



**KINGS**  
ENGINEERING COLLEGE

**NATURAL DISASTER INTENSITY ANALYSIS  
&  
CLASSIFICATION USING ARTIFICIAL INTELLIGENCE**

**A IBM PROJECT REPORT**

*Submitted by*

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**BONAFIED CERTIFICATE**

Certified that this project report **“NATURAL DISASTER INTENSITY  
ANALYSIS CLASSIFICATION USING ARTIFICIAL INTELLIGENCE”**

is the bonafied work of **“Shiji, Sharmila, Ranjani, Reenathangam ,Nivetha**  
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# **1. INTRODUCTION**

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.

## **1.1 OVERVIEW**

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.

## **1.2 PURPOSE**

The main purpose of this model is to detect and classify the type of disaster with a high accuracy rate. To prevent natural disasters in the future, said model can be used to predict future disasters and take some action against heavy loss of human ecological systems and property.

## 2. LITERATURE SURVEY

1. Natural Disasters Intensity Analysis and Classification Based on Multispectral Images Using Multi-Layered Deep Convolutional Neural Network Natural hazards pose significant risks throughout the world. They are among the deadliest disasters. These events cause significant economic damage as well, with losses from a large tropical cyclone impacting a developed nation approaching or, at times, exceeding U.S. \$100 billion. Risk analysis is, in broad terms, a systematic process aimed at understanding the nature of risk in a given situation and expressing the risk together with the underlying knowledge base. The primary focus is on artificial intelligence, machine learning, and statistical methods. The proposed model works in two blocks: Block-I convolutional neural network (B-I CNN), for detection and occurrence of disasters, and Block-II convolutional neural network (B-II CNN), for classification of natural disaster intensity types with different filters and parameters.

2. Tropical Cyclone Intensity Estimation Using Multidimensional Convolutional Neural Network From Multichannel Satellite Imagery Tropical Cyclone is a severe storm that occurs over the tropical ocean.

TC intensity is one of the key parameters for TC prediction and disaster prevention. Accurate estimation of TC intensity is important to theoretical research studies and practical applications.

Inspired by the

success of deep learning technology in various fields, recent attempts for TC intensity estimation focus on designing effective convolutional neural network (CNN). We design a deep

learning model, called 3DAttentionTCNet, which is inspired by AlexNet. Unlike Alexnet, as the pooling layer compresses some important information resulting in the loss of some intensity features, we remove the pooling layers. In addition, we remove the dropout layer, the reason why we make this adjustment is that dropout

regularization technology randomly removes some neurons during the training process. It has been confirmed that removing the dropout layer will cause negative deviations.

### 3. Designing Deep-Based Learning Flood Forecast Model With ConvLSTM Hybrid Algorithm

Early detection of natural disasters such as floods can greatly assist humans in reducing the extent of the damage caused by such events. In the Fiji Islands, where this study is focused, recent flood events resulted in major damages amounting to millions of dollars. The loss of at least 225 lives during the 1931 flood event in Fiji was primarily due to the unavailability of efficient flood warning systems.

One simple, yet a robust mathematical tool used to determine the flood state at a particular time for a given area is the Flood Index (IF). A model is developed Develop multi-step predictive model using ConvLSTM, as an objective model, with alternative methods of LSTM, CNN-LSTM and SVR that can also determine the flood state.

### 4. A Conformal Regressor With Random Forests for Tropical Cyclone Intensity Estimation

Tropical Cyclone is an intense vortex system that originates over the tropical ocean and is one of the most destructive natural disasters. TC intensity usually refers to the maximum wind speed near the TC center.



TC intensity is an important indicator to quantify the destruction potential. The basic idea of using satellite data to estimate the intensity is that the cloud pattern strongly correlates with the TC intensity in the image. It is considered an excellent way to extract features from satellite images to estimate TC intensity. The most common technique is the Dvorak technique. The Dvorak technique tried to estimate the TC intensity using visible or infrared images based on the cloud structure. Various machine learning models have also been applied to TC intensity estimation. Among them, the most widely used was the linear regression

model. A multiple linear regression (MLR) model was constructed based on the extraction of the most significant signals and parameters from satellite infrared images.

5. Rainformer: Features Extraction Balanced Network for Radar-Based Precipitation Nowcasting Precipitation nowcasting task is one of the basic challenges in meteorological research. It aims at predicting the rainfall intensity in the future 0–2 h by using specific meteorological information. It has an enormous application range related with human beings. Precipitation nowcasting methods can be roughly divided into numerical weather prediction (NWP) and extrapolation-based methods. NWP relies on vast complex meteorological data as input data and requires an expensive computing resource. At this point, radar extrapolation-based methods may be a good choice. It does not need

other meteorological information and only uses several radar maps/frames to predict future radar maps. Convolutional long short-term memory (ConvLSTM) is the first ConvRNN-based method applied to the precipitation nowcasting field to the best of our knowledge. Due to the structure of long short-term memory (LSTM), the ConvRNN-based methods can memorize the past information and effectively capture the movement trend and rainfall intensity variation of

rainfall. Although many prior works are superior to traditional algorithms, several issues remain. A new framework for precipitation nowcasting named Rainformer is introduced. It can extract global and local features from radar echo maps separately, and fuses balanced these two features to enhance the model's ability to predict heavy rain or rainstorm. Rainformer consists of an encoder (green box) and decoder (blue box). They both have four stages. When the stage goes deeper, the feature size becomes smaller. Both encoder and decoder include FEBM. FEBM enhances the low to medium and high-intensity rainfall features at every stage.

## **2.1 EXISTING PROBLEM**

The overall proposed model works on an image dataset to detect and classify the natural disasters. As the model is evaluated on a simple central processing unit (CPU)-based system, it only detects disaster types and then classifies them into cyclone, earthquake, flood and wildfire classes. However, if this model is run on a graphic processing unit (GPU)-based system in the future with real time sensors and monitoring power, then the proposed model will be used as a real time natural disaster detection model and provide some upcoming predictions for future disasters.

## **2.2 REFERENCES**

1. Mignan A., Broccardo M. Neural network applications in earthquake prediction (1994–2019): Meta-analytic and statistical insights on their limitations. *Seism. Res. Lett.* 2020;91:2330–2342. doi: 10.1785/0220200021. [[CrossRef](#)] [[Google Scholar](#)]
2. Tonini M., D'Andrea M., Biondi G., Degli Esposti S., Trucchia A., Fiorucci P. A Machine Learning-Based Approach for Wildfire Susceptibility Mapping. The Case Study of the Liguria Region in Italy. *Geosciences*. 2020;10:105. doi: 10.3390/geosciences10030105. [[CrossRef](#)] [[Google Scholar](#)]

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## 2.3 PROBLEM STATEMENT DEFINITION

Why does the problem affect?	Structural damage to buildings. Loss of utilities like electricity and water. Debris cleanup and waste management solutions. Infrastructure-related problems such as closed roads and communication losses.
What is issue?	Natural disasters can cause great damage on the environment, property, wildlife and human health. These events may include earthquakes, floods, hurricanes, tornadoes, tsunamis, landslides, wildfires, volcanic eruptions, and extreme temperatures.
When does the issue occurs?	Different disasters occur due to various causes. Causes for such calamities can be contributed to deforestation, soil erosion, and pollution. The major causes of catastrophic disasters are natural phenomena occurring in the earth's crust as well as on the surface.

