NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE

Project Report

Submitted by

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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. 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 purpose of this project to detect the natural disaster and reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

CHAPTER 2

LITERATURE SURVEY

TITLE : A Deep Learning Approach of Recognizing Natural Disasters on Images.

PROPOSED WORK

First, this work introduces to the research community a new dataset for the joint classification of natural disaster types and intensity. Moreover, this study primarily aims to explore natural disasters recognition using a convolutional neural network and transfer learning. An open source tool is used for finding and removing the repeated images for analysis. Wildfire, Earthquake, Flood and Volcanic eruption are taken. In particular, this study attempts to build and train a lightweight convolutional neural network that can jointly recognize natural disaster types and intensity. Based on the intensity, it classifies as Severe, Moderate, Insignificant Lastly, this study attempts to measure the model performance using four performance measures; accuracy, precision, recall, and F1-Score.

TOOLS USED/ALGORITHM

· Image Processing

· Slope NDVI

· Location API

· Cloud Architecture

· Google Earth Engine

· K-Means and Classification Algorithm

· RGB Scale

TECHNOLOGY : Artificial Intelligence

TITLE : Disaster Intensity-Based Selection of Training Samples for Remote Sensing Building Damage Classification.

PROPOSED WORK

In this proposed work, two fully automatic procedures for the detection of severely damaged buildings are introduced. The fundamental assumption is that samples that are located in areas with low disaster intensity mainly represent nondamaged buildings. Furthermore, areas with moderate to strong disaster intensities likely contain damaged and nondamaged buildings. Under this assumption, a procedure that is based on the automatic selection of training samples for learning and calibrating the standard support vector machine classifier is utilized. The second procedure is based on the use of two regularization parameters to define the support vectors. These frameworks avoid the collection of labeled building samples via field surveys and/or visual inspection of optical images, which requires a significant amount of time. The performance of the proposed method is evaluated via application to three real cases. The resulted accuracy ranges between 0.85 and 0.89, and thus, it shows that the result can be used for the rapid allocation of affected buildings.

TOOLS USED/ALGORITHM

· Automatic labelling

· Building damage

· Multi regularization parameters

· Demand Parameter

· Support Vector Machine (SVM)

TECHNOLOGY : Machine Learning

TITLE : Hurricane Damage Detection using Machine Learning and Deep Learning Techniques

PROPOSED WORK

In this proposed work, Disaster detection can be done through social media and satellites. Images obtained from satellites are widely used since capturing and processing of these images can be done in a shorter span of time. Satellite images help to recognize damage pattern caused by the disasters. The images from social media are also useful since they provide information on an immediate basis. Since manual methods are error-prone, deep learning and machine learning are used which used for detecting the damage caused by disasters effectively.

TOOLS USED/ALGORITHM

· Social-media

· Satellite imagery

· Deep learning techniques

· CNN,VGG-16, ResNet

· Machine learning techniques

· Support Vector Machine, Decision trees, random forest.

TECHNOLOGY : Machine Learning, Deep Learning

2.1 Existing Problem

Earlier we focus on post disaster relief and rehabilitation measures. Now the focus is shifted. As per sec.2(e) of DM Act 2005, Disaster Management means a coordination and integrated process of planning, organizing, coordinating, and implementing measures which are necessary or expedient for-

(i) Prevention of danger or threat of any disaster

(ii) Preparedness to deal with any disaster

(iii) Prompt response to any threatening disaster situation or disaster

(iv) Assessing the severity or magnitude of effects of any disaster

(v) Evacuation, rescue, and relief

(vi) Rehabilitation and reconstruction

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. The Case Study of the Liguria Region in Italy. Geosciences 2020, 10, 105. [CrossRef]

3. Islam, A.R.M.T.; Talukdar, S.; Mahato, S.; Kundu, S.; Eibek, K.U.; Pham, Q.B.; Kuriqi, A.; Linh, N.T.T. Flood susceptibility modelling using advanced ensemble machine learning models. Geosci. Front. 2021, 12, 101075. [CrossRef]

4. Schlemper, J.; Caballero, J.; Hajnal, V.; Price, A.N.; Rueckert, D. A deep cascade of convolutional neural networks for dynamic MR image reconstruction. IEEE Trans. Med. Imaging 2017, 37, 491–503. [CrossRef] [PubMed]

5. Tang, C.; Zhu, Q.; Wu, W.; Huang, W.; Hong, C.; Niu, X. PLANET: Improved convolutional neural networks with image enhancement for image classification. Math. Probl. Eng. 2020, 2020. [CrossRef]

2.3 Problem Statement Definition

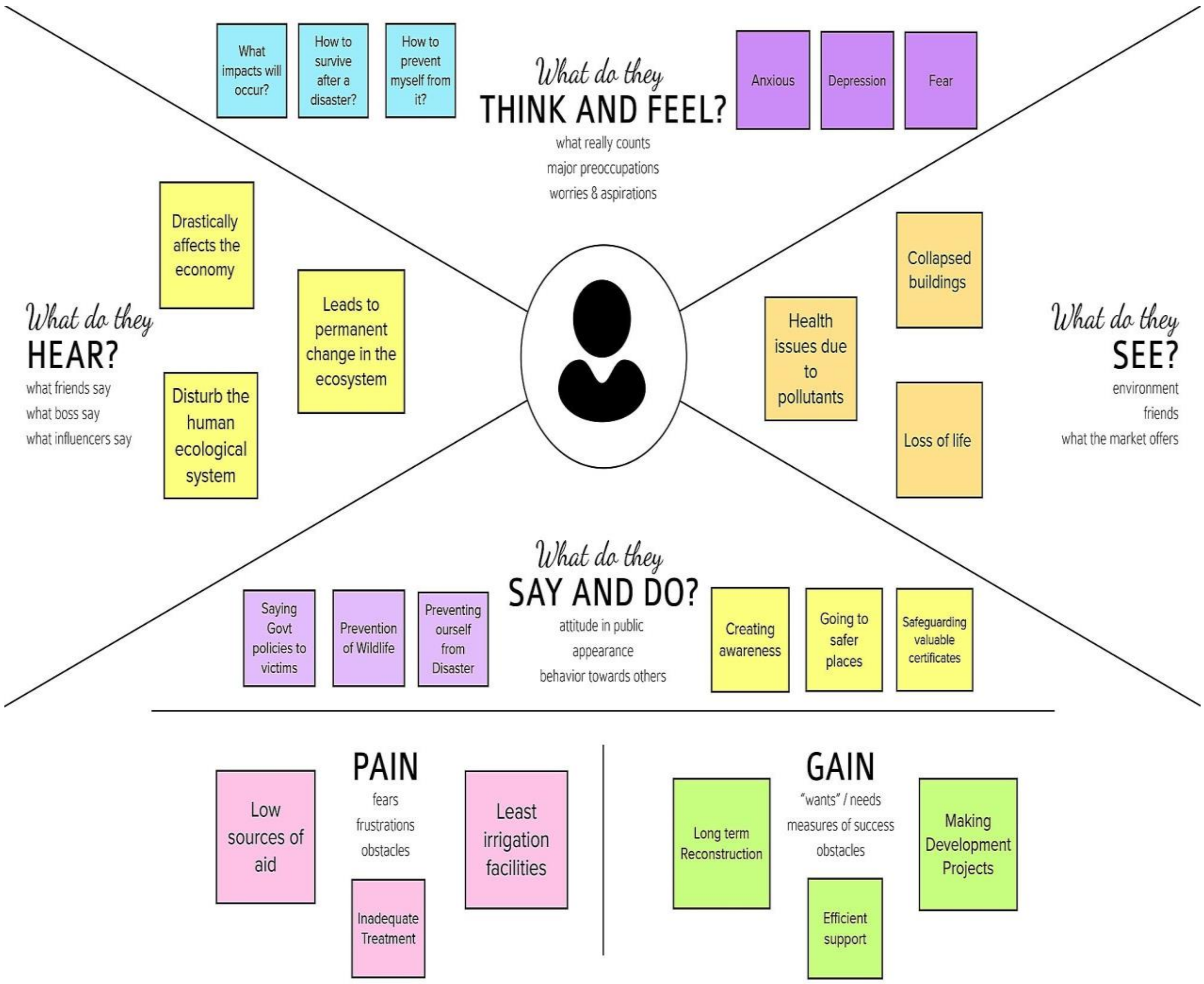
People needs a way to classify and analyse the natural disaster so that they can prevent themselves from losses due to the disaster and millions of lives.

