstructured data**	• Processing of raw and clustered data into clear and refined data which is useful for analysis and prediction tasks
FR-7	**Algorithm selection**	• The freedom to choose from several classes of algorithm to be used in the process • Customization of algorithm to suit the needs of a specific purpose
FR 8	**Prediction and analysis of data the process**	• Advanced visualization techniques to help visualize the processed data for effective

FR-9	**Report generation**	• Restructuring of obtained results into clear and detailed report for future studies

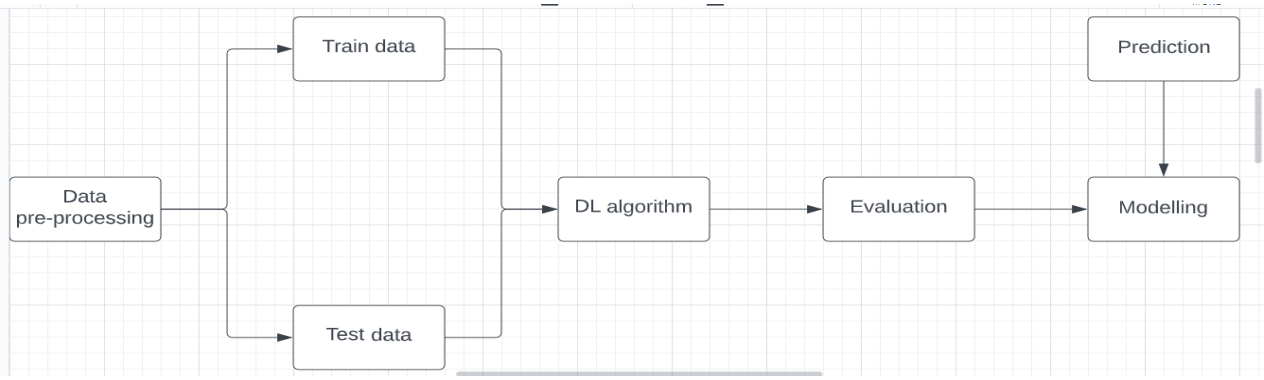
NON-FUNCTIONAL REQUIREMENTS:

Following are the non-functional requirements of the proposed solution.

NFR No	**Non-Functional Requirement**	**Description**
NRF - 1	**Usability**	It is well suited for fields requiring diverse application of processes with efficiency. precision and ease.
NRF - 2	**Security**	It provides a distinct and secure encryption layer to the system interface for additional security standards.
NRF - 3	**Reliability**	The product is robust and is capable of execution of processes even in the most difficult and unpredictable environments.
NRF - 4	**Performance**	The product boasts a high precision and efficient working capacity which helps in escalating its performance to the highest degree.
NRF - 5	**Availability**	Despite the complexity and degree of difficulty in its operation, the product is equipped with all-round maintenance and readily available technical services which provides the necessary support any individual requires in their duties.
NRF - 6	**Scalability**	The product also possess enough room for the improvement of its specifications to upgrade its capabilities according to the needs of the user and their organization

5. PROJECT DESIGN:

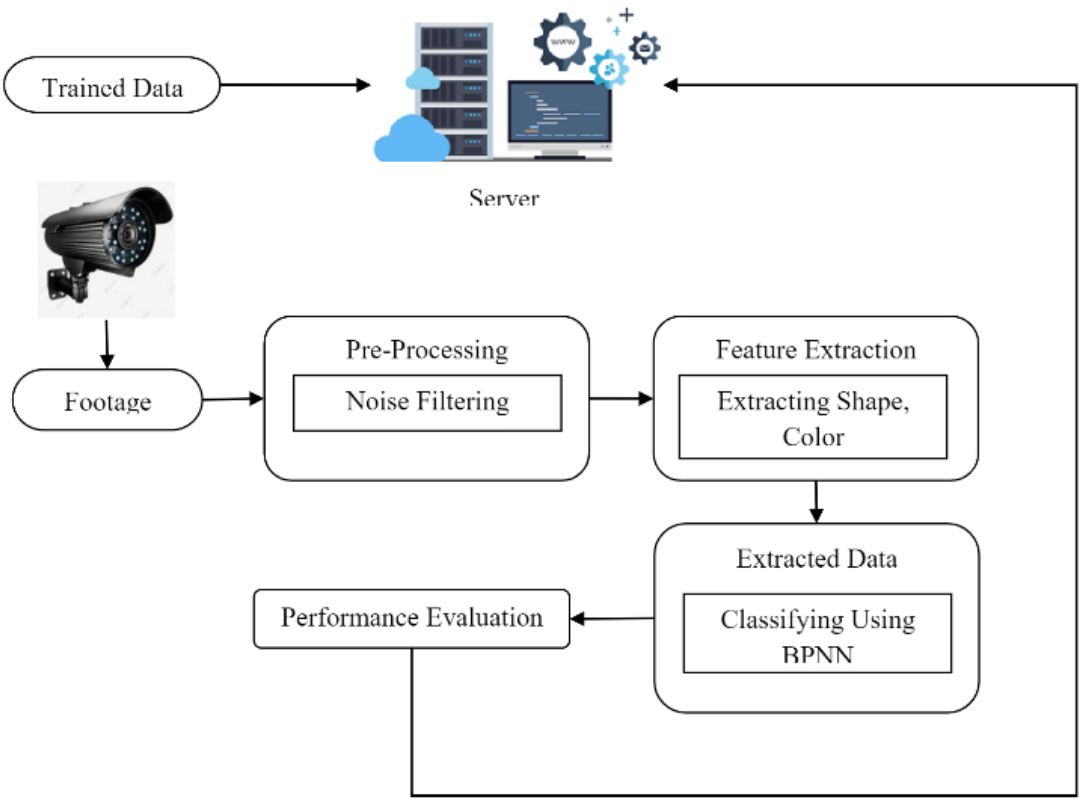
DATA FLOW DIAGRAMS:

