

# **NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE**

PROJECT REPORT

Submitted by

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# **TABLE OF CONTENTS**

<b>1. INTRODUCTION</b>	<b>4</b>
a. PROJECT OVERVIEW	
b. PURPOSE	
<b>2. LITERATURE SURVEY</b>	<b>5</b>
a. EXISTING PROBLEM	
b. REFERENCES	
c. PROBLEM STATEMENT DEFINITION	
<b>3. IDEATION AND PROPOSED SOLUTION</b>	<b>7</b>
a. EMPATHY MAP CANVAS	
b. IDEATION & BRAINSTORMING	
c. PROPOSED SOLUTION	
d. PROBLEM SOLUTION FIT	
<b>4. REQUIREMENT ANALYSIS</b>	<b>11</b>
a. FUNCTIONAL REQUIREMENTS	
b. NON FUNCTIONAL REQUIREMENTS	
<b>5. PROJECT DESIGN</b>	<b>14</b>
a. DATA FLOW DIAGRAM	
b. SOLUTION & TECHNICAL ARCHITECTURE	

**c. USER STORIES**

**6. PROJECT PLANNING AND SCHEDULING**

**18**

**a. SPRINT PLANNING AND ESTIMATION**

**b. SPRINT DELIVERY SCHEDULE**

**7. CODING & SOLUTIONING**

**8. HTML CODE**

**9.PYTHON CODE**

**10.CONCLUSION**

**11.SOURCE CODE GITHUB PROJECTDEM**

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 PROJECT OVERVIEW**

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.

### **1.2 PURPOSE**

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. 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.

## **CHAPTER2**

### **LITERATURE SURVEY**

#### **2.1 EXISTING PROBLEM**

Many researchers have attempted to use different deep learning methods for detection of natural disasters. However, the detection of natural disasters by using deeplearning 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.

#### **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. [CrossRef]

2. Tonini, M.; D'Andrea, M.; Biondi, G.; Degli Esposti, S.; Trucchia, A.; Fiorucci, P.A Machine Learning-Based Approach for Wildfire Susceptibility Mapping.