People and animals are facing so many issues like loss of life, property, resources and deterioration of the air quality due to the natural disaster. So we need to analyse and detect natural disaster and protect them from such disaster.

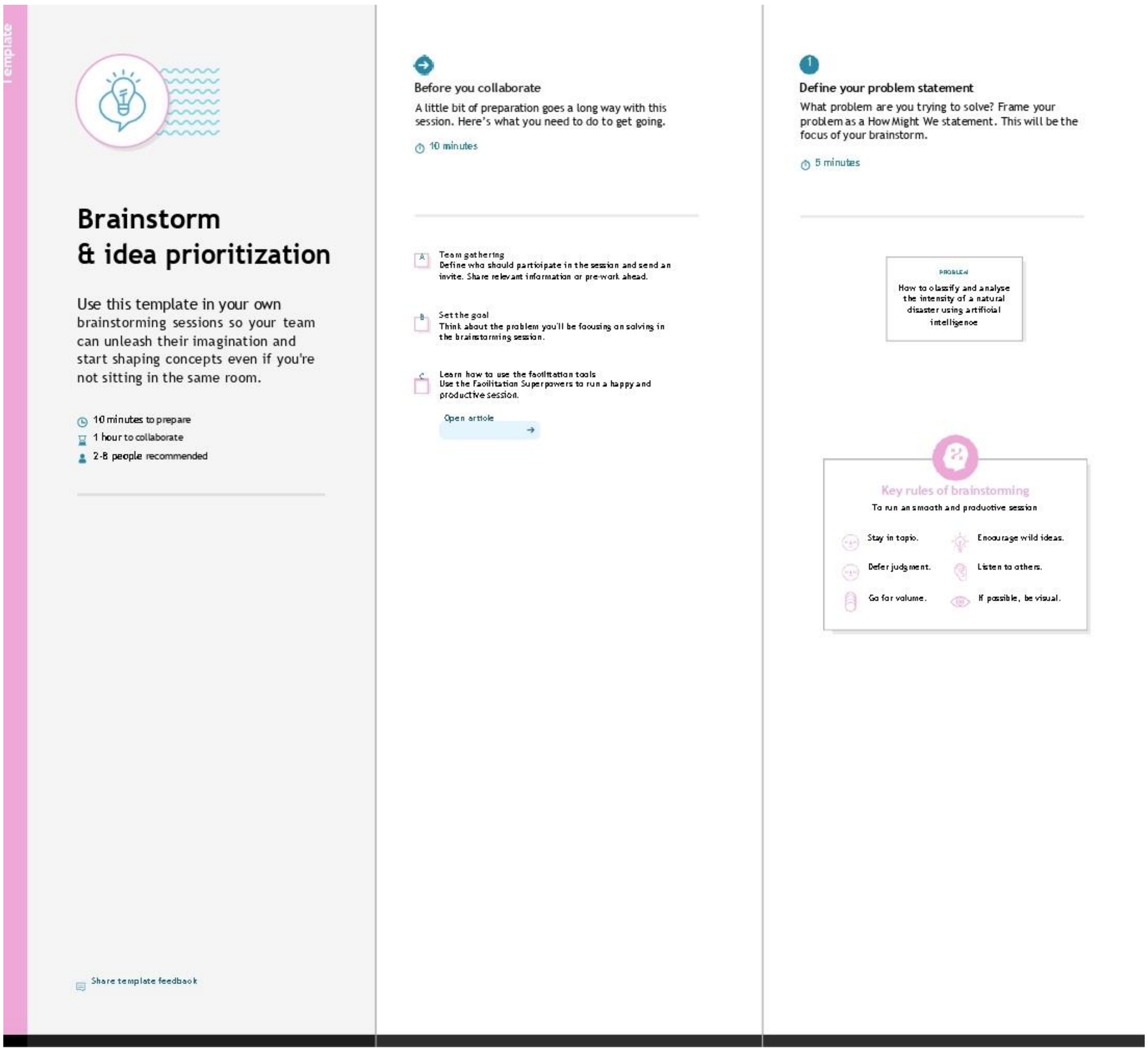
CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Praveen S

- AI-based methods can be very effective if a training dataset covers very large events
- To analyse the intent of disaster use CNN
- To classify the disasters use ML models
- Get insights from previous research works

Muralitharan

- . The proposed model should achieve high accuracy
- Do a literature survey
- Use CNNs they efficiently perform feature extraction
- Using massive volumes of high quality dataset.

Naveen S

- Information from social media can be used as data sources to carry out disaster analysis
- To prevent natural disasters in the future
- prepare an outline on how to approach the problem
- Help the victims of natural disaster

Bhavitharan K

- Social media is considered as a main source of big data
- find out the victims of natural disasters using streaming cameras
- to predict future disasters
- take some action against heavy loss of human ecological systems and property

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Grouping bases on dataset

- AI-based methods can be very effective if a training dataset covers very large events
- Information from social media can be used as data sources to carry out disaster analysis
- Using massive volumes of high quality dataset.
- Social media is considered as a main source of big data

Grouping based on literature survey

- Get insights from previous research works
- Do a literature survey
- prepare an outline on how to approach the problem

Grouping based on models

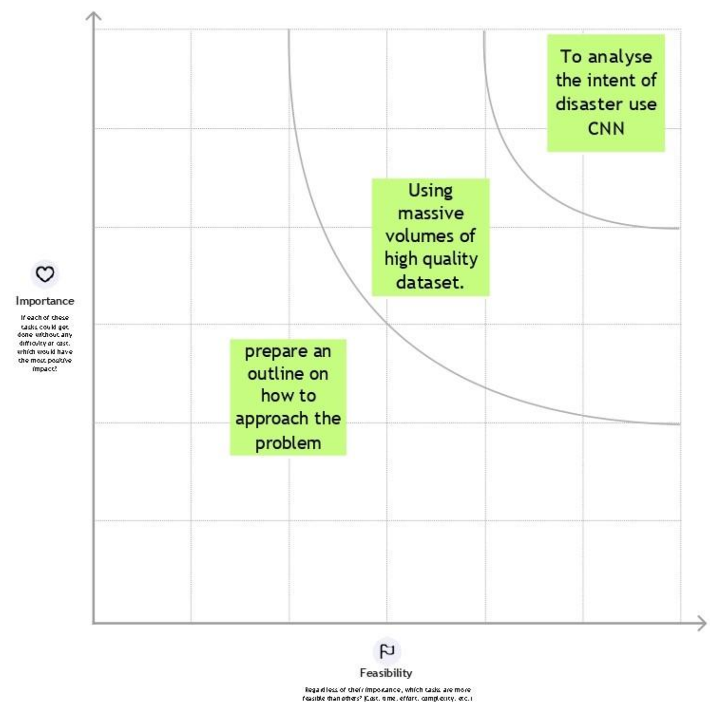
- To analyse the intent of disaster use CNN
- find out the victims of natural disasters using streaming cameras