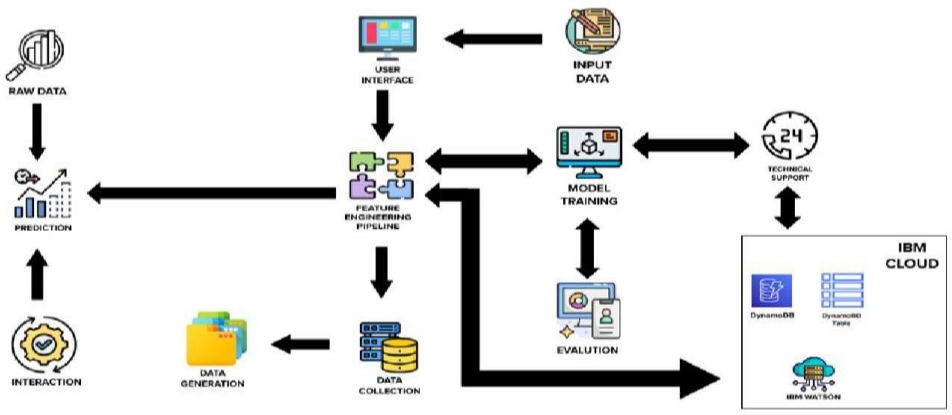


SOLUTION & TECHNICAL ARCHITECTURE:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.


Trained Data
Server
Footage
Pre-Processing
Noise Filtering
Feature Extraction
Extracting Shape, Color
Extracted Data
Classifying Using BPNN
Performance Evaluation



COMPONENTS & TECHNOLOGIES:

1. USER INTERFACE

Description

User interacts with the application for the prediction of Any Natural disaster which will happen in future minutes.

Technology

HTML, CSS, JavaScript, Django, Python.

2. FEATURE ENGINEERING PIPELINE

Description

Algorithms can't make sense of raw data. We have to select, transform, combine, and otherwise prepare our data so the algorithm can find useful patterns.

Technology

Image processing, pattern extraction, etc.

3. MODEL TRAINING KIT

Description

It learns patterns from the data. Then they use these patterns to perform particular tasks

Technology

Multiclass Classification Model, Regression Model, etc.

4. PREDICTION UNIT

Description
This function is used to predict outcomes from the new trained data to perform new tasks and solve new problems.
Technology
Decision trees, Regression, Neural networks.

5. EVALUATION SYSTEM

Description
It monitors that how Algorithm performs on data as well as during training
Technology
Chi-Square, Confusion Matrix, etc.

6. INTERACTIVE SERVICES

Description
To interact with our model and give it problems to solve. Usually this takes the form of an API. a user interface or a command-line interface
Technology
Application programming interface, etc.

7. DATA COLLECTION UNIT

Description

Data is only useful if it's accessible, so it needs to be stored ideally in a consistent structure and conveniently in one place.
Technology
IBM Cloud, SQL Server.

8. DATA GENERATION SYSTEM

Description

Every machine learning application lives off data. That data has to come from somewhere. Usually, it's generated by one of your core business functions
Technology
Synthetic data generation.

9. DATABASE MANAGEMENT SYSTEM

Description

An organized collection of data stored in a database, so that it can be easily accessed and managed.

Technology

MySQL, DynamoDB etc.

10. IBM CLOUD SERVICES

Description

Processed data stored in cloud service which can be access by the admin anywhere over the internet.

Technology

IBM Cloud etc.