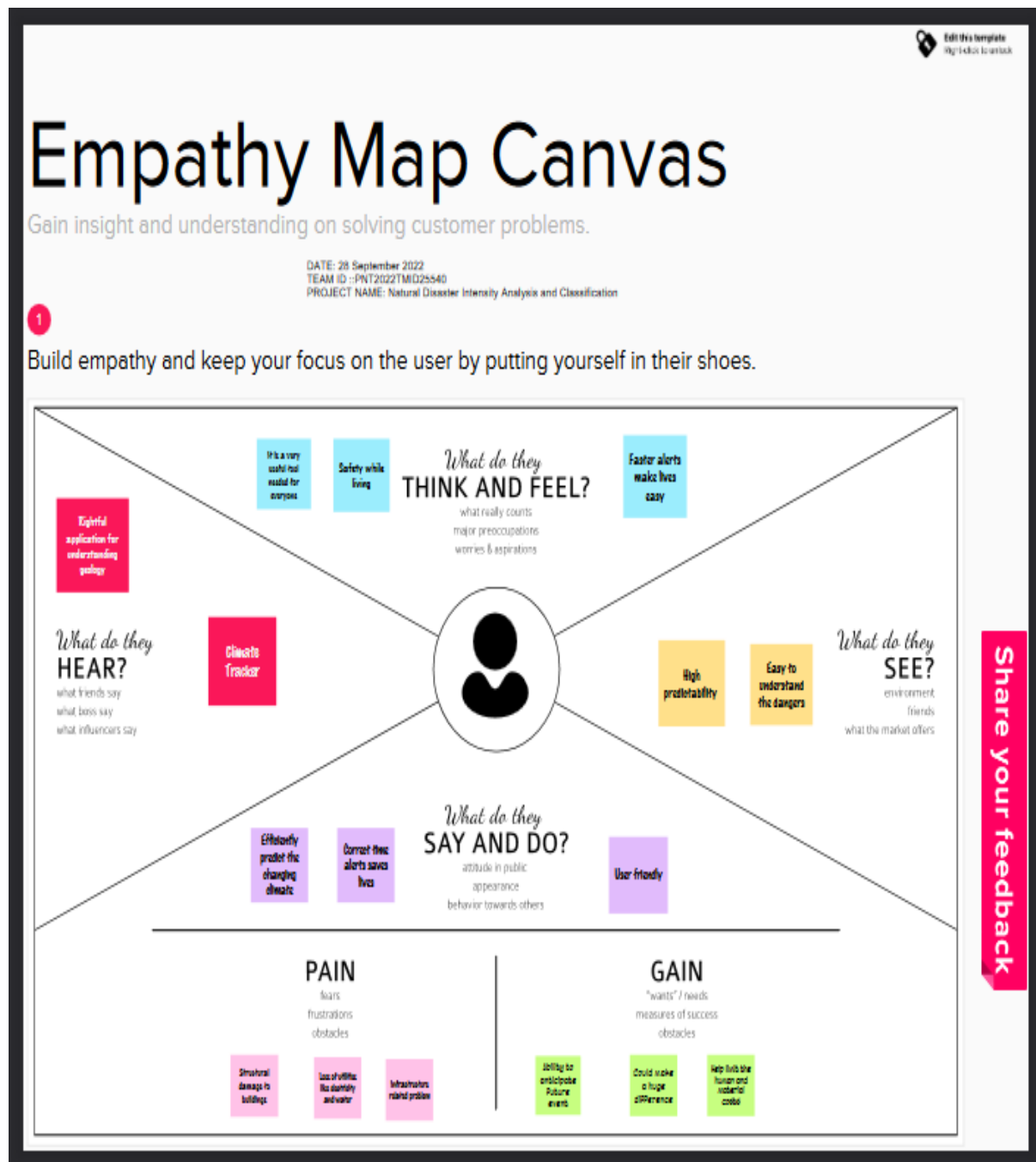
Where is the issue occurring?	Disasters can be caused by natural, man-made and technological hazards, as well as various factors that influence the exposure and vulnerability of a community.
Why is it important that we fix problem?	Disaster management measures can help removing people and property from a threatened location by facilitating timely and effective rescue, relief and rehabilitation at the place of disaster thereby reducing loss of property, protecting people and reducing trauma among people.

### 3. IDEATION & PROPOSED SOLUTION

In the ideation process, **have each member of the team put a minimum of five big ideas on the wall. Of each person's five big ideas, at least one must break the laws of physics.** This last rule forces each member of the team to step out of their current thought process.

In this activity you are expected to prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.

### 3.1 EMPATHY MAP CANVAS



## 3.2 IDEATION & BRAINSTORMING

### Brainstorming & idea prioritization

Use this template to capture your own brainstorming sessions so your team can discuss their suggestions and start shaping concepts when it's time to start doing in the same room.

- Workspaces
- Team members
- Project manager

#### Before you collaborate

1. Identify a specific problem or challenge to solve. Write it down. Then, ask your team to brainstorm ideas to solve it. Write them down.

2. Workspaces

3. Team members

4. Project manager

#### Define your problem statement

What problem are you trying to solve? Write your problem statement in the center. Then, ask your team to brainstorm ideas to solve it. Write them down.

5. Workspaces

#### Brainstorm

Write down any ideas that come to mind. Don't worry about whether they are good or bad. Just write them down.

6. Workspaces

##### Design

- Workspaces
- Team members
- Project manager

##### Structure

- Workspaces
- Team members
- Project manager

##### Results/Outputs

- Workspaces
- Team members
- Project manager

##### Barriers

- Workspaces
- Team members
- Project manager

#### Group ideas

Now, let's group your ideas into categories. Write each idea on a sticky note. Then, ask your team to group the ideas into categories. Write the category names on the sticky notes.

7. Workspaces

#### Prioritize

Now, let's prioritize your ideas. Write each idea on a sticky note. Then, ask your team to rank the ideas from 1 to 10. Write the rank on the sticky note.

8. Workspaces

#### After you collaborate

Now, let's discuss the results of your brainstorming session. Write each idea on a sticky note. Then, ask your team to discuss the ideas. Write the discussion notes on the sticky notes.

9. Workspaces

### Technical Aspects

- Workspaces
- Team members
- Project manager

### Social Impacts

- Workspaces
- Team members
- Project manager

### Availability of Resources

- Workspaces
- Team members
- Project manager

### People Emotions

- Workspaces
- Team members
- Project manager

Importance

Feasibility

### 3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	AI can help response teams understand natural hazards, monitor events in real time, and anticipate specific risks in the face of impending or on-going disasters.
2.	Idea / Solution description	The impact of extreme natural events is also defined by socio-economic resilience, with inequalities exacerbating risks and vulnerabilities. Experts stress the need to explore interoperable solutions that can work in different contexts and even across borders to reach areas with less developed disaster infrastructure.

3.	Novelty / Uniqueness	Artificial intelligence (AI) can enhance our understanding of natural disasters and support disaster relief/early warning. However, AI is not yet part of the modus operandi in natural disaster management. Therefore, the Focus Group on AI for Natural Disaster Management (FG-AI4NDM) capitalizes on the growing interest and novelty of AI in the field of natural disaster management to help lay the groundwork for best practices in the use of AI for: assisting with data collection and handling, improving modelling across spatiotemporal scales, and providing effective communication.
4.	Social Impact / Customer Satisfaction	Natural Disasters can cause social impacts that are similar in different types of communities such as the need for rebuilding, urgent access to health care, simply accessing shelter during/after a storm, availability to food and water, turning towards the government for aid or towards religious organization for aid and moral support.