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

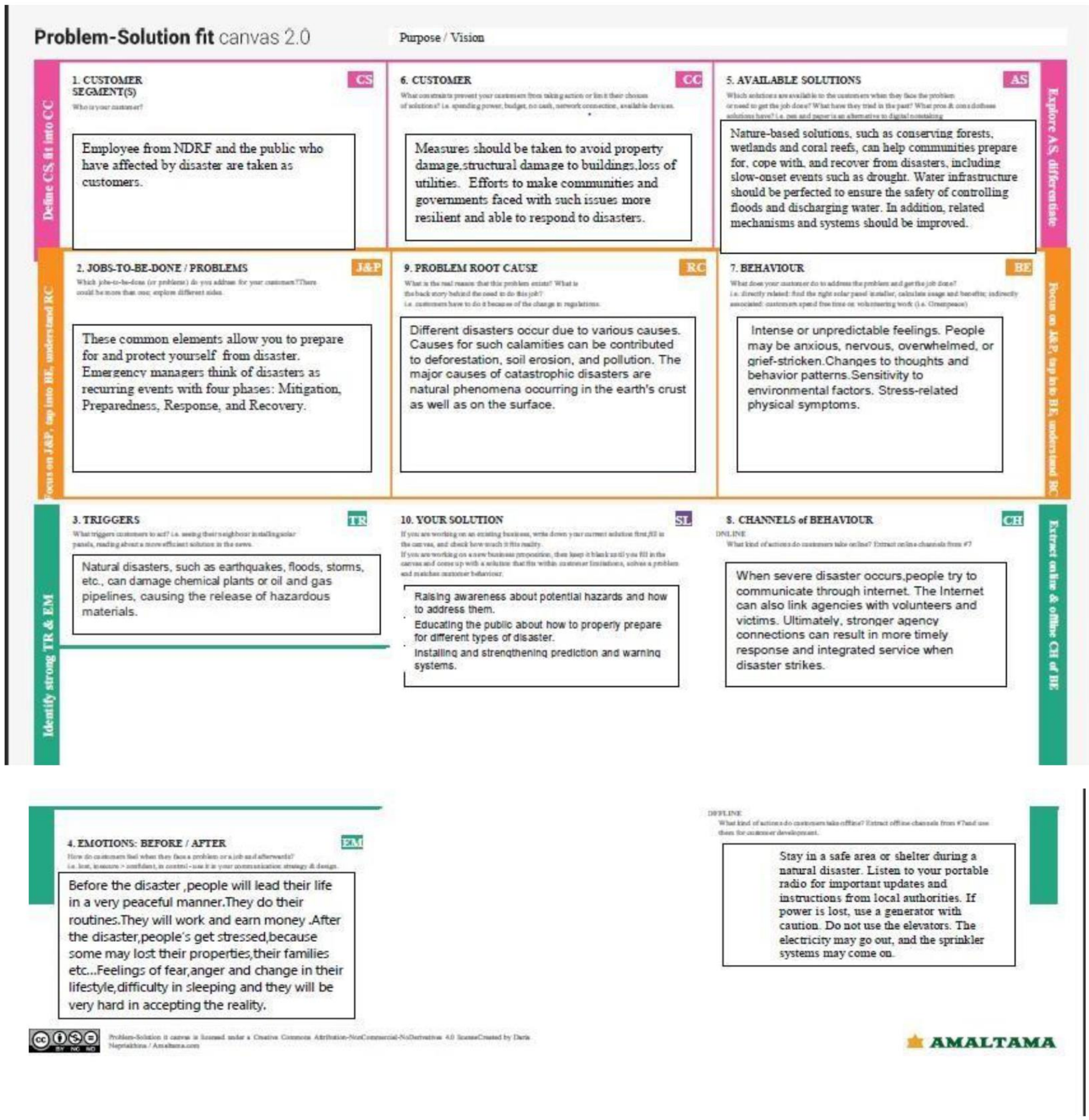


3.3 Proposed solution

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	People needs a way to classify and analyse the Disaster priorly so that they can protect themselves from losses due to the Disaster and Millions of Lives.,
2.	Idea/Solution description	This project uses Multi-layered Deep Convolutional Neural Network (pre-trained) model to classify Natural Disaster and calculate the intensity of the Disaster.
3.	Novelty/Uniqueness	To reduce the issues due to imbalance structure of images, the model uses an integrated webcam to capture the video frame and test data is compared with pretrained data.
4.	Social impact/Customer Satisfaction	By the Application, economic damage caused by Disaster can be reduced. Detection of Natural Disaster will become easier while using videos in Deep CNN instead of images.
5.	Business Model (Revenue Model)	Multi-layered Deep Convolutional Neural Network Model.
6.	Scalability of the Solution	Highly expandible, dependable, reliable, scalable and has robustness.

3.4 Problem Solution Fit

Problem Solution Fit for Natural Disaster Intensity Analysis and Classification UsingArtificial Intelligence:


Problem-Solution fit canvas 2.0

Purpose / Vision

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Employee from NDRF and the public who have affected by disaster are taken as customers.

6. CUSTOMER CC

Measures should be taken to avoid property damage,structural damage to buildings,loss of utilities. Efforts to make communities and governments faced with such issues more resilient and able to respond to disasters.

5. AVAILABLE SOLUTIONS AS

Nature-based solutions, such as conserving forests, wetlands and coral reefs, can help communities prepare for, cope with, and recover from disasters, including slow-onset events such as drought. Water infrastructure should be perfected to ensure the safety of controlling floods and discharging water. In addition, related mechanisms and systems should be improved.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P

These common elements allow you to prepare for and protect yourself from disaster. Emergency managers think of disasters as recurring events with four phases: Mitigation, Preparedness, Response, and Recovery.

9. PROBLEM ROOT CAUSE RC

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.

7. BEHAVIOUR BE

Intense or unpredictable feelings. People may be anxious, nervous, overwhelmed, or grief-stricken.Changes to thoughts and behavior patterns.Sensitivity to environmental factors. Stress-related physical symptoms.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR

Natural disasters, such as earthquakes, floods, storms, etc., can damage chemical plants or oil and gas pipelines, causing the release of hazardous materials.

10. YOUR SOLUTION SL

Raising awareness about potential hazards and how to address them.
Educating the public about how to properly prepare for different types of disaster.
Installing and strengthening prediction and warning systems.

8. CHANNELS of BEHAVIOUR CH

ONLINE

When severe disaster occurs,people try to communicate through internet. The Internet can also link agencies with volunteers and victims. Ultimately, stronger agency connections can result in more timely response and integrated service when disaster strikes.

Extract online & offline CH of BE

4. EMOTIONS: BEFORE / AFTER EM

Before the disaster ,people will lead their life in a very peaceful manner.They do their routines.They will work and earn money .After the disaster,people's get stressed,because some may lost their properties,their families etc...Feelings of fear,anger and change in their lifestyle,difficulty in sleeping and they will be very hard in accepting the reality.

OFFLINE

Stay in a safe area or shelter during a natural disaster. Listen to your portable radio for important updates and instructions from local authorities. If power is lost, use a generator with caution. Do not use the elevators. The electricity may go out, and the sprinkler systems may come on.

AMALTAMA

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CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Functional Requirement

FR No.	Functional Requirement(Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Request Permission	Access permission from web camera.
FR-2	Disaster Detection	Based on the webcam image, natural disaster isclassified.
FR-3	Accuracy	Since the training and testing images are huge, theaccuracy is higher.
FR-4	Speed	The generation of results from the input imagesare faster.
FR-5	Resolution	The resolution of the integrated web camerashould be high enoughto capture the video frames.
FR-6	User Interface	Maximizing the interaction in Web DesigningService.