APPLICATION CHARACTERISTICS:

1. OPEN-SOURCE FRAMEWORKS

Description

An open source framework is a template for software development that is designed by a social network of software developers. These frameworks are free for public use and provide the foundation for building a software application.

Technology

Keras, tensor flow.

2. AUTHENTICATION

Description

This keeps our models secure and makes sure only those who have permission can use them.

Technology

Encryption and Decryption (OTP).

3. APPLICATION INTERFACE

Description

User uses mobile application and web application to interact with model

Technology
Android and Web Development (PhoneGap, ReactNative, and NativeScript).

4. AVAILABILITY (BOTH ONLINE AND OFFLINE WORK)

Description

It includes both online and offline work. A good internet connection is needed for online work to explore the software perfectly. Offline work includes the saved data to explore for later time.

Technology
Caching, backend server.

5. REGULAR UPDATES

Description

The truly excellent software product needs a continuous process of improvements and updates. Maintain your server and make sure that your content is always up-to-date. Regularly update an app and enrich it with new features.

Technology

- Waterfall Approach
- Incremental Approach
- Spiral Approach

6. PERSONALIZATION

Description

Software has features like flexible fonts, backgrounds settings, colour themes, etc. which make a software interface look good and functional.

Technology

- HubSpot
- Proof

USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Upload Data	USN-1	As a user, I can upload either a live stream, video or photo of the disaster	I can upload the data.	High	Sprint-1
Functional Requirement (Epic)	Obtain Output	USN-2	As a user, I can receive the classification and the intensity of the disaster	I can receive the information about the disaster	High	Sprint-1
Customer (Mobile user)	Upload Data	USN-1	As a user, I can upload either a live stream, video or photo of the disaster	I can upload the data.	High	Sprint-1
Customer (Mobile user)	Obtain Output	USN-1	As a user, I can receive the classification and the intensity of the disaster.	I can receive the information about the disaster	High	Sprint-1

6.PROJECT PLANNING & SCHEDULING:

SPRINT PLANNING AND ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by enteringmy email, password, and confirming my password.	3	Low	R.Gokul Raja
Sprint-1		USN-2	As a user, I can register for the application usingFacebook	3	Low	J.Vasu
Sprint-1		USN-3	As a user, I can register the application by entering the phone number	3	Low	M.Vinoth
Sprint-1		USN-4	As a user, I will get the confirmation email	3	Medium	K.Rajapandi
Sprint-1		USN-5	As a user I will get the confirmation code	3	Medium	S.Prakashraj
Sprint-2	Login	USN-1	As a user I can log in by using email id or phonenumber and password	5	High	J.Vasu
Sprint-3	Upload or Capture	USN-1	As a user, I can upload the image from the existingimages	8	High	R.Gokul Raja
		USN-2	As a user, I can upload the image by capturing theimage using satellite or Drone.	8	High	M.Vinoth
Sprint-4	Share	USN-1	As a user, I can share the result	8	High	K.Rajapandi
	Save	USN-2	As a user, I can save the result	8	High	S.Prakashraj

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	15	6 Days	24 Oct 2022	29 Oct 2022	15	10 Nov 2022
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	5	10 Nov 2022
Sprint-3	16	6 Days	07 Nov 2022	12 Nov 2022	16	12 Nov 2022
Sprint-4	16	6 Days	14 Nov 2022	19 Nov 2022	16	19 Nov 2022

7 CODING & SOLUTIONING:

FEATURE 1:

A convolutional neural network is a class of artificial neural networks. It is a Deep Learning algorithm that can take in an input image, assign importance to various objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms.
The advantage of CNNs is to provide an efficient dense network which performs the prediction or identification efficiently.

Code is attached below.

FEATURE 2:

We developed a multilayered deep convolutional neural network model that classifies the natural disaster and tells the intensity of disaster of natural The model uses an integrated webcam to capture the video frame and the video frame is compared with the Pre-trained model and the type of disaster is identified and showcased on the OpenCV window. A multilayer neural network with appropriate weights has been shown **to be able to approximate any input-output function making it an attractive tool for modeling and forecasting**.

Code is attached below.

8. TESTING:

TEST CASES
USER ACCEPTANCE TESTING

This document serves as a quick reference for the Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy project's test coverage and open issues as of the project's release for user acceptance testing.