5.	Scalability of the Solution	<ul style="list-style-type: none"> <li>• <b>Be Hardware Agnostic.</b> A hardwareagnostic DR solution can replicate data from a virtual machine to a DR Target so long as the underlying hypervisors are compatible. This allows businesses to take the complexity out of DR.</li> <li>• <b>Work on an Individual Virtual Machine Level.</b> The ability to target and replicate individual virtual machines (VMs) rather than entire logical unit numbers (LUNs) is a must for scalability, especially on modern, highefficiency computing environments that use virtualization. This helps to reduce overall storage and network requirements.</li> <li>• <b>Enable Simplistic Management.</b> Over time, business computing needs can grow to the point where a single business is running dozens or hundreds of individual VMs for all of their different applications and databases. If the DR solution is too complex, it can turn managing recovery operations for all of the company's servers and VMs too difficult to be effective.</li> </ul>
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### 3.4 PROBLEM SOLUTION FIT

<p><b>WHO ARE AFFECTED?</b></p> <p>Natural disasters present a significant and growing threat to the well-being of children. Every year, <b>175 million children globally</b> are expected to be affected by natural disasters, including floods, cyclones, droughts, heatwaves, severe storms, and earthquakes.</p>	<p><b>PROBLEMROOT CAUSE</b></p> <p>Disasters occur when people are affected by natural or technical hazards – when lives are lost or property is destroyed. As the Swiss writer <u>Max Frisch</u> observed in his 1979 book <i>'Man in the Holocene'</i>, "only human beings can recognise catastrophes, provided they survive them; <b>nature recognises no catastrophes.</b>"</p>	<p><b>DISADVANTAGES</b></p> <p>In a disaster, <b>you face the danger of death or physical injury</b>. 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.</p>
<p><b>PROBLEMS</b></p> <p>Climate change is increasing the frequency, intensity and magnitude of disasters, leading to a higher number of deaths and injuries, as well as increased property and economic losses. In the past 20 years, 90% of major disasters have been caused by weather-related events such as heatwaves, storms, floods and droughts, according to the UN Office for Disaster Risk Reduction (UNISDR).</p>	<p><b>AVAILABLE SOLUTIONS</b></p> <p>With each passing year, weather extremes seem to become more a part of our daily lives. Natural catastrophes have recently captured public attention with California wildfires on the West Coast, hurricanes on the East Coast, and a series of tornadoes in between. The cost of cleanup alone is in the billions, once the price of home and public infrastructure repairs, debris removal, and temporary housing is included. Many millions more are spent on less obvious items, such as medical/dental care, small business loans, water, and ice—the list goes on.</p>	<p><b>OUR SOLUTION</b></p> <p>such as <b>conserving forests, wetlands and coral reefs</b>, can help communities prepare for, cope with, and recover from disasters, including slow-onset events such as drought. They can also reduce the secondary impacts from non-climate-related disasters such as landslides following an earthquake.</p>

## 4. REQUIREMENT ANALYSIS

Functional requirements are **product features or functions that developers must implement to enable users to accomplish their tasks**. So, it's important to make them clear both for the development team and the stakeholders. Generally, functional requirements describe system behavior under specific conditions.

## 4.2 FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

<b>FR No.</b>	<b>Functional Requirement</b>	<b>Sub Requirement</b>
FR-1	User Registration	Registration through GMAIL. Registration through Linked IN.
FR-2	User Confirmation	Confirmation via Email. Confirmation via OTP.
FR-3	Authorization levels	Normal user. Premium user.
FR-4	External Interfaces	Database.
FR-5	Transaction processing	Sender's search details are send to the Database. Database is send the results to application.
FR-6	Reporting	User can any feedback he is report in our application.
FR-7	Business rules	Premium users only can access the categorical data. Premium users are get offline search feature.

## 4.3NON-FUNCTIONAL REQUIREMENT

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

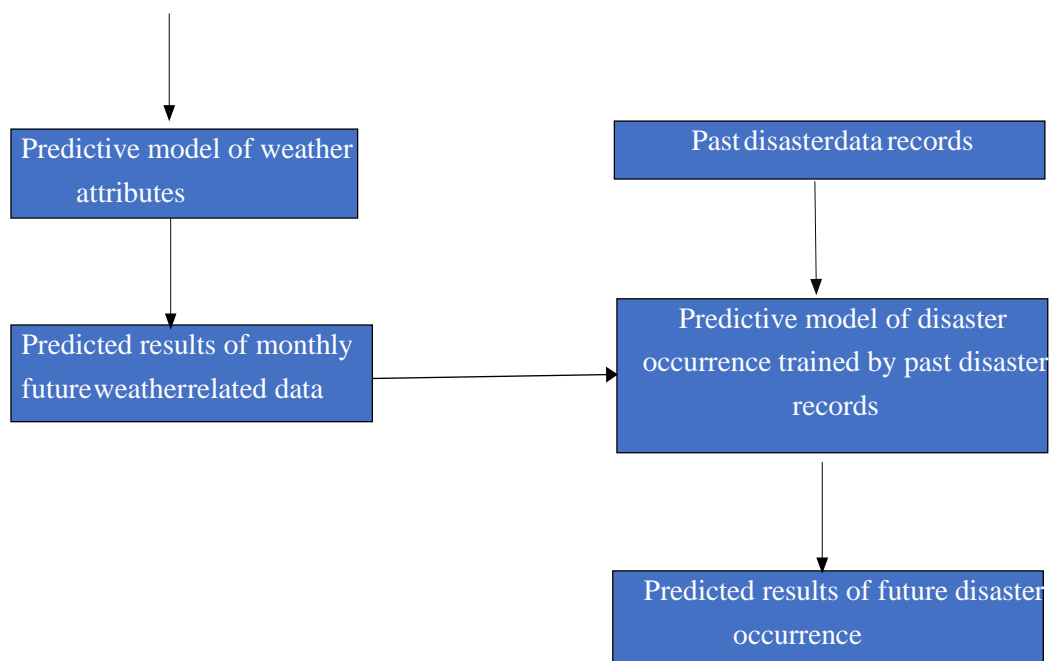
<b>FR No.</b>	<b>Non-Functional Requirement</b>	<b>Description</b>
NFR-1	<b>Usability</b>	Search results can be delayed where there is no network get for online users.
NFR-2	<b>Security</b>	User's details will be very secured in our application.

NFR-3	<b>Reliability</b>	the database update process must roll back all related updates when any update fails.
NFR-4	<b>Performance</b>	The front page load time will be no more than 5 seconds for users that access the application.
NFR-5	<b>Availability</b>	the pages that experience problem then display a notification
NFR-6	<b>Scalability</b>	The application can be used by 2,00,000 users simultaneously.