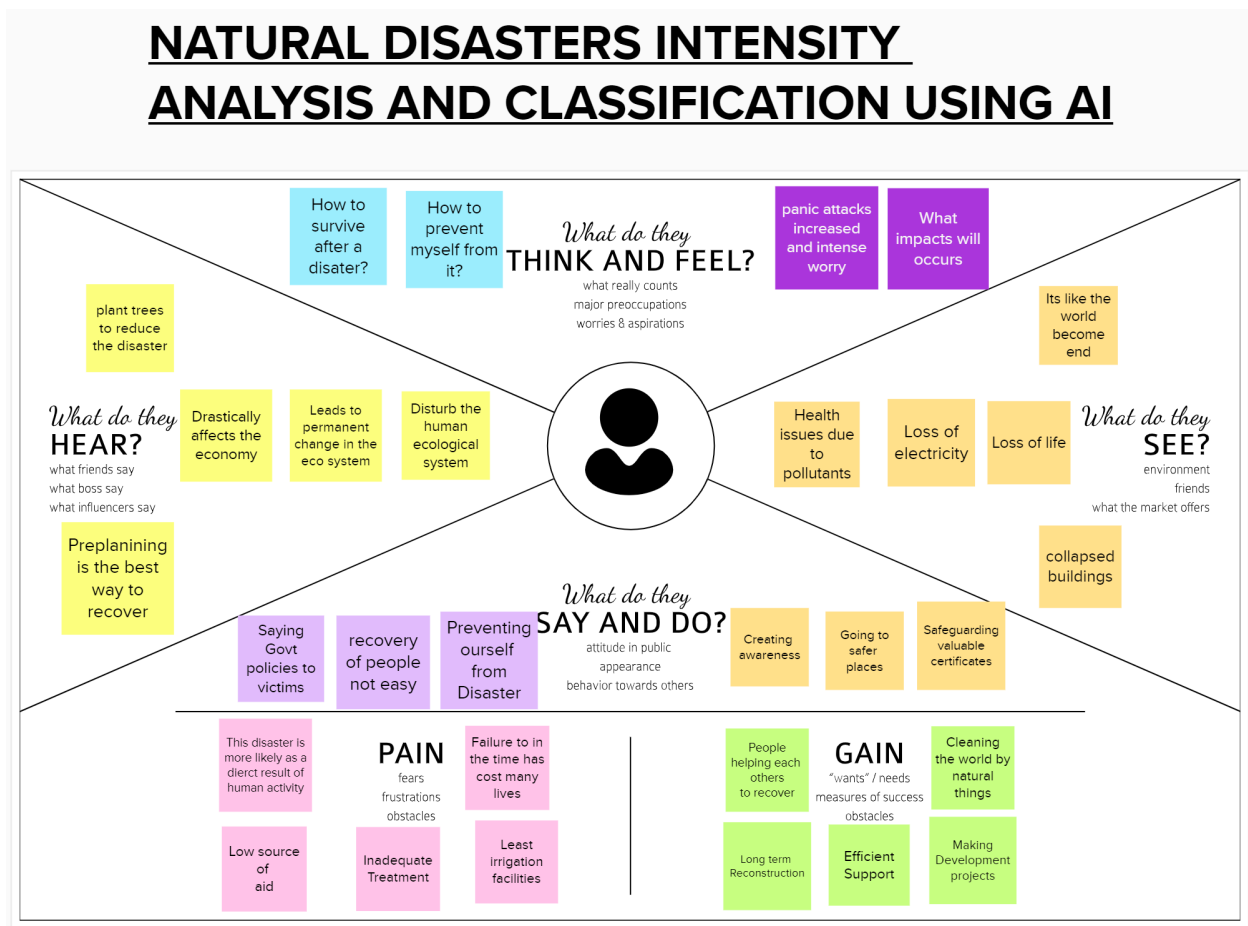
### **2.3 PROBLEM STATEMENT DEFINITION**

"IMD (Indian Meteorology department) is responsible to issue warnings for the rainfall and CWC (Central Water Commission) keeps a record of water reservoirs, however there is a lack of collation of data issued from both these departments. This prevents us from determining the impact/seriousness and due to which there are times where adequate forewarnings are not provided. There are several High rainfall areas, low lying areas or flood prone areas. Currently there are limitations that these areas cannot be alerted before the critical situation because of the data unavailability or unavailability of simulation models which can calculate and predict the data. There is a requirement of data on the area likely to be inundated(depth) by release of water from reservoirs. 3D models may help in calculation of such data.a) Adequate forewarning for the area where floods are likely to occur. b) Low lying areas may be alerted about the release of accurate quantity of water from the reservoirs and thus evacuation/shifting of the people can be planned. c) It will help the Response forces to deploy their resources accordingly d) Prediction of release of water based on rainfall in catchment area and dissemination of information to the affected public through mobile and other mediums.

## CHAPTER 3

### IDEATION AND PROPOSED SOLUTION

#### 3.1 EMPATHY MAP CANVAS



The collage consists of six screenshots from a workshop, showing various diagrams and notes related to AI system functionalities and disaster response. The diagrams include flowcharts, matrices, and conceptual models for AI system functionalities in disaster response.

- Brainstorm & Idea prioritization:** A slide with a blue header and a list of instructions for a brainstorming session. It includes a section for "Before you collaborate" with three steps: 1. List all ideas, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.
- Define your problem statement:** A slide with a blue header and a list of instructions for defining a problem statement. It includes a section for "Before you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.
- Brainstorm:** A slide with a blue header and a list of instructions for a brainstorming session. It includes a section for "Before you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.
- Group ideas:** A slide with a blue header and a list of instructions for a brainstorming session. It includes a section for "Before you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.
- causes of disaster:** A slide with a blue header and a list of instructions for a brainstorming session. It includes a section for "Before you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.
- system functionalities of AI system:** A slide with a blue header and a list of instructions for a brainstorming session. It includes a section for "Before you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea. It also includes a section for "After you collaborate" with three steps: 1. Write down the idea, 2. Write down the idea, 3. Write down the idea.