4.2 Non-Functional Requirement

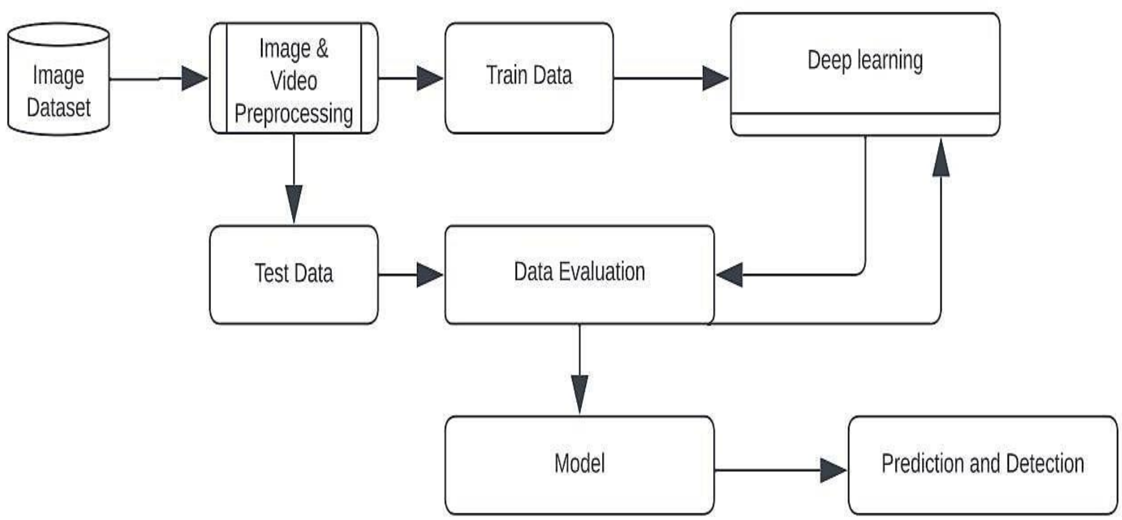
NFR. No.	Non-Functional Requirement	Description
NFR-1	Usability	User friendly and classify the disaster easily.
NFR-2	Security	The modelis secure due to the cloud deploymentmodels and also thereis no login issue.
NFR-3	Reliability	Accurate prediction of the natural disaster and thewebsite can also be fault tolerant.
NFR-4	Performance	It is shown thatthe model givesalmost 95 percentaccuracy after continuous training.
NFR-5	Availability	The website will be made available for 24 hours.
NFR-6	Scalability	The website can run on web browsers like Googlechrome, Microsoft edge and also it can be extended to the NDRFand customers.

CHAPTER 5

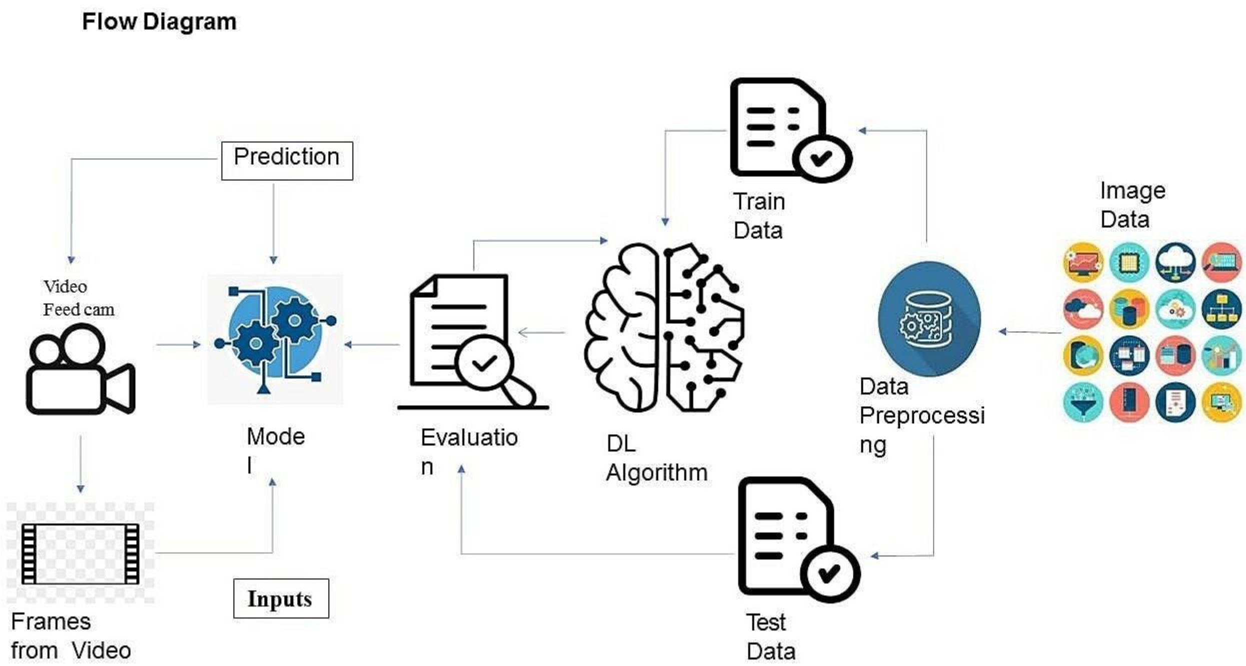
PROJECT DESIGN

5.2 Data Flow Diagrams

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 to be enter and leaves the system, what changes the information, and where data is stored.