## 5. PROJECT DESIGN

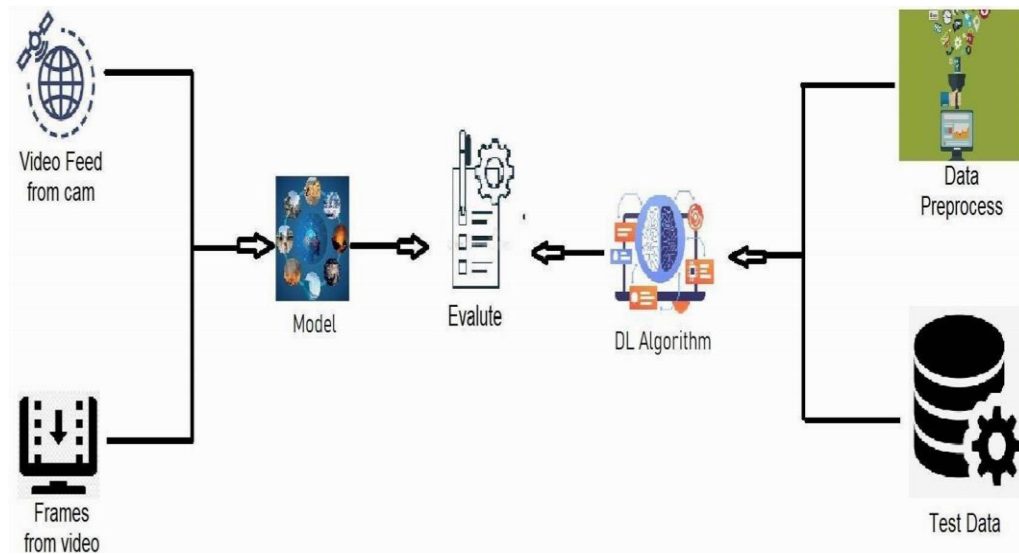
Project design is **an early phase of the project lifecycle where ideas, processes, resources, and deliverables are planned out**. A project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information.

### 5.1 DATA FLOW DIAGRAM

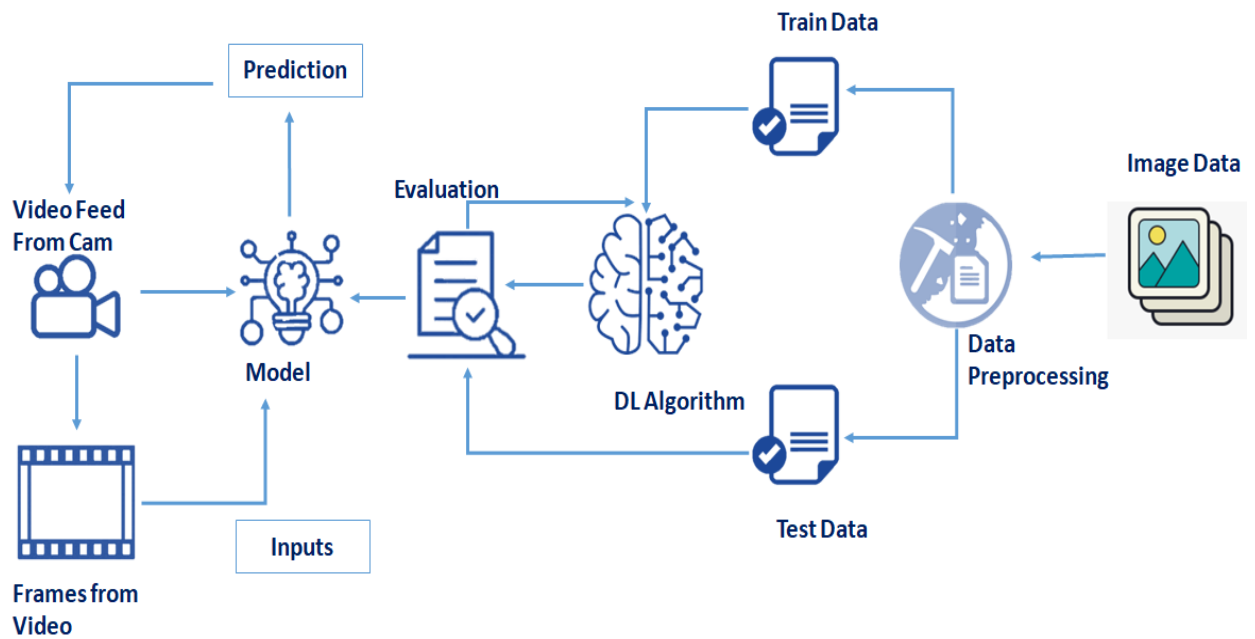


## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

### Solution Architecture



### Technology Architecture



## 5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
General User	Authentication	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password. (Facebook Login)	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register& access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can login with my password	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can see the dashboard now	High	Sprint-1
	Dashboard	USN-6	As a user, I can update Disaster incidents	I can update now	Medium	Sprint-1
		USN-7	As a user,I can view Map Data	I can see Map Data	Medium	Sprint-1
Community Leader and Officer(Disaster Team)	Authentication	USN-8	As a Community Leader,I can log into the application using my password	I can access my account	High	Sprint-1
		USN-9	As a Community Leader ,I can apply for membership	I can apply membership	High	Sprint-1
		USN-10	As a community Leader, I can verify Disaster	Disaster Verification	High	Sprint-1

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
System Administrator	Membership Approval	USN-11	As a administrator, I can approve the Membership application	I can approve Membership	High	Sprint-1
	Update Disaster Information	USN-12	As a administrator, I can update information about Disaster	I can Update Disaster Information	High	Sprint-1
	Disaster Verification	USN-13	As a administrator, I can verify disaster	I can verify Disaster	High	Sprint-1
Community Leader and System Administrator	Disaster Queries	USN-14	Both are can able to ask disaster queries	We can ask Queries about disaster	Low	Sprint-2
	Disaster Reports	USN-15	Both are can able to give disaster reports	Both will give the disaster reports	Low	Sprint-2

## 6. PROJECT PLANNING &SCHEDULING

Fundamentally, 'Project planning' is all about choosing and designing effective policies and methodologies to attain project objectives. While 'Project scheduling' is a procedure of assigning tasks to get them completed by allocating appropriate resources within an estimated budget and time-frame.

## 6.1 Sprint Planning & Estimation

ACTIVITY ID	ACTIVITY TITLE	ESTIMATED DURATION	ACTIVITY DESCRIPTION	ACTIVITY OWNER
01	Brainstorming Phase	5/9/22 - 10/9/22	In this activity you are expected to list the ideas by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	Shiji
02	Requirement analysis	10/9/22 - 25/9/22	In this activity you are expected to prepare the functional requirement document.	Sharmila
03	Design	25/9/22 - 10/10/22	Project design comes before a project plan as it's a broad overview whereas a project plan includes more detailed information	Ranjani sharmila
04	Sprint Planning	10/10/22 - 20/10/22	In this activity you are expected to prepare the sprint delivery plan	Shiji
05	Code	20/10/22 - 4/11/22	Building HTML Pages Building serverside scrip	Shiji Nivetha
06	Testing	4/11/22 - 9/11/22	Let us train our model with our image dataset.	Sharmila
07	Implementation	9/11/22 - 15/11/22	Trained model will be implemented	Ranjani
08	Documentation	15/11/22 - 18/11/22	After the model will stored in a	

documentation format.

Reenathangam

## MILESTONE LIST

**ACTIVITY ID: S01**

**ACTIVITY TITLE: Brainstorming  
Phase**

MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S01-A	Project Takeoff	7/9/22 - 15/9/22	In this activity you are expected to develop & submit the developed code by testing it.

**ACTIVITY ID: S02**

**ACTIVITY TITLE: Requirement  
analysis**

MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S02-B	Setting up the environment	15/9/22 - 25/9/22	In this activity you are expected to develop & submit the developed code by testing it.

**ACTIVITY ID: S03**

**ACTIVITY TITLE: Design**



MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S03-C	Designing Phase	10/10/22 - 20/10/22	From this milestone you will be continue working on the project design phase. You are expected to cover the activities given.