### 3.3 PROPOSED SOLUTION

#### Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To monitoring and predicting the disasters and its intensity of impacts on the region.
2.	Idea / Solution description	To use classification algorithm to identify the impacts of disaster.
3.	Novelty / Uniqueness	A Natural disaster is" the negative impact following an actual occurrence of natural hazard in the event that is significantly harms a community".
4.	Social Impact / Customer Satisfaction	Copying capacity,culturals impacts,loss of livelihood,loss absorption,loss acceptance,social vulnerability.
5.	Business Model (Revenue Model)	Revenue generated through Royalty payments, product license costs in department , research and educational platforms.
6.	Scalability of the Solution	A first scalable implicit solver for nonlinear time-evolution earthquakes city problem on low ordered unstructured finite elements with artificial intelligence.

## 3.4 PROBLEM SOLUTION FIT

Problem-Solution Fit canvas		Purpose / Vision	Version:	
Define CS, fit into CL	<b>1. CUSTOMER SEGMENT(S)</b> <span>CS</span> Natural disaster intensity can mainly affected to people.  It can cause great damages on the environment human health.	<b>6. CUSTOMER LIMITATIONS</b> <span>CL</span> <small>EG. BUDGET, DEVICES</small> Many deep learning techniques have been applied by various researchers to detect and classify natural disasters to overcome losses in ecosystem.  But detection of natural disasters still faces issues due to the complex and imbalanced structures of images.	<b>5. AVAILABLE SOLUTIONS</b> <span>AS</span> <small>PLUSES &amp; MINUSES</small> When using AI to detect extreme events such as avalanches or earthquakes, the availability of data can be a limiting factor.  It can identify climatic patterns, at-risk areas and populations.	
	<b>2. PROBLEMS / PAINS</b> <span>PR</span>  Hazardous waste.  Loss of utilities like electricity and water.  Infrastructure- related problems such as closed roads & communications losses.	<b>9. PROBLEM ROOT / CAUSE</b> <span>RC</span>  Causes for such calamities can be contributed to deforestation, soil erosion and pollution.  The major causes of catastrophic disaster are natural phenomena occurring in the earth's crust as well as on the surface.	<b>7. BEHAVIOR</b> <span>BE</span> <small>+ ITS INTENSITY</small>  Emotional instability, stress reactions, anxiety trauma and other psychological symptoms are observed commonly after the disaster and other traumatic experiences.	Explore AS, differentiate
Focus on PR, tap into BE, understand RC	<b>3. TRIGGERS TO ACT</b> <span>TR</span> 1. Urge of saving the lives of people. 2. Fear of facing a downfall of economy due to the loss caused by natural disaster.	<b>10. YOUR SOLUTION</b> <span>SL</span> We developed a multilayered deep convolutional neural network model that classifies the natural disaster accurately and within short span of time. The model uses an integrated webcam to capture the video frame and the video frame is compared with the predefined model and the video and the type of disaster is identified and showcased on the openCV window.	<b>8. CHANNELS of BEHAVIOR</b> <span>CH</span> ONLINE 1. Collects images from online sources like google. 2. Gathering information about the disaster through social media by the people.  OFFLINE Classify the disaster from the collected images.	Focus on PR, tap into BE, understand RC
Identify strong TR & EM	<b>4. EMOTIONS</b> <span>EM</span> <small>BEFORE / AFTER</small> BEFORE: Fear, inadequate, uncertain.  AFTER: Proud, Happiness of saving people.			Extract online & offline CH of BE



Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.  
Designed by Daria Nepriakhina / [ideahackers.nl](https://ideahackers.nl) - we tailor ideas to customer behaviour and increase solution adoption probability.