Flow Diagram



5.2 Solution & Technical Architecture

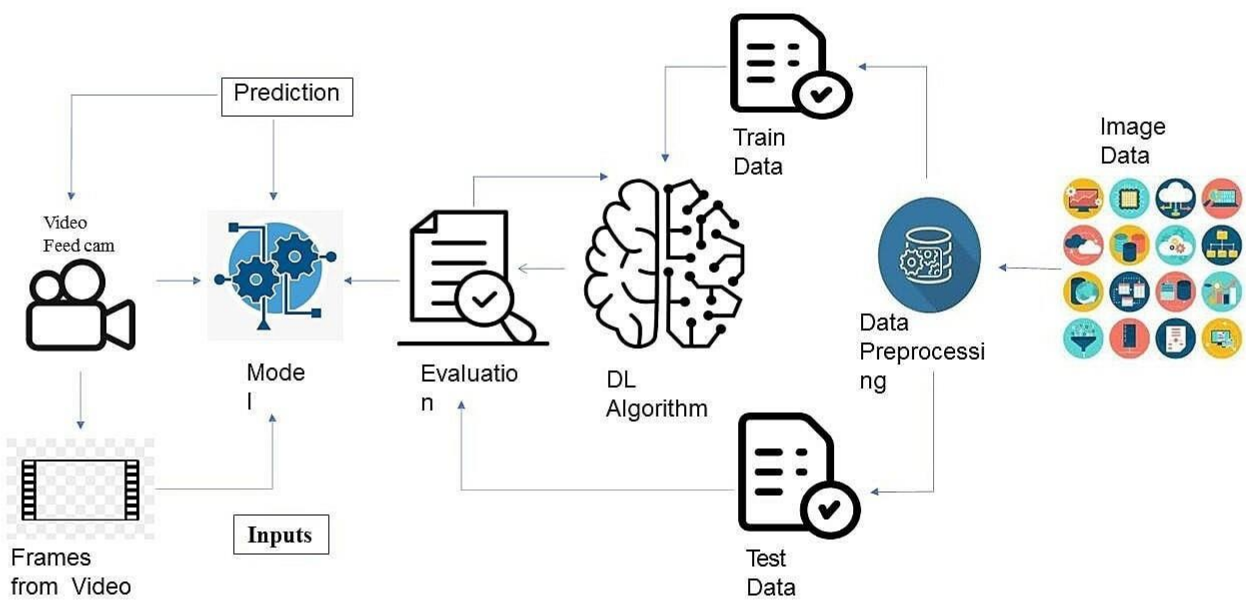
Solution Architecture

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

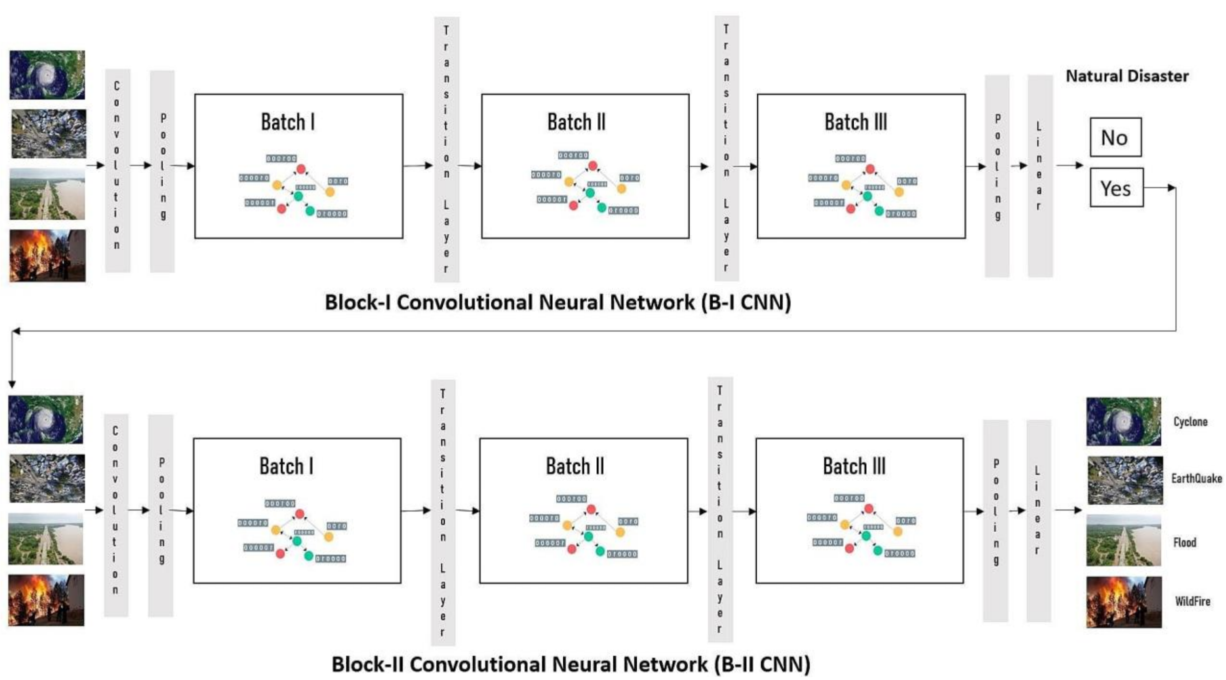
- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution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

Solution Architecture Diagram

Flow Diagram



Technical Architecture



Components &Technologies:

S.No	Component	Description	Technology
1.	User Interface	User interacts with application for the detection of any Natural disaster's intensity and classifywhich happened just before.	HTML, CSS, JavaScript, Django, Python.
3.	Disaster Detection	This functionis used to detect, outcomesfrom the new trained data to performnew tasks andsolve new problems.	Decision trees,Regression, Convolutio nal Neural networks.
4.	Evaluation system	It monitors that how Algorithm performs on data as well as during training.	Chi-Square, Confusion Matrix, etc.
5.	Input data	To interactwith our model and give it problems to solve.Usually this takesthe form of an API, auserinterface, or a command-line interface.	Application programming interface, etc.

6.	Data collectionunit	Data is only usefulif it's accessible, so it needsto be stored ideally in a consistent structureand conveniently in one place.	IBM Cloud,SQL Server.
7.	Database management system	An organized collection of data stored in database,so that it can be easily accessed and managed.	MySQL, DynamoDB etc.

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	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.	Keras, Tensorflow.
2.	Authentication	This keepsour models secureand makes sureonly those who have permission can use them.	Encryption and Decryption (OTP).

3.	Application interface	User uses mobile application and web applicationto interact withmodel	Web Develop ment (HTML,C SS)
4.	Availability (both Online and Offline work)	Its include both online and offline work. As goodinternet connection is need for online work to explore the software perfectly. Offline work includes thesaved data to explore for later time.	Caching, backend server.
5.	Regular Updates	Thetruly excellent software product needs a continuous processof improvements and updates. Maintain your server andmake sure thatyour content is always up-to-date. Regularly update an app and enrich it with new features.	Waterfall Approach, Incremental Approach, Spiral Approach
6.	Personalization	Software has features like flexible fonts, backgrounds, settings, colour themes, etc. whichmake a software interface looks good and functional.	• CSS

5.3 User Stories

Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria
Collection of dataset	USN-1	As a user, I can collect the dataset for monitoring and analyzing.	Enough data collected for training Model.
Home Page	USN-2	As a user, I want to know to about the basics of frequently occurring Disasters.	I can get the idea about the Application.
Intro page	USN-3	As a user, I want to about the introduction of Disaster in particular areas.	I can get idea about the disaster and where it occurs.
Open webcam	USN-4	As a user, I adapt with the webcam to analyze and classify the Disaster from video capturing	I can capture a video or image of particular disaster to analyze and classify.
Analysis of required phenomenon	USN-5	As a user, I can regulate certain factors influencing the action and report on past event analysis.	Model should be easy to use & working fine from the web app.

Algorithm selection	USN-6	As a user, I can choose the required algorithm for specific analysis.	Selection must give the better accuracy and better output.
Training and Testing	USN-7	As a user, I can train and test the model using the algorithm.	Training the model to classify and analyze the intensity
Detection and analysis of data	USN-8	As a user, I can detect and visualize the data effectively.	I can capture a video or image of particular disaster to analyze and detect.
Model building	USN-9	As a user I can build with the web application	Model should be predicting occurrence of the disaster and intensity level of disaster.
Integrate the web app with the AI Model	USN-10	As a user, I can use Flask app to use model easily through web app.	Model should be easy to use and working fine from the web app.
Model deployment	USN-11	As an administrator, I can deploy the AI model in IBM Cloud.	Model's prediction should be available for users to make decision.

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 Sprint planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points
Sprint-1	Collection of Dataset	USN-1	As a user, I can collect the dataset for monitoring and analysing.	5
Sprint-1	Home page	USN-2	As a user, I want to know to about the basics of frequently occurring Disasters.	5
Sprint-1	Intro page	USN-3	As a user, I want to about the introduction of Disaster in particular areas.	5
Sprint-1	Open webcam	USN-4	As a user, I adapt with the webcam to analyse and classify the Disaster from video capturing.	5
Sprint-2	Analysis of required phenomenon	USN-5	As a user, I can regulate certain factors influencing the action and report on past event analysis.	5

Sprint-2	Algorithm selection	USN-6	As a user, I can choose the required Algorithm for specific analysis.	5
Sprint-2	Training and Testing	USN-7	As a user, I can train and test the model using the algorithm.	10
Sprint-3	Detection and analysis of data	USN-8	As a user, I can detect and visualise the data effectively.	10
Sprint-3	Model building	USN-9	As a user, I can build with the web application.	10
Sprint-4	Integrate the web app with the AI model	USN-11	As a user, I can use Flask app to use model easily through web app.	10
Sprint-4	Model deployment	USN-12	As an administrator, I can deploy the AI model in IBM Cloud.	10

6.2 Sprint Delivery schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	20	19 Nov 2022

6.3 Reports from Jira

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)

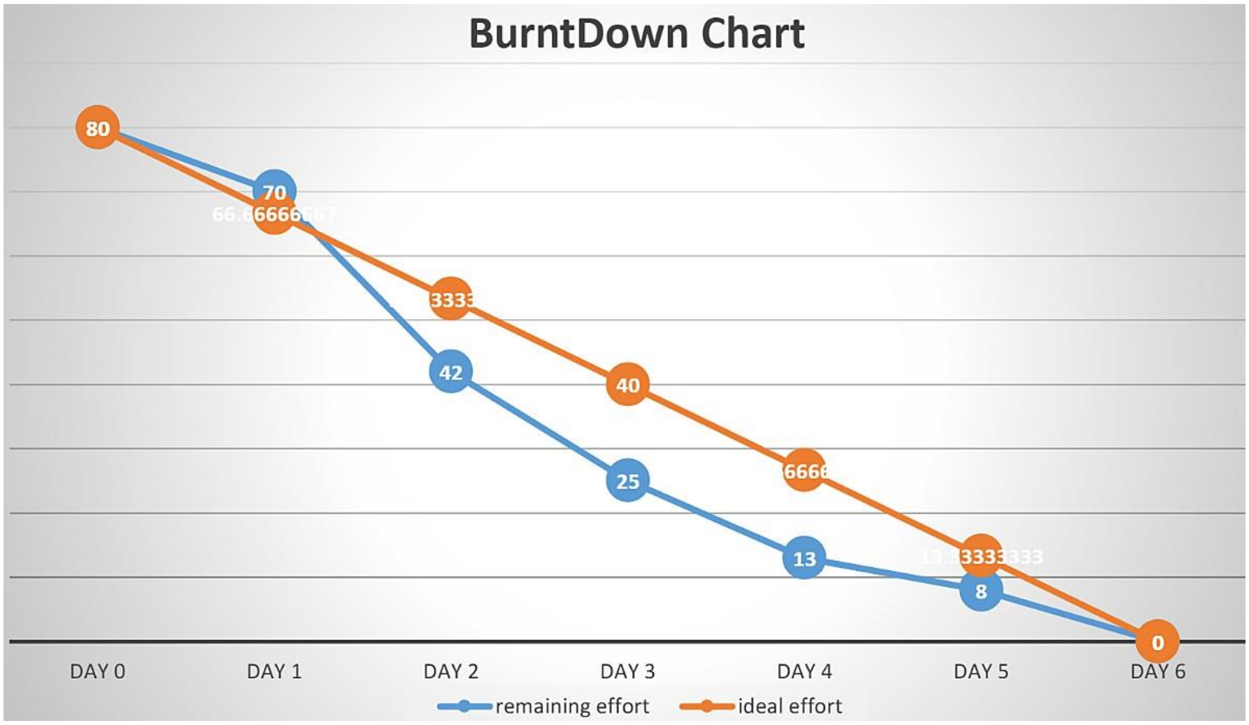
Average velocity = Sprint duration / velocity