<b>ACTIVITY ID: S04</b>	<b>ACTIVITY TITLE: Sprint Planning</b>
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MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S04-D	Dataset Collection & Preprocessing	20/10/22 - 22/10/22	This milestone lets you create the dataset or download the dataset
S04-E	Feature Extraction	24/10/22 - 26/10/22	The new set of features will have different values as compared to the original feature values
S04-F	Develop model for Training & Testing	26/10/22 - 1/11/22	Train our model with our image dataset.
S04-G	Performance Measure	01/11/22 - 4/11/22	Measure the performance of trained model

<b>ACTIVITY ID: S05</b>	<b>ACTIVITY TITLE: Testing</b>
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MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S05-H	Test samples	4/11/22 - 9/11/22	Evaluation is a process during the development of the model to check whether the model is the best fit for the given problem and corresponding data.
S05-I	Test Performance	4/11/22 - 9/11/22	Test the performance of the model.
S05-J	Scalability	4/11/22 - 9/11/22	Ensure that the model is scalable

**ACTIVITY ID: S06**

**ACTIVITY TITLE:  
Implementation**

MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION
S06-K	Jupiter Installation	9/11/22 - 13/11/22	Install the Jupiter .
MILESTONE ID	MILESTONE TITLE	ESTIMATED DURATION	MILESTONE DESCRIPTION

S06-L	Project Review	13/11/22- 15/11/22	The completed phase will put in to mentor to review
<b>ACTIVITY ID: S07</b>		<b>ACTIVITY TITLE: Documentation</b>	

S07-M	Project Completion	15/11/22 - 18/11/22	All the process have done and it will stored in documentation format.
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## 6.2 Sprint Delivery Schedule

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 entering my email, password, and confirming my password.	2	High	Shiji
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Sharmila
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Ranjani
Sprint-2		USN-4	As a user, I can register for the application through Gmail	2	Medium	Reenathangam
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	1	High	Nivetha
Sprint-1	Dashboard	USN-6	As a user, I can access the services and information provided in the dashboard	2	High	Shiji
Sprint-1	login	USN-7	As a user, I can log into the web application and access the dashboard	2	High	Sharmila
Sprint-4	Helpdesk	USN-8	As a user, I can get the guidance from the customer care	1	High	Ranjani

Sprint-3	Management	USN-9	As an administrator, I can collect new datasets and keep the model trained	2	High	Reenathangam
----------	------------	-------	--	---	------	--------------

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3		USN-10	As an administrator, I can update other features of the application	2	Medium	Nivetha
Sprint-3		USN-11	As an administrator, I can maintain the information about the user	2	Medium	Shiji
Sprint-4		USN-12	As an administrator, I can maintain third-party services	1	Low	Sharmila

#### Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	8	6 Days	26 Oct 2022	31 Oct 2022	8	29 Oct 2022
Sprint-2	4	6 Days	1 Oct 2022	05 Nov 2022	4	05 Nov 2022
Sprint-3	6	6 Days	6 Nov 2022	10 Nov 2022	6	12 Nov 2022
Sprint-4	2	6 Days	10 Nov 2022	13 Nov 2022	2	19 Nov 2022

#### Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

$$AV (\text{Sprint 1}) = 8/6 = 1$$

$$AV (\text{Sprint 2}) = 4/6 = 1$$

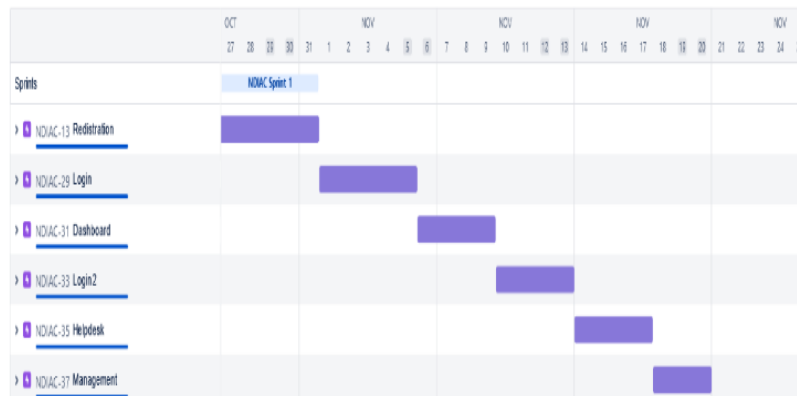
$$AV (\text{Sprint 3}) = 6/6 = 1$$

$$AV (\text{Sprint 4}) = 2/6 = 1$$

$$AV (\text{Total}) = 20/24 = 1 \text{ (approx., 1 sprint to be completed per day)}$$

#### Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

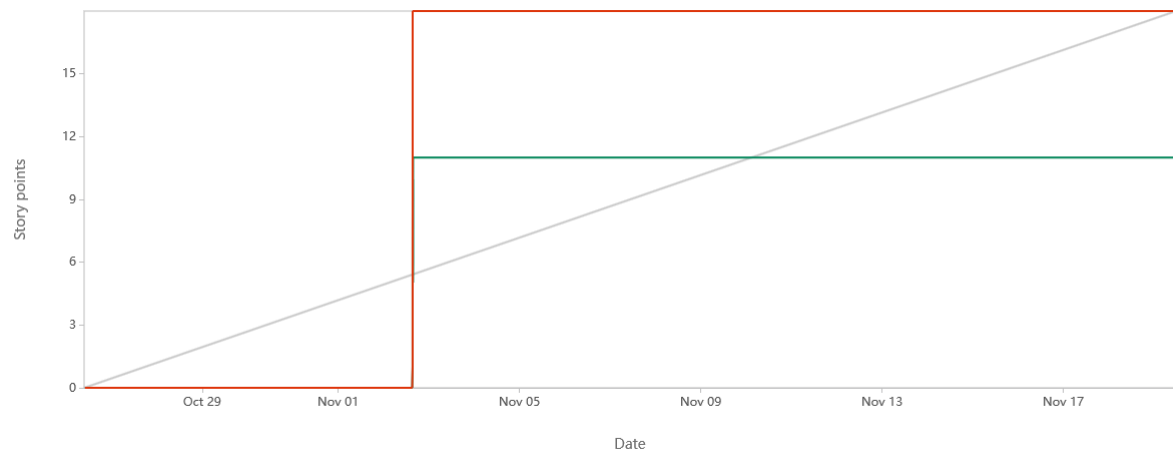


## 6.3 Reports from JIRA

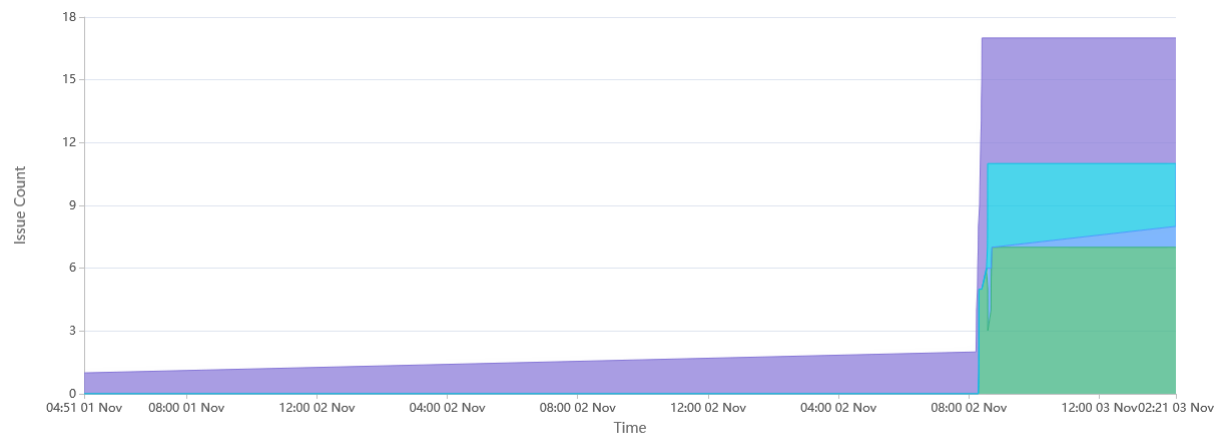
### ROADMAP



## BURNUP REPORT



## CUMULATIVE FLOW DIAGRAM



## **7. CODING AND SOLUTIONING**

### **7.1 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.

### **7.2 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**

### **8.1 Test Cases**

### **8.2 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 report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	11	5	3	4	23
Duplicate	2	1	4	1	8
External	2	3	0	1	6
Fixed	12	1	5	19	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	27	15	16	27	85