## **CHAPTER 4**

### **REQUIREMENT ANALYSIS**

#### **4.1 FUNCTIONAL REQUIREMENTS**

## Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Sub Requirement (Story / Sub-Task)
FR-1	<b>Tsunami</b> : A series of large waves of extremely long wavelength and period usually generated by a violent, impulsive undersea disturbance or activity near the coast or in the ocean. When a sudden displacement of a large volume of water occurs, or if the seafloor is suddenly raised or dropped by an earthquake, big tsunami waves can be formed.
FR-2	<b>Earthquake</b> : Any sudden shaking of the ground caused by the passage of seismic waves through Earth's rocks. Seismic waves are produced when some form of energy stored in Earth's crust is suddenly released, usually when masses of rock straining against one another suddenly fracture and "slip."
FR-3	<b>Droughts</b> : The primary cause of any drought is efficiency of rainfall and in particular , the timing, distribution and intensity of this deficiency in relation to existing reserves.
FR-4	<b>Tropical cyclones</b> : The major natural disaster that affects the coastal regions of India is cyclone and has a coastline of about 7516 kilometres , it is exposed to nearly 10% of worlds tropical cyclones.
FR-5	<b>Landslides</b> : It mainly affects the Himalayan region and the western ghats of India. Landslides are also common in the nilgiri range. It is estimated that 30 percent of the world's landslides occur in the Himalayas. The Himalayan mountains which constitute the youngest and most dominating mountain system in the world.

FR-6	<b>Volcanoes:</b> A volcano is an opening in the earth's crust through which lava, volcanic ash, and gases escape. Volcanic eruptions are partly driven by pressure from dissolved gas, much as escaping gases force the cork out of a bottle of champagne.
------	---

## Non-functional Requirements:

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

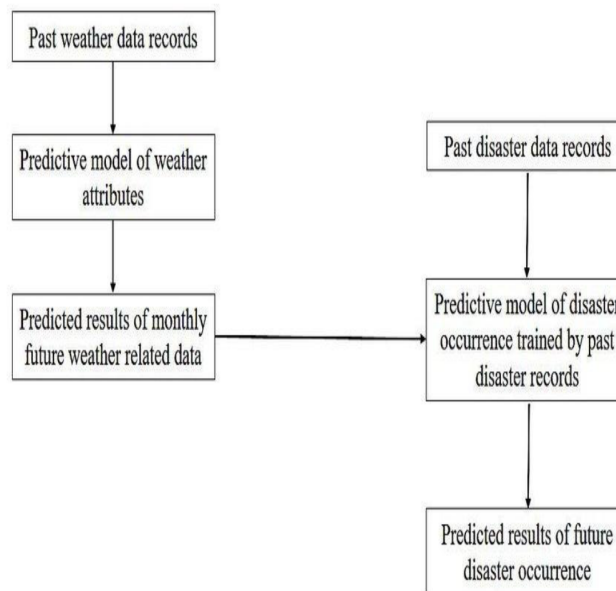
FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	The wide spectrum of technologies used in Geographical Information System, Global Positioning System (GPS), Satellite navigation system, Satellite communication.
NFR-2	<b>Security</b>	Identification and measuring disaster risk. Incorporating DRM into national planning and investment.
NFR-3	<b>Reliability</b>	Disaster-related damages are typically measured by separately examining the numbers of fatalities, injuries.
NFR-4	<b>Performance</b>	The identification of hazards; a review of the technical characteristics of hazards such as their location, intensity, frequency and probability.
NFR-5	<b>Availability</b>	The number and cost of weather and climate disasters is rising due to a combination of population growth and development along with the influence of human-caused climate change.