DEFECT ANALYSIS:-

This shows how many bugs were fixed or closed at each severity level and how they were fixed.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	4	5	2	3	14
Duplicate	1	0	3	1	5
External	2	3	0	1	6
Fixed	9	2	4	15	30
Not Reproduced	0	0	1	0	1
Skipped	1	0	1	1	3
Won't Fix	0	5	2	1	8
Totals	17	14	13	22	64

TEST-CASE ANALYSIS

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	9	0	0	9
Client Application	40	0	0	40
Security	3	0	0	3
Out-source Shipping	3	0	0	3
Exception Reporting	8	0	0	8
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

Performance Metrics:

S.No.	Parameter	Values(Percentage)
1.	Model Summary	-96%
2.	Accuracy	Training Accuracy - 96.5% Validation Accuracy -92.3%
3.	Confidence Score (Only Yolo Projects)	Class Detected - Nil Confidence Score - Nil

Our Project marks the successive performance by implementing in order to be cost effective and more reliable to use and to predict the future from the natural disaster that we are ahead of. The successive way includes the objectives, activities and the approaches for the project. It mainly includes the trained dataset which gives an excessive measure of success which helps to overcome the future from this natural disaster.

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- The use of AI to forecast natural disasters would save millions of lives. Furthermore, the information evaluated by AI-powered systems can aid in understanding the scale and patterns of natural catastrophes such as floods, earthquakes, and tsunamis, which would aid in improved infrastructure development in disaster-prone areas.

- Disaster management plays an integral role in keeping communities safe. It involves coordinating the resources, such as pollution control systems, and responsibilities, such as following best practice policies, needed to prevent, prepare for, respond to, and recover from emergencies.

DISADVANTAGES:

- A forest fire is a natural disaster that cannot be forecasted.
- Sometimes the prediction may fail and result in huge loss.

11. CONCLUSION

Natural disasters inflict severe damage on almost the entire spectrum of social and natural habitats, ranging from housing and shelter, water, food, health, sanitation, and waste management to information and communication networks, supply of power and energy, and transportation infrastructure. The major challenges faced in all disasters include pre-disaster early warning infrastructure; the supply of food and clean drinking water; health and sanitation; information and communication; power and energy for lighting and cooking; waste collection and disposal, including rapid disposal of dead bodies of humans and animals; disaster-proof housing and shelter; emergency and post-disaster shelters; rescue and relief operations; and transport infrastructure. Though it is not possible to prevent most of the disasters, still their effects can be alleviated or mitigated in magnitude by anticipated preparedness. Advanced disaster management technology could provide a critical support system for disaster management authorities at times of disaster-related crises. Such a technology also provides important inputs for any disaster management plan of action in modern times. Communities and individuals have to be educated on pre-disaster planning and preparedness. Awareness must be created amongst masses, for which first-aid training at grass roots level is essential. There should be a National Disaster Plan that defines the tasks of the communities and local health personnel. For the evaluation of the model ROC and 30% landslide point's residual was used. The results showed that the accuracy of the model was estimated by ANFIS in the study area of 77.48% (good accuracy); this data-mining method depends on the number of pairs of training, experimental and fuzzy data used in the research, and, in particular, by increasing the number of fuzzy rules of the process, more accurate simulation can be provided. So far, different methods have been proposed for landslide susceptibility zonation. The accuracy or the error of each of these methods, as well as the use and comparison of each of these methods, requires knowledge of the foundations on which the methods are based. So far, different approaches to landslide susceptibility zonation have been proposed, but what is certain is that all these methods can provide accurate results with minimal data and costs and at very low levels. Combining these models with GIS and RS systems not only increases the accuracy of dealing with complex issues and uncertainties, but also leads to the emergence and development of new theories and methods in a variety of issues.

12. FUTURE SCOPE

The term "Natural Disaster" encompasses the complete realm of disaster-related activities. Traditionally people tend to think of disaster management only in terms of the post-disaster actions taken by relief and reconstruction officials; yet disaster management covers a much broader scope, and many modern disaster managers may find themselves far more involved in pre-disaster activities than in post-disaster response. Those are:

1. The refugee field of disaster management is highly specialized and requires not only many development skills but also a broader awareness of political, legal, and humanitarian issues.
2. DM aims and objectives, elements, Natural/man-made Disasters, Victims, Relief Systems.
3. Phases of Disaster Response/Relief Operations, Government's Role.

To Safeguard and make available vital materials, supplies and equipment to ensure the safety and recovery of records from predictable disasters.To reduce the risk of disasters caused by human error, deliberate destruction, and building or equipment failures. Be better prepared to recover from a major natural catastrophe.

In this project we help to build preparedness for threats and hazards by providing a low-risk, cost-effective environment to: **Test and validate plans, policies, procedures and capabilities**. Identify resource requirements, capability gaps, strengths, areas for improvement, and potential best practices. Disaster management aims to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. Disaster Risk Management includes the sum total of all activities, programmes and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover from its losses.