## Test Case Analysis

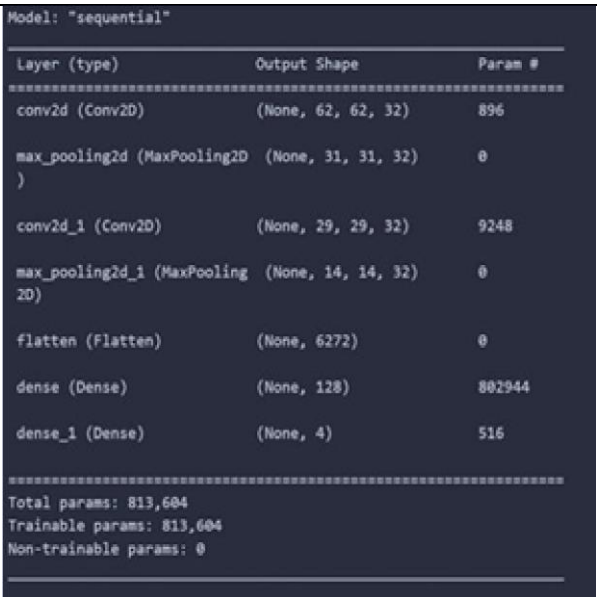
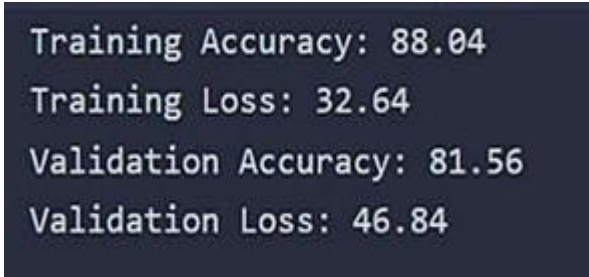
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	8	0	0	8
Client Application	32	50	0	50
Security	4	0	0	4



## 9.RESULTS

### 9.1 PERFORMANCE METRICS

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	 <pre> Model: "sequential" Layer (type)                Output Shape              Param # ----- conv2d (Conv2D)              (None, 62, 62, 32)        896 max_pooling2d (MaxPooling2D) (None, 31, 31, 32)        0 conv2d_1 (Conv2D)            (None, 29, 29, 32)        9248 max_pooling2d_1 (MaxPooling2D) (None, 14, 14, 32)        0 flatten (Flatten)            (None, 6272)              0 dense (Dense)                (None, 128)               802944 dense_1 (Dense)              (None, 4)                 516 Total params: 813,604 Trainable params: 813,604 Non-trainable params: 0           </pre>
2.	Accuracy	Training Accuracy – 88.04%  Validation Accuracy -81.56%	 <pre> Training Accuracy: 88.04 Training Loss: 32.64 Validation Accuracy: 81.56 Validation Loss: 46.84           </pre>

## 10.ADVANTAGES & DISADVANTAGES

### Advantages

1. Humans also need breaks and time offs to balance their work life and personal life. But AI can work endlessly without breaks.

2. With the use of various AI-based techniques, we can also anticipate today's weather and the days ahead.
3. Helpful in getting life back on track..
4. Their Alert nature able to respond effectively and efficiently which defend the society from large scale damages.

### **Disadvantages**

1. It involves huge money to be equipped.
2. Problems faced in life basic needs.
3. One application of artificial intelligence is a robot, which is displacing occupations and increasing unemployment .
4. Machines can perform only those tasks which they are designed or programmed to do, anything out of that they tend to crash or give irrelevant outputs which could be a major backdrop.

## **11.CONCLUSION**

Many researchers have attempted to use different deep learning methods for detection of natural disasters. However, the detection of natural disasters by using deep learning techniques still faces various issues due to noise and serious class imbalance problems. To address these problems, we proposed a multilayered deep convolutional neural network for detection and intensity classification of natural disasters. The proposed method works in two blocks—one for detection of natural disaster occurrence and the second block is used to remove imbalanced class issues.

The results were calculated as average statistical values: sensitivity, 97.54%; specificity, 98.22%; accuracy rate, 99.92%; precision, 97.79%; and

F1-score, 97.97% for the proposed model. The proposed model achieved the highest accuracy as compared to other state-of-the-art methods due to its multilayered structure. The proposed model performs significantly better for natural disaster detection and classification, but in the future the model can be used for various natural disaster detection processes.

## **12.FUTURE SCOPE**

AI -smart technology, which has enabled accurate and speedy solutions. If harnessed properly, the technology has the potential of predicting, preventing and providing response faster than ever.

AI data setups are trained to predict seismic data to analyze the patterns of earthquake occurrences, rainfall records and monitor flooding, measure the intensity of hurricanes and read the geological data to understand volcanic eruptions, such systems can reduce the catastrophic impact of natural disasters.


Last year, Google's Pilot project to monitor flood in India with the help of AI, was a successful one – it was a Patna project. They were able to predict floods and the regions that it would be affected due to the natural disaster with an accuracy of over 90%. It was possible owing to the combination of data from government agencies that provide onground information – from measuring devices placed on the spot and satellite captured images of flood-prone areas. They ran hundreds of thousands of simulations on its machine learning (ML) models to predict the flow of water. In the future, leveraging AI can help disaster management bodies install drones, sensors and robots to provide accurate information about damaged buildings and landscapes, potential floods, making rescue missions safer and less time-consuming.

There is a need for smart technology to be integrated within our local communities. Immediate response and tech-based solutions can help reduce the extent of damage. However, since AI is based on machine codes, there is a scope

of limitations and errors. However, the amalgamation of human, empathy and alertness, could do wonders in the field of crisis management.