## CHAPTER 5

### PROJECT DESIGN

#### 5.1 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



## 5.2 USER STORIES

### CHAPTER 6

#### PROJECT PLANNING AND SCHEDULING

##### 6.1 6.2 SPRINT DELIVERY SCHEDULE

<b>Sprint</b>	<b>Total Story Points</b>	<b>Duration</b>	<b>Sprint End Date (Planned )</b>	<b>Story Points Completed (as on Planned End Date)</b>	<b>Sprint Release Date (Actual)</b>
<b>Sprint -1</b>	<b>14</b>	<b>6 days</b>	<b>24 Oct 2022</b>	<b>29 Oct 2022</b>	<b>30 Oct 2022</b>
<b>Sprint- 2</b>	<b>12</b>	<b>6 days</b>	<b>31 Oct 2022</b>	<b>5 Nov2022</b>	<b>6 Nov 2022</b>
<b>Sprint - 3</b>	<b>6</b>	<b>6 days</b>	<b>07 Nov2022</b>	<b>12 Nov2022</b>	<b>8 Nov 2022</b>
<b>Sprint - 4</b>	<b>6</b>	<b>6 days</b>	<b>14 Nov2022</b>	<b>19 Nov2022</b>	<b>20 Nov 2022</b>

## 7.HTML CODE

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
<meta charset="UTF-8">
```

```
<meta http-equiv="X-UA-Compatible" content="IE=edge">
```

```
<meta      name="viewport"      content="width=device-width,  
initial-scale=1.0">
```

```
<link
```

```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.  
min.
```

```
css"
```

```
rel="stylesheet" integrity="sha384-
```

```
Zenh87qX5JnK2JI0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9
```

```
Bv1WTRi">
```

```
<title>Document</title>
```

```
</head>
```

```
<body>
```

```
<div class="card text-center">
```

```
<div class="card-header">
```



```
<ul class="nav nav-tabs card-header-tabs">

<li class="nav-item">

<a class="nav-link active" aria-current="true" href="home.html"
style="font-size:
24px;">Home</a>

</li>

<li class="nav-item">

<a class="nav-link" href="intro.html" style="font-size:
24px;">Introduction</a>

</li>

<li class="nav-item">

<a      class="nav-link"      href="upload.html"      style="font-size:
24px;">Upload</a>

</li>

</ul>

<h3 style="float: right;">AI based Natural Disaster Analysis</h3>

</div>

</div>

<div class = "container" style="text-align: center;">

<div class="card" style="width: 18rem; padding: 10px; margin: 40px;
margin-left:
40px;display:inline-block">
```

```


<div class="card-body" >

<h5 class="card-title">Cyclone</h5>

<p class="card-text">cyclone, large system of winds that circulates
counterclockwise directionnorth of the Equator and clockwise
direction to
the south.</p>

<a href="https://en.wikipedia.org/wiki/Cyclone" class="btn
btn-primary">Know more</a></div>

</div>
```

```
<div class="card" style="width: 18rem; padding: 10px; margin: 40px;
margin-left:
```

```
40px;display:inline-block">
```

```

```

```
<div class="card-body" >
```

```
<h5 class="card-title">Earthquake</h5>
```

```
<p class="card-text">A sudden violent shaking of the ground,
causing great
```

```
destruction, as aresult of movements within the earth's crust.</p>
```

```
<a href="https://en.wikipedia.org/wiki/Earthquake" class="btn
```

```
btn-primary">Knowmore</a>
```

```
</div>
```

```
</div>
```

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</div>
```

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<div class = "container" style="text-align: center;">
```

```
<div class="card" style="width: 18rem; padding: 10px; margin: 40px;
margin-left:
```

```
40px;display:inline-block">
```

```

```

```
<div class="card-body" >
```

```
<h5 class="card-title">Flood</h5>
```

```
<p class="card-text">An overflow of a large amount of water beyond
its
```

```
normal limits, especially over what is normally dry land.</p>
```

```
<a      href="https://en.wikipedia.org/wiki/Flood"      class="btn
btn-primary">know
```