=20/6

=3

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.



CHAPTER 7

CODING & SOLUTIONING

7.1 Feature 1

The project focuses on the analysis of intensity of Disaster for giving precautionary measures for the people living in the Danger zone.

It focuses on classifying the type of Disaster which oftenly occurs in that particular zone.

7.2 Feature 2

The accuracy of the project is improved more better than the previously submitted models.

The accuracy is improved by training and testing more images in the dataset.

CHAPTER 8
TESTING

8.1 Test cases

Test Case ID	Component	Test Scenario	Expected Result	Actual Result	Status
TC_001	Home Page	Verify user is able to see the Home page	Home page should display	Working as expected	Pass
TC_002	Home Page	Verify the UI elements in Home page	Application should show below UI elements: Home page button Intro page button Open webcam button	Working as expected	Pass
TC_003	Home Page	Verify user is able to see the cards about Disaster	Application should show the cards about Disaster.	Working as expected	Pass
TC_004	Home Page	Verify user is able to navigate to the required page	Application should navigate to the Intro page	Working as expected	Pass
TC_005	Intro Page	Verify user is able to see the Intro page	Intro page should display	Working as expected	Pass
TC_006	Intro Page	Verify the UI elementsin Intro page	Application should show below UI elements: Home page Intro page Open webcam button	Working as expected	Pass

TC_007	Intro Page	Verify the user is able to see the introduction of the Disaster	Application should show the sentences about the Disaster	Working as expected	Pass
TC_008	Intro Page	Verify user is able to navigate to the required page	Application should navigate to the Open webcam page	Working as expected	Pass
TC_009	Webcam page	Verify user is able to see the webcam page	Webcam page is displayed	Working as expected	Pass
TC_010	Webcam page	Verify the Emergency pull button is visible while the webcam is not connected	Application should show below UI elements: a. Emergency pull button	Working as expected	Pass
TC_011	Webcam page	Verify user is able to see the outputwindow	Application should detect the type of Disaster from the real time video	Working as expected	Pass

8.2 User Acceptance Testing

It is to briefly explain the test coverage and open issues of the natural disasters intensity analysis and classification using artificial intelligence project at the time of the release to User Acceptance Testing (UAT).

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	1	0	0	2	3
Duplicate	1	0	0	0	1
External	0	0	0	0	0
Fixed	1	0	0	2	3
Not Reproduce	0	0	0	0	0
Skipped	0	0	0	1	1
Won't Fix	0	0	0	0	0
Totals	3	0	0	5	8

Test Case Analysis:

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

Section	Test Cases	Not Tested	Fail	Pass
Home Page	4	0	0	4
Intro Page	4	0	0	4
Open Webcam	3	0	0	3