## 13.APPENDIX

### Sourcecode

 Jupyter Home.html ✓ a minute ago Logout

File Edit View Language HTML

```
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4   <title>Home Page</title>
5   <meta charset="utf-8">
6   <meta name="viewport" content="width=device-width, initial-scale=1">
7   <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
8   <link href="https://fonts.googleapis.com/css?family=Montserrat" rel="stylesheet" type="text/css">
9   <link href="https://fonts.googleapis.com/css?family=Lato" rel="stylesheet" type="text/css">
10  <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js"></script>
11  <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
12
13  <style>
14
15    body {
16      font: 400 15px Lato, sans-serif;
17      line-height: 1.8;
18      color: #818181;
19    }
20    h2 {
21      font-size: 24px;
22      text-transform: uppercase;
23      color: #303030;
24      font-weight: 600;
25      margin-bottom: 30px;
26    }
27    h4 {
28      font-size: 19px;
29      line-height: 1.375em;
30      color: #303030;
```

File Edit View Language

```

31 font-weight: 400;
32 margin-bottom: 30px;
33 }
34 .jumbotron {
35 background-color: #f4511e;
36 color: #fff;
37
38 font-family: Montserrat, sans-serif;
39 }
40 .container-fluid {
41 padding: 60px 50px;
42 }
43 .g-grey {
44 background-color: #f6f6f6;
45 }
46 .logo-small {
47 color: #f4511e;
48 font-size: 50px;
49 }
50 .logo {
51 color: #f4511e;
52 font-size: 200px;
53 }
54 .thumbnail {
55 padding: 0 0 15px 0;
56 border: none;
57 border-radius: 0;
58 }
59 .thumbnail img {
60 width: 100%;

```

File Edit View Language

```

61 height: 100%;
62 margin-bottom: 10px;
63 }
64 .carousel-control.right, .carousel-control.left {
65 background-image: none;
66 color: #f4511e;
67 }
68 .carousel-indicators li {
69 border-color: #f4511e;
70 }
71 .carousel-indicators li.active { background-color: #f4511e;
72 }
73 .item h4 {
74 font-size: 19px;
75 line-height: 1.375em;
76 font-weight: 400;
77 font-style: italic;
78 margin: 70px 0;
79 }
80 .item span {
81 font-style: normal;
82 }
83 .panel {
84 border: 1px solid #f4511e;
85 border-radius: 0 !important;
86 transition: box-shadow 0.5s;
87 }
88 .panel:hover {
89 box-shadow: 5px 0px 40px rgba(0,0,0, .2);
90 }

```

File Edit View Language

H

```

91 .panel-footer .btn:hover {
92   border: 1px solid #f4511e;
93   background-color: #fff !important;
94   color: #f4511e; }
95 .panel-heading {
96   color: #fff !important;
97   background-color: #f4511e !important;
98   padding: 25px; rde -bottom: 1px solid transparent;
99
100   border-top-left-radius: 0px;
101   border-top-right-radius: 0px;
102   border-bottom-left-radius: 0px;
103   border-bottom-right-radius: 0px;
104 }
105 .panel-footer {
106   background-color: white !important;
107 }
108 .panel-footer h3 {
109   font-size: 32px;
110 }
111 .panel-footer h4 {
112   color: #aaa;
113   font-size: 14px;
114 }
115 .panel-footer .btn {
116   margin: 15px 0;
117   background-color: #f4511e;
118   color: #fff;
119 }
120 .navbar {

```

File Edit View Language

HTM

```

121   margin-bottom: 0;
122   background-color: #0059ff;
123   z-index: 9999;
124   border: 0;
125   font-size: 12px !important;
126   line-height: 1.42857143 !important;
127   letter-spacing: 4px; rde -radius: 0; font-family: Montserrat, sans-serif;
128 }
129 .navbar li a, .navbar .navbar-brand {
130   color: #fff !important;
131 }
132 .navbar-nav li a:hover, .navbar-nav li.active a {
133   color: #f4511e !important;
134   background-color: #fff !important;
135 }
136 .navbar-default .navbar-toggle {
137   border-color: transparent;
138   color: #fff !important;
139 }
140 footer .glyphicon {
141   font-size: 20px;
142   margin-bottom: 20px;
143   color: #f4511e;
144 }
145 .slideanim {visibility:hidden;}
146 .slide {
147   animation-name: slide;
148   -webkit-animation-name: slide;
149   animation-duration: 1s;
150   -webkit-animation-duration: 1s;

```

```
File Edit View Language HTM
150
151 visibility: visible;
152 }
153 @keyframes slide {
154 0% { opacity: 0; transform: translateY(70%);
155 }
156 100% {
157 opacity: 1;
158 transform: translateY(0%);
159 }
160 }
161 @-webkit-keyframes slide {
162 0% {
163 opacity: 0;
164 -webkit-transform: translateY(70%);
165 }
166 100% {
167 opacity: 1;
168 -webkit-transform: translateY(0%);
169 }
170 }
171 @media screen and (max-width: 768px) {
172 .col-sm-4 {
173 text-align: center;
174 margin: 25px 0;
175 }
176 .btn-lg {
177 width: 100%;
178 margin-bottom: 35px;
179 }
180 }
```

```
File Edit View Language
180 }
181 @media screen and (max-width: 480px) {
182 .l go {
183
184 font-size: 150px;
185 }
186 }
187
188 .container {
189 padding: 16px;
190 max-width: max-content;
191 }
192
193 .container {
194 max-width: 1376px;
195 margin: auto;
196 padding: 2rem 1.5rem;
197 }
198
199 .cards {
200 display: flex;
201 flex-wrap: wrap;
202 align-items: center;
203 justify-content: center;
204 }
205
206 .card {
207 cursor: pointer;
208 background-color: transparent;
209 height: 300px;
210 perspective: 1000px;
```

```
File Edit View Language HTML
211     margin: 1rem;
212     align-items: center;      justify-content: center;
213 }
214
215 .card h3 {
216     border-bottom: 1px #fff solid;
217     padding-bottom: 10px;
218     margin-bottom: 10px;
219     text-align: center;
220     font-size: 1.6rem;
221     word-spacing: 3px;
222 }
223
224 .card p{
225     opacity: 0.75;
226     font-size: 0.8rem;
227     line-height: 1.4;
228 }
229
230 .card img {
231     width: 360px;
232     height: 300px;
233     object-fit: cover;
234     border-radius: 3px;
235 }
236
237 .card-inner {
238     position: relative;
239     width: 360px; height: 100%;      transition: transform 0.9s;
240     transform-style: preserve-3d;
241 }
```

```
File Edit View Language H
242
243 .card:hover .card-inner {
244     transform: rotateY(180deg);
245 }
246
247 .card-front,
248 .card-back {
249     position: absolute;
250     width: 360px;
251     height: 100%;
252     -webkit-backface-visibility: hidden;
253     backface-visibility: hidden;
254 }
255
256 .card-back {
257     background-color: #222;
258     color: #fff;
259     padding: 1.5rem;
260     transform: rotateY(180deg);
261 }
262 .text-block {
263     position: absolute;
264     bottom: 20px;
265     right: 20px;
266     background-color: black; color: white;
267
268     padding-left: 20px;
269     padding-right: 20px;
270 }
271 .features-section img {
272     display: none;
273 }
```



```

File Edit View Language

275 .testimonials-section {
276     background: var(--primary-colour);
277     color: white;
278 }
279
280 .testimonials-section li {
281     background: #0059ff;
282     text-align: center;
283     width: 80%;
284     border-radius: 1em;
285 }
286
287 .testimonials-section li img {
288     width: 6em;
289     height: 6em;
290     border: 3px solid #ffffff;
291     border-radius: 50%;
292     margin-top: -2.5em;
293 }
294
295 ul {
296     list-style-type: none;
297     margin: 0;
298     padding: 0;
299 }
300
301 ul.features-list { margin: 0;
302     padding-left: .1em;
303 }
304
305 ul.features-list li {

```

```

File Edit View Language

307     margin-bottom: 1em;
308     margin-left: 2em;
309     position: relative;
310 }
311
312 ul.features-list li:before {
313     content: '';
314     left: -2em;
315     position: absolute;
316     width: 20px;
317     height: 20px;
318     background-image: url("#");
319     background-size: contain;
320     margin-right: .5em;
321 }
322
323 .features-section img {
324     display: none;
325 }
326 </style>
327 </head>
328 <body>
329 <div class="card text-center">
330 <div class="card-header">
331 <ul class="nav nav-tabs card-header-tabs">
332 <li class="nav-item">
333 <a class="nav-link active" aria-current="true" href="home.html" style="font-size:
334 24px;">Home</a>
335 </li>
336 <li class="nav-item">
337 <a class="nav-link" href="intro.html" style="font-size: 24px;">Introduction</a>