```
more</a></div>
```

```
</div>
```

```
<div class="card" style="width: 18rem; padding: 10px; margin: 40px;
margin-left:
```

```
40px;display:inline-block">

<div class="card-body" >
<h5 class="card-title">Wild Fire</h5>
<p class="card-text">A wildfire is an unplanned, uncontrolled and
unpredictable fire in area of combustible vegetation starting in rural
and urban areas.</p>
a href="https://en.wikipedia.org/wiki/Wildfire" class="btn
btn-primary">Know more</a></div>
</div>
</div>
</body>
</html
```

## PYTHON CODE

```
# -*-
coding:
utf-8
 -*-

"""Build Python Code & Run the Application

Automatically generated by Colaboratory.

Original file is located at

https://colab.research.google.com/drive/1TxSPz40WJMI7I8puz5QG3LOHXUQF36Us
"""

from flask import Flask, render_template

app = Flask(__name__)

@app.route('/')
def home():
    return render_template('homepage.html', title='Disaster
Classifier | Home', active_page='home')

@app.route('/intro')
def intro():
    return render_template('intro.html', title='Disaster
Classifier | About', active_page='intro')

@app.route('/launch')
def launch():
```

```
        return render_template('launch.html', title='Disaster  
Classifier | Launch', active_page='launch')
```

```
if __name__ == '__main__':  
    app.run(debug=True)
```

## **CHAPTER 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.

## **CHAPTER 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 be used for various natural disaster detection processes.



## **FUTURE SCOPE**

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 on-ground 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.

# APPENDIX

## SOURCE CODE MODEL CREATION

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
<meta charset="UTF-8">
```

```
<meta http-equiv="X-UA-Compatible" content="IE=edge">
```

```
<meta          name="viewport"          content="width=device-width,  
initial-scale=1.0">
```

```
<link
```

```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.  
min.
```

```
css"
```

```
rel="stylesheet" integrity="sha384-
```

```
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9
```

```
Bv1WTRi">
```

```
<title>Document</title>
```

```
</head>
```

```
<body>
```

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<div class="card text-center">
```

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24px;">Introduction</a>

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<li class="nav-item">

<a      class="nav-link"      href="upload.html"      style="font-size:
24px;">Upload</a>

</li>

</ul>

<h3 style="float: right;">AI based Natural Disaster Analysis</h3>

</div>

</div>

<div class = "container" style="text-align: center;">

<div class="card" style="width: 18rem; padding: 10px; margin: 40px;
margin-left:
```

40px;display:inline-block">



<div class="card-body" >

<h5 class="card-title">Cyclone</h5>

<p class="card-text">cyclone, large system of winds that circulates  
counterclockwise directionnorth of the Equator and clockwise  
direction to  
the south.</p>

<a href="https://en.wikipedia.org/wiki/Cyclone" class="btn  
btn-primary">Know more</a></div>

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<div class="card" style="width: 18rem; padding: 10px; margin: 40px;  
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40px;display:inline-block">



<div class="card-body" >

<h5 class="card-title">Earthquake</h5>

<p class="card-text">A sudden violent shaking of the ground,  
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destruction, as aresult of movements within the earth's crust.</p>

```
<a href="https://en.wikipedia.org/wiki/Earthquake" class="btn
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</div>
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<p class="card-text">An overflow of a large amount of water beyond
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btn-primary">know
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more</a></div>
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</div>
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<div class="card-body" >

<h5 class="card-title">Wild Fire</h5>

<p class="card-text">A wildfire is an unplanned, uncontrolled and unpredictable fire in area of combustible vegetation starting in rural and urban areas.</p>

a href="https://en.wikipedia.org/wiki/Wildfire" class="btn

btn-primary">Know more</a></div>

</div>

</div>

</body>

</html