13. APPENDIX:

Source Code

APP.PY:

```
from flask import
Flask,
render_template,
flash, request,
session,send_file
                    from flask import render_template, redirect, url_for, request
                    import warnings
                    import datetime
                    import cv2
                    app = Flask(__name__)
                    app.config['DEBUG']
                    app.config['SECRET_KEY'] = '7d441f27d441f27567d441f2b6176a'
                    @app.route("/")
                    def homepage():
                        return render_template('index.html')
                    @app.route("/Training")
                    def Training():
                        return render_template('Tranning.html')
                    @app.route("/Test")
                    def Test():
                        return render_template('Test.html')
                    @app.route("/train", methods=['GET', 'POST'])
                    def train():
                        if request.method == 'POST':
                            import model as model
                            return render_template('Tranning.html')
                    @app.route("/testimage", methods=['GET', 'POST'])
                    def testimage():
                        if request.method == 'POST':
                            file = request.files['fileupload']
                            file.save('static/Out/Test.jpg')
                            img = cv2.imread('static/Out/Test.jpg')
                            if img is None:
                                print('no data')
                            img1 = cv2.imread('static/Out/Test.jpg')
                            print(img.shape)
                            img = cv2.resize(img, ((int)(img.shape[1] / 5), (int)(img.shape[0] / 5)))
```

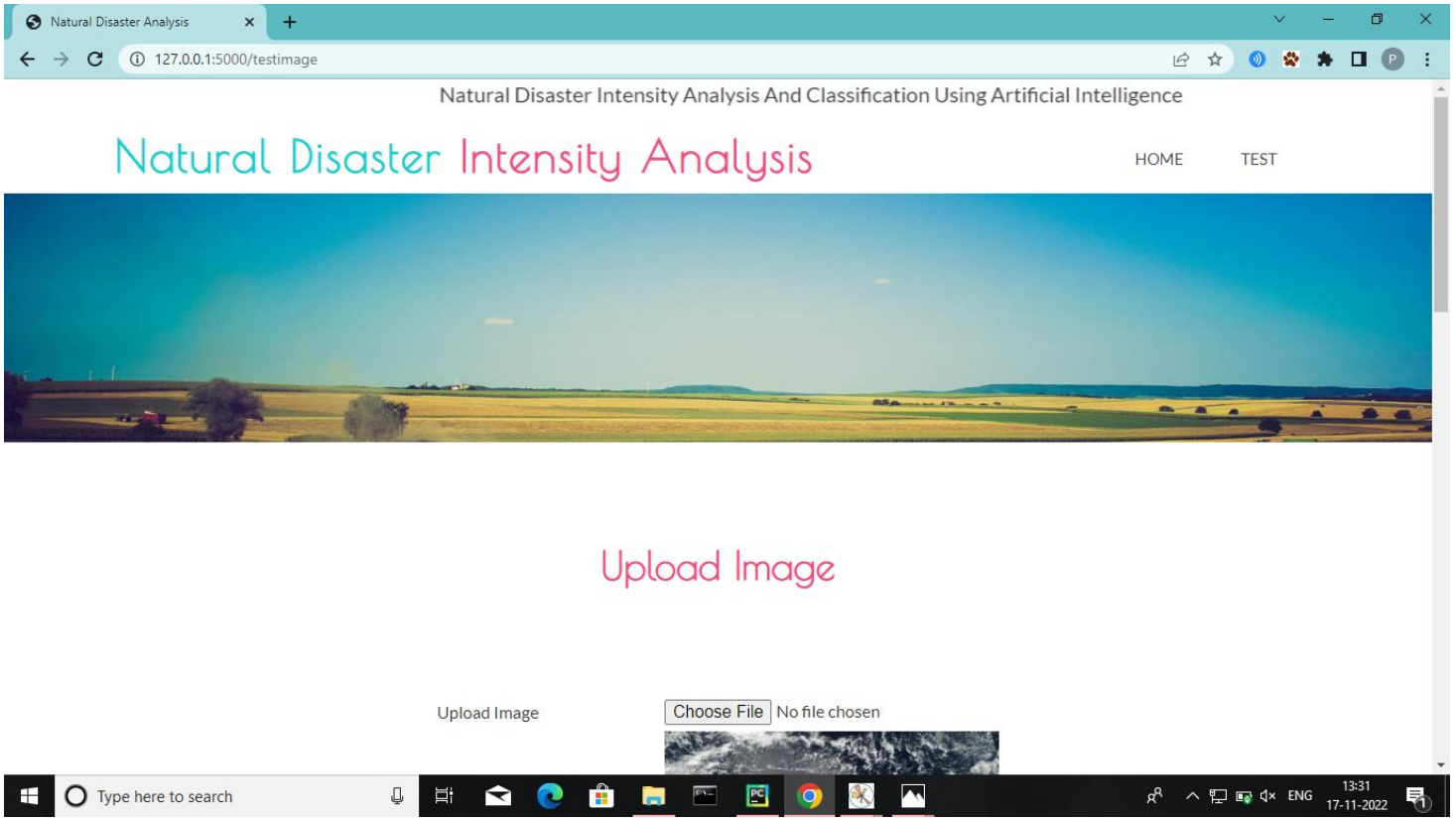
```
        original = img.copy()
        neworiginal = img.copy()
        cv2.imshow('original', img1)
        gray = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
        img1S = cv2.resize(img1, (960, 540))
        cv2.imshow('Original image', img1S)
        grayS = cv2.resize(gray, (960, 540))
        cv2.imshow('Gray image', grayS)
        gry = 'static/Out/gry.jpg'
        cv2.imwrite(gry, grayS)
        from PIL import  ImageOps,Image
        im = Image.open(file)
        im_invert = ImageOps.invert(im)
        inv = 'static/Out/inv.jpg'
        im_invert.save(inv, quality=95)
        dst = cv2.fastNlMeansDenoisingColored(img1, None, 10, 10, 7, 21)
        cv2.imshow("Nosie Removal", dst)
        noi = 'static/Out/noi.jpg'
        cv2.imwrite(noi, dst)
        import warnings
        warnings.filterwarnings('ignore')
        import tensorflow as tf
        classifierLoad = tf.keras.models.load_model('firemodel.h5')
        import numpy as np
        from keras.preprocessing import image
        test_image = image.load_img('static/Out/Test.jpg', target_size=(200, 200))
        img1 = cv2.imread('static/Out/Test.jpg')
        # test_image = image.img_to_array(test_image)
        test_image = np.expand_dims(test_image, axis=0)
        result = classifierLoad.predict(test_image)
        out = ''
        pre = ''
        if result[0][0] == 1:
            out = "Cyclone"
        elif result[0][1] == 1:
            out = "Earthquake"
        elif result[0][2] == 1:
            out = "Flood"
        elif result[0][3] == 1:
            out = "Wildfire"
        org = 'static/Out/Test.jpg'
        gry ='static/Out/gry.jpg'
        inv = 'static/Out/inv.jpg'
        noi = 'static/Out/noi.jpg'
        return render_template('Test.html',result=out,org=org,gry=gry,inv=inv,noi=noi)
if __name__ == '__main__':
    app.run(debug=True, use_reloader=True)
```