```

```

File Edit View Language
337 <a class="nav-link" href="/introduction/" style="font-size: 24px;"/>Introduction</a>
338 </li>
339 <li class="nav-item">
340 <a class="nav-link" href="/upload.html" style="font-size: 24px;"/>Upload</a>
341 </li>
342 </ul>
343 <h3 style="float: right;"/>AI based Natural Disaster Analysis</h3>
344 </div>
345 <div class="container-fluid">
346 <div class="container">
347
348 <div class="cards">
349
350 <div class="card">
351 <div class="card-inner">
352 <div class="card-front">
353 
357 <div class="text-block">
358 <h1>Cyclone</h1>
359 <h3>violent winds, torrential rain, high waves and, very destructive storm</h3>
360 </div>
361
362 </div>
363 <div class="card-back">
364 <h3>Cyclone</h3>
365 <h3>The effects of tropical cyclones include heavy rain, strong wind, large storm surges near
366 landfall, and tornadoes. The destruction from a tropical cyclone, such as a hurricane or
367 tropical storm, depends mainly on its intensity, its size, and its location.</h3>
368 ...

```

```

File Edit View Language
368 </div>
369 </div>
370 </div>
371 <div class="container">
372
373 <div class="cards">
374
375 <div class="card">
376 <div class="card-inner">
377 <div class="card-front">
378 
381 <div class="text-block">
382 <h1>Earth Quake</h1>
383 <h2>Sudden release of stored energy in the Earth's crust that creates seismicwaves.
384 </h2>
385 </div>
386
387 </div>
388 <div class="card-back">
389 <h3>Earth Quake</h3>
390 <h3>Earthquakes are usually caused when rock underground suddenly breaks fault.
391 This sudden release of energy causes the seismic waves that make the ground shake.
392 ... During the earthquake and afterward, the plates or blocks of rock start moving,
393 and they continue to move until they get stuck again.</h3>
394 </div>
395 </div>
396 </div>
397 <div class="container">
398 <div class="cards">

```

```
File Edit View Language

400         <div class="card-inner">
401             <div class="card-front">
402                 
405                 <div class="text-block">
406                     <h1>Flood</h1>
407                     <h3>A flood is an overflow of water on normally dry ground</h3>
408                 </div>
409             </div>
410             <div class="card-back">
411                 <h3>Flood</h3>
412                 <h3>During heavy rain, the storm drains can become overwhelmed or plugged by
413                 debris and flood the roads and buildings nearby. Low spots, such as
414                 underpasses, underground parking garages, basements, and low watercrossings
415                 can become death traps. Areas near rivers are at risk from floods.</h3>
416             </div>
417         </div>
418     </div>
419 </div>
420 <div class="container">
421
422     <div class="cards"
423     <div class="card">
424         <div class="card-inner">
425             <div class="card-front">
426                 
430                 <div class="text-block">
```

```
File Edit View Language

429                 alt="">
430                 <div class="text-block">
431                     <h1>WildFire</h1>
432                     <h3>Uncontrolled fire in a forest, grassland, brushland</h3>
433                 </div>
434             </div>
435             <div class="card-back">
436                 <h3>Wildfire</h3>
437                 <h3>Wildfires can be caused by an accumulation of dead matter (leaves,
438                 twigs, and trees) that can create enough heat in some instances to
439                 spontaneously combust and ignite the surrounding area. Lightning
440                 strikes the earth over 100,000 times a day. 10 to 20% of these
441                 lightning strikes can cause fire.</h3>
442             </div>
443         </div>
444     </div>
445 </div>
446
447 intro.html:
448 <!DOCTYPE html>
449 <html lang="en">
450 <head>
451 <meta charset="UTF-8">
452 <meta http-equiv="X-UA-Compatible" content="IE=edge">
453 <meta name="viewport" content="width=device-width, initial-scale=1.0"> <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2
454 /dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-
455 Zenh87qX5JnK2J10vWa8CK2rdkQ2Bzep5IDxbcnCeu0XjzrPF/et3URy9Bv1WTRI" crossorigin="anonymous">
456 </head>
457 <body>
458 <div class="card text-center">
```

```

457 </body>
458 <div class="card text-center">
459 <div class="card-header">
460 <ul class="nav nav-tabs card-header-tabs">
461 <li class="nav-item">
462 <a class="nav-link" aria-current="true" href="home.html" style="font-size:
463 24px;">Home</a>
464 </li>
465 <li class="nav-item">
466 <a class="nav-link active" href="intro.html" style="font-size: 24px;">Introduction</a></li>
467 <li class="nav-item">
468 <a class="nav-link" href="upload.html" style="font-size: 24px;">Upload</a>
469 </li>
470 </ul>
471 <h3 style="float: right;">AI based Natural Disaster Analysis</h3>
472 </div>
473 </div>
474 <h2 style="padding: 50px; margin: 50px; word-spacing: 15px; text-align: center ;line-height: 1.6;">
475 China, India and the United States are among the countries in the world most affected by natural disasters. Natural disasters have the
potential to wreck and even end the lives of those people, who stand in their way. <br><br> However, whether or not you are likely to
be affected by a natural disaster dramatically depends on where in the world you live, The objective of the project is to human build a
web application to detect the type of disaster. The input is taken from the in-built webcam, which in turn is given to the pre-trained
model. The model predicts the type of disaster and displayed on UI. </h2>
476 </body>
477 </html>
478
479 upload.html:
480
481 <!DOCTYPE html>
482 <html lang="en">
483 <head>

```

```

487 <crossorigin="anonymous">
488 <title>Document</title>
489 </head>
490 <body>
491 <div class="card text-center">
492 <div class="card-header">
493 <ul class="nav nav-tabs card-header-tabs">
494 <li class="nav-item">
495 <a class="nav-link" aria-current="true" href="home.html" style="font-size:
496 24px;">Home</a>
497 </li>
498 <li class="nav-item">
499 <a class="nav-link" href="intro.html" style="font-size: 24px;">Introduction</a>
500 </li>
501 <li class="nav-item">
502 <a class="nav-link active" href="upload.html" style="font-size: 24px;">Upload</a>
503 </li>
504 </ul>
505 <h3 style="float: right;">AI based Natural Disaster Analysis</h3>
506 </div>
507 </div>
508 <form action = "uploader.html" method = "POST" enctype = "multipart/form-data">
509 <input type = "file" name = "filename" />
510 <input type = "submit" value="Submit"/>
511 </form>
512 <script src="https://cdn.jsdelivr.net/npm/@popperjs/core@2.11.6/dist/umd/popper.min.js" integrity="sha384-
oBqDVmMz9ATKxIep9tiCxS/Z9fNfEXiDAYTujMAeBAsjFuCZSmKbSSUnQlhm/jp3" crossorigin="anonymous"></script>
513 <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.min.js" integrity="sha384-
IDwe1+LCz02ROU9k972gdyv1+AESN10+x7tBKgc9I5HFTuNz0wWnPclzo6p9vxnk" crossorigin="anony mous"></script>
514 </body>
515 </html>
516

```

## **GITHUB LINK**

- <https://github.com/IBM-EPBL/IBM-Project-26538-1660029169>

## **PROJECT DEMO LINK**