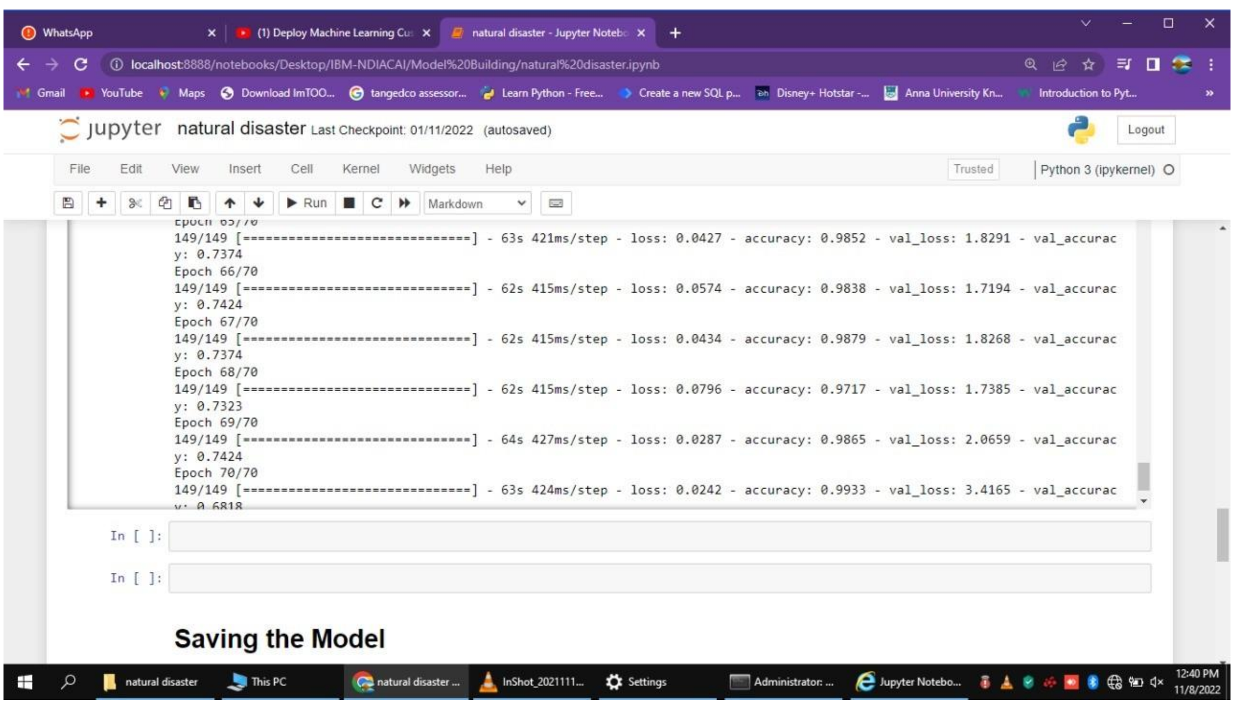
CHAPTER 9

RESULTS

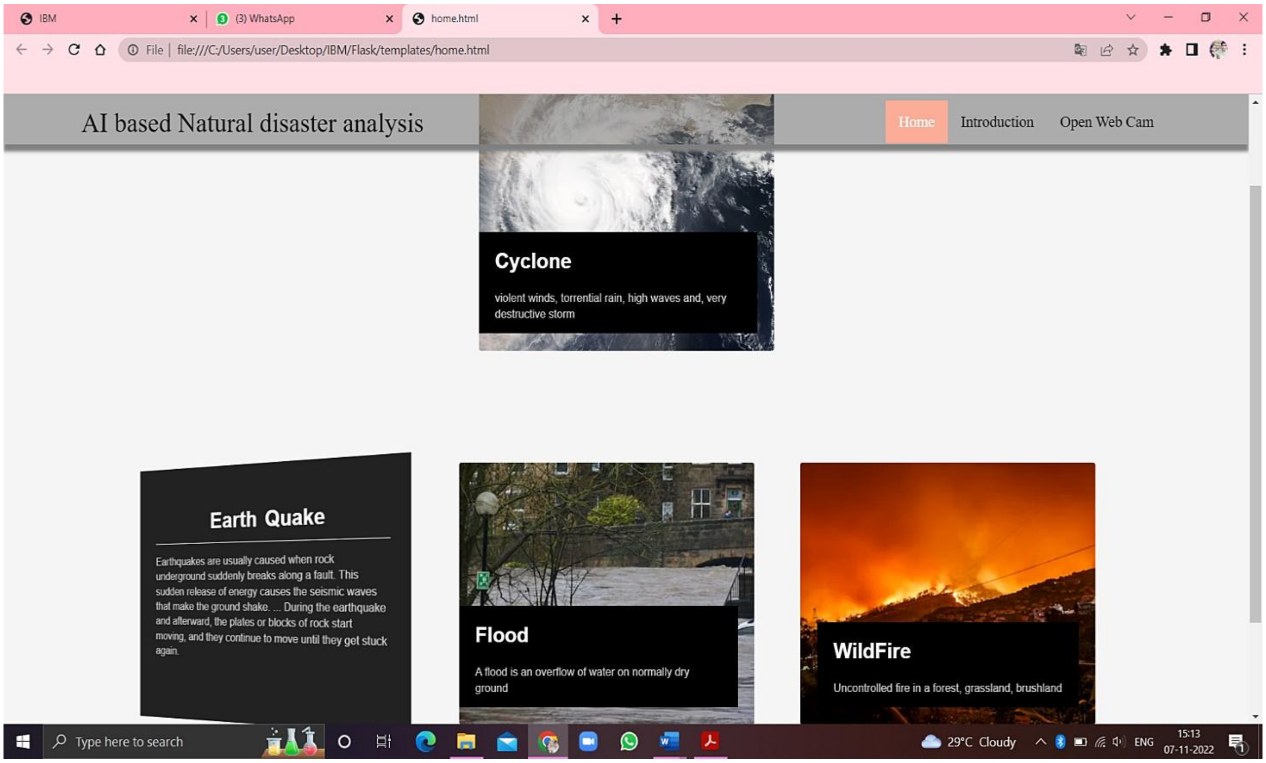
9.1 Performance Metrics

The nature disaster intensity analysis and classification with test data and train data has been executed successfully. The model has been trained over 1000+ images and the model have an accuracy of nearly 99% and the model has been tested withthe data which is separate from the trained data and has predicted the data well.