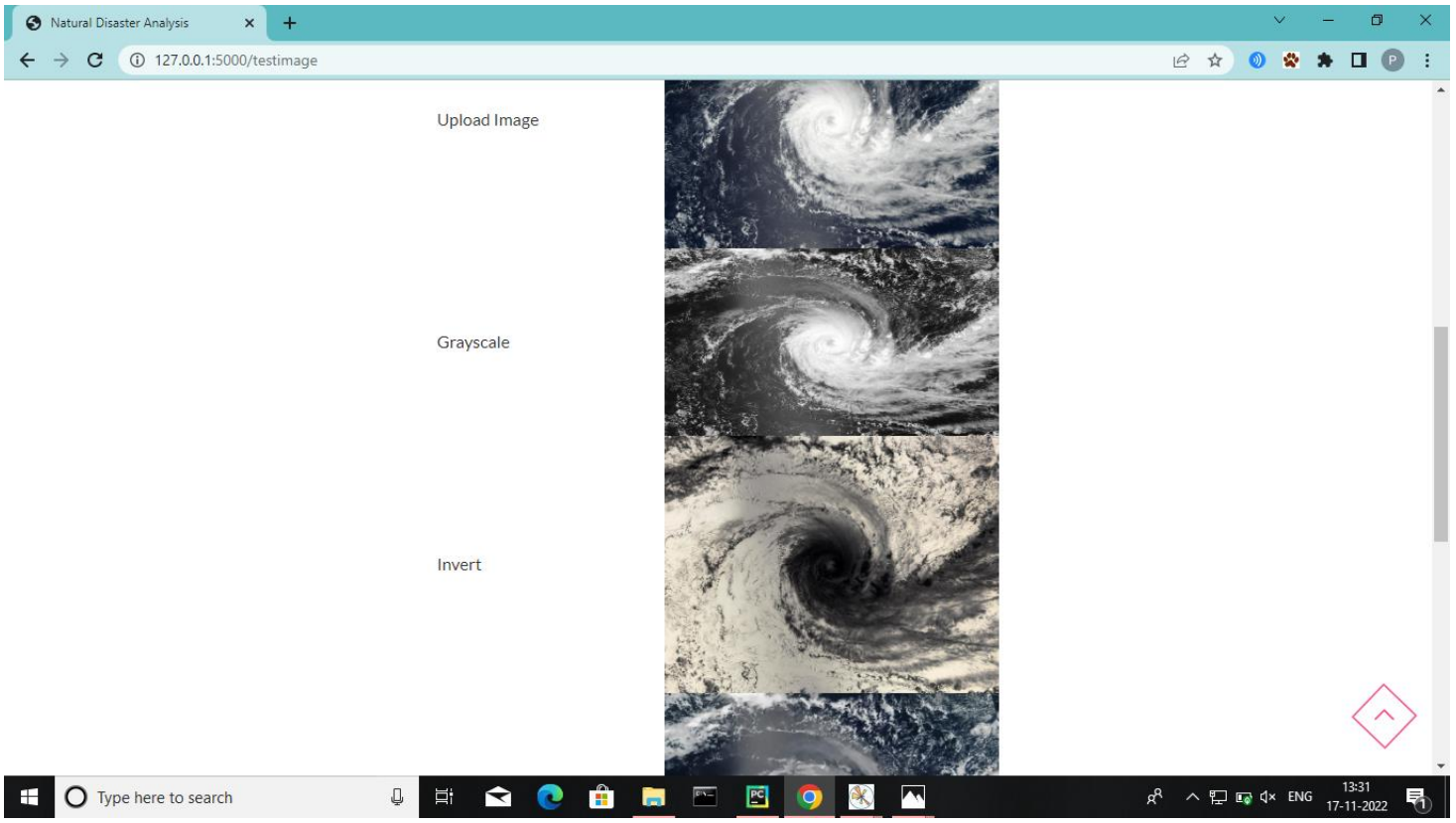
MODEL.PY:

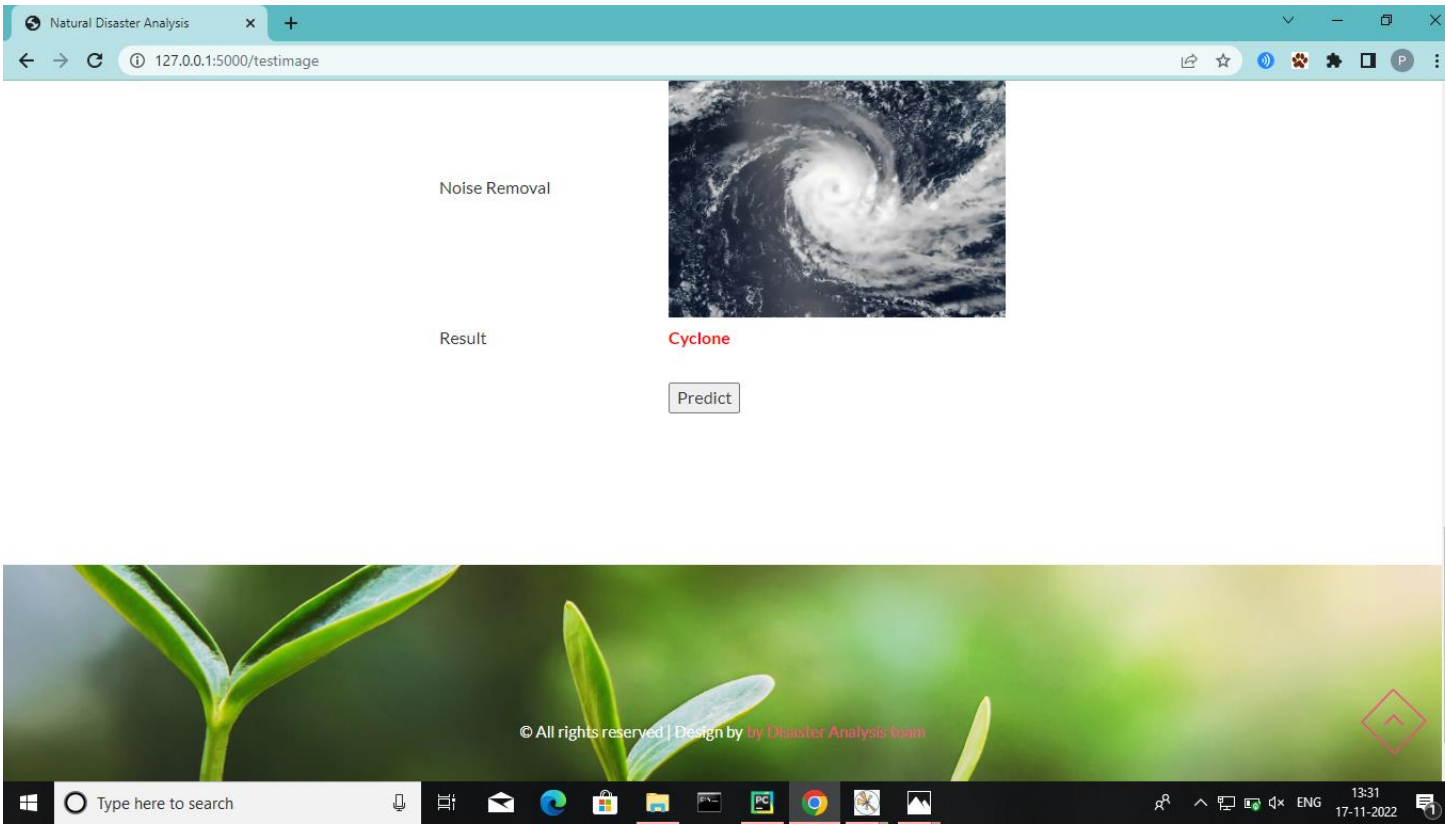
```
# Part 1
-
Building
the CNN
            # Importing the Keras libraries and packages
            from keras.models import Sequential
            from keras.layers import Convolution2D
            from keras.layers import MaxPooling2D
            from keras.layers import Flatten
            from keras.layers import Dense
            from keras.models import model_from_json
            import matplotlib.pyplot as plt
            import warnings
            warnings.filterwarnings('ignore')
            batch_size = 32
            from tensorflow.keras.preprocessing.image import ImageDataGenerator
            # All images will be rescaled by 1./255
            train_datagen = ImageDataGenerator(rescale=1/255)
            # Flow training images in batches of 128 using train_datagen generator
            train_generator = train_datagen.flow_from_directory(
                    'Data',  # This is the source directory for training images
                    target_size=(200, 200),  # All images will be resized to 200 x 200
                    batch_size=batch_size,
                    # Specify the classes explicitly
                    classes = ['Cyclone','Earthquake','Flood','Wildfire'],
                    # Since we use categorical_crossentropy loss, we need categorical labels
                    class_mode='categorical')
            import tensorflow as tf
            model = tf.keras.models.Sequential([
                # Note the input shape is the desired size of the image 200x 200 with 3 bytes color
                # The first convolution
                tf.keras.layers.Conv2D(16, (3,3), activation='relu', input_shape=(200, 200, 3)),
                tf.keras.layers.MaxPooling2D(2, 2),
                # The second convolution
                tf.keras.layers.Conv2D(32, (3,3), activation='relu'),
                tf.keras.layers.MaxPooling2D(2,2),
                # The third convolution
                tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
                tf.keras.layers.MaxPooling2D(2,2),
                # The fourth convolution
                tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
                tf.keras.layers.MaxPooling2D(2,2),
                # The fifth convolution
                tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
                tf.keras.layers.MaxPooling2D(2,2),
                # Flatten the results to feed into a dense layer
                tf.keras.layers.Flatten(),
                # 128 neuron in the fully-connected layer
                tf.keras.layers.Dense(128, activation='relu'),
                # 5 output neurons for 5 classes with the softmax activation
                tf.keras.layers.Dense(4, activation='softmax')
            ])
            model.summary()
            from tensorflow.keras.optimizers import RMSprop
            early = tf.keras.callbacks.EarlyStopping(monitor='val_loss',patience=5)
            model.compile(loss='categorical_crossentropy',
```

```
              optimizer=RMSprop(lr=0.001),
              metrics=['accuracy'])
total_sample=train_generator.n
n_epochs = 10
history = model.fit_generator(
        train_generator,
        steps_per_epoch=int(total_sample/batch_size),
        epochs=n_epochs,
        verbose=1)
model.save('firemodel.h5')
acc = history.history['accuracy']
loss = history.history['loss']
epochs = range(1, len(acc) + 1)
# Train and validation accuracy
plt.plot(epochs, acc, 'b', label=' accurarcy')
plt.title('  accurarcy')
plt.legend()
plt.figure()
# Train and validation loss
plt.plot(epochs, loss, 'b', label=' loss')
plt.title('  loss')
plt.legend()
plt.show()
```

OUTPUT:


Natural Disaster Analysis
127.0.0.1:5000/testimage
Natural Disaster Intensity Analysis And Classification Using Artificial Intelligence
Natural Disaster Intensity Analysis
HOME
TEST
Upload Image
Upload Image
Choose File
No file chosen
Type here to search
ENG
13:31
17-11-2022


Natural Disaster Analysis
127.0.0.1:5000/testimage
Upload Image
Grayscale
Invert
Type here to search
ENG
13:31
17-11-2022



GIT HUB LINK:

https://github.com/IBM-EPBL/IBM-Project-43470-1660717154

DEMOLINK:

https://drive.google.com/file/d/1WkHxGReeveEci5razPfCGllulp7jJZlU/view?usp=drivesdk