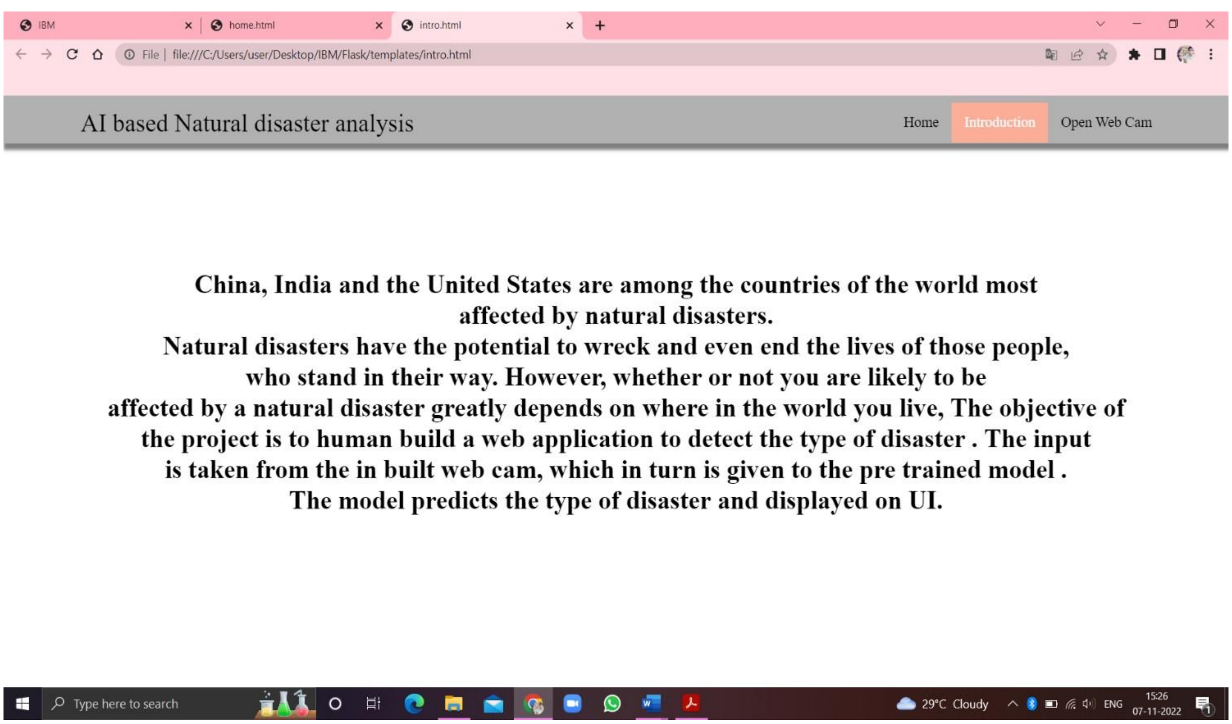
Output of application



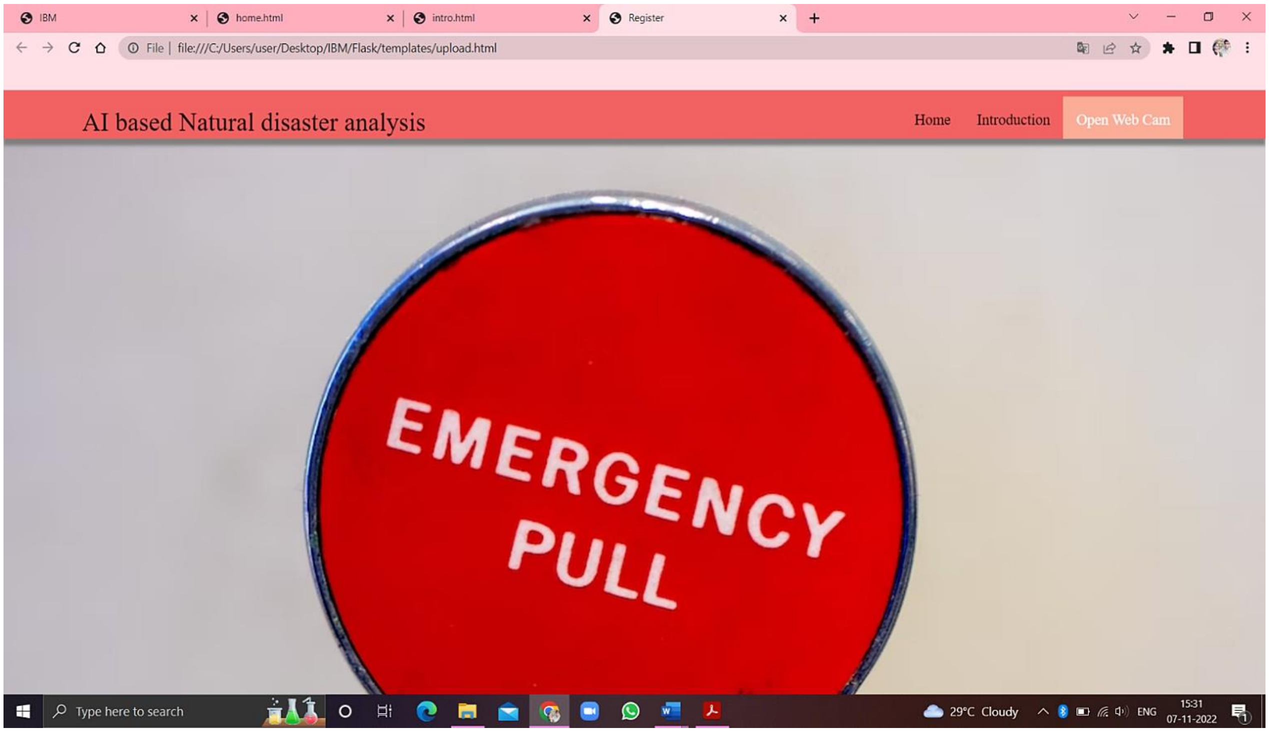
HOME PAGE



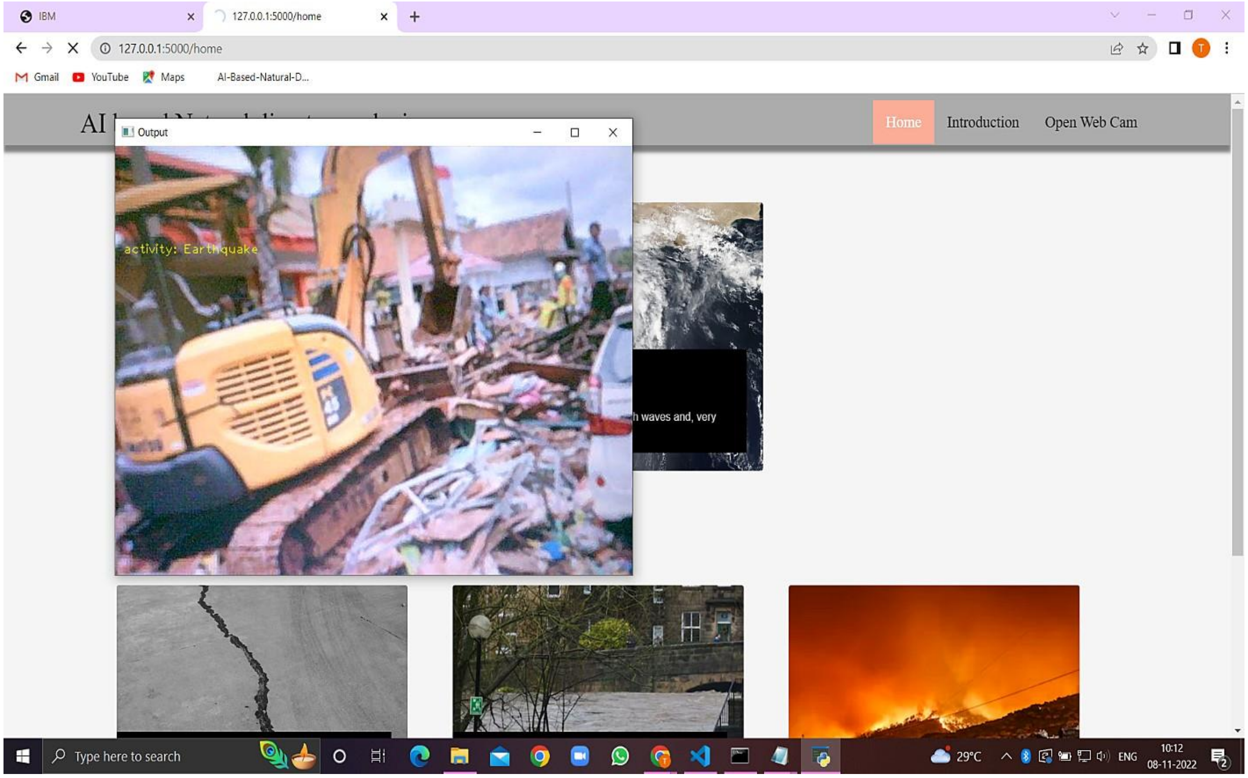
INTRODUCTION PAGE

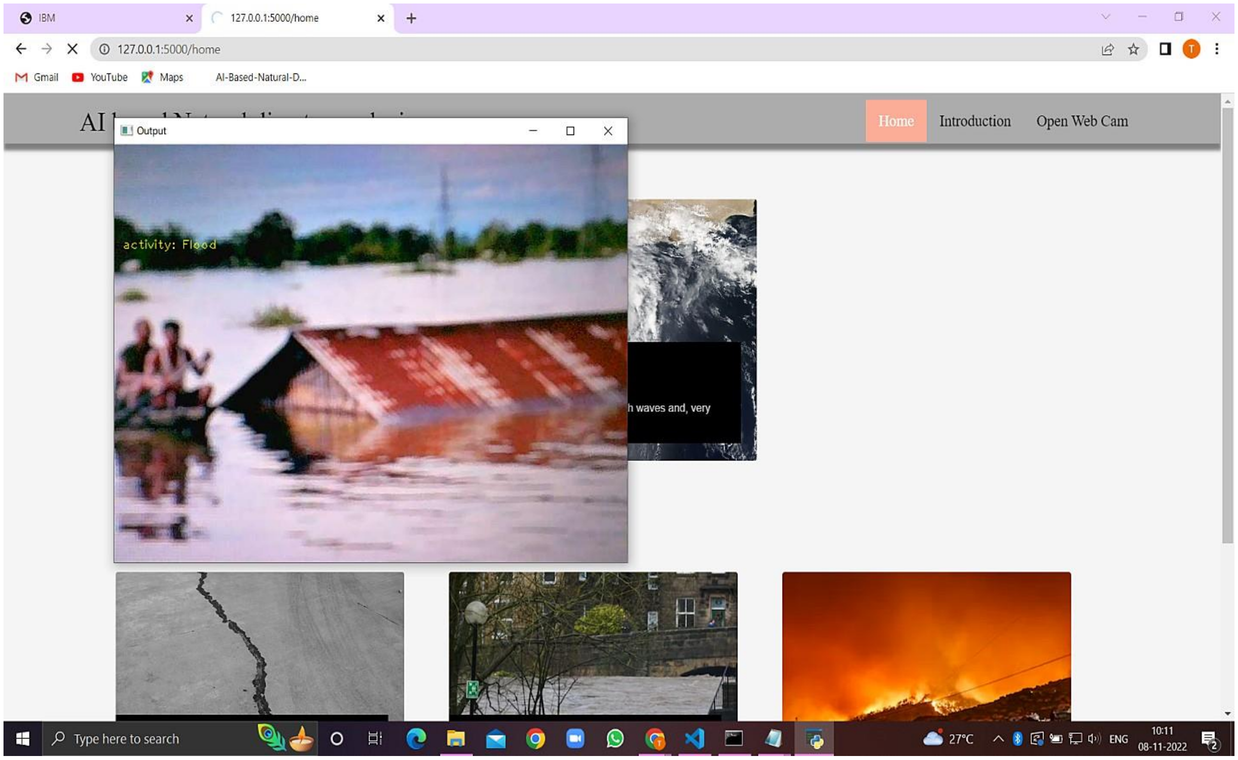


WEB CAM



DETECTION OF NATURE DISASTER





IBM
127.0.0.1:5000/home
127.0.0.1:5000/home
Gmail
YouTube
Maps
AI-Based-Natural-D...
Output
activity: Flood
Home
Introduction
Open Web Cam
h waves and, very
Type here to search
27°C
ENG
10:11
08-11-2022

CHAPTER 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES

1. The proposed model will be used as a real time natural disaster detection model and provide some upcoming predictions for future disasters.

2. The model is to detect and classify the type of disaster and The model have a high accuracy rate (99.33).

3. The model was used to prevent natural disasters in the future and model can be used to predict future disasters and take some action against heavy loss of human ecological systems and property.

4. The proposed system helps to reduce the impact of hazards occur during natural disaster. This provides an efficient way to warn and educate people about disaster prone areas.

5. It will help us be prepared in times of disaster

DISADVANTAGES

1. The resultant model unable to validate the model performance under uncontrolled conditions.

2. The model cannot be used for various natural disaster

CHAPTER 11

CONCLUSION

It focused how image from given dataset (trained dataset) in field and past data set used predict the pattern of different nature disaster using CNN model. In the system had applied different type of CNN compared the accuracy. The natural disaster in Indonesia frequently happened, due to the geographical position of the country. Thus, natural disasters mostly occurred as an impact of the natural condition. However, the weather and climate condition has also influenced and triggered the disasters.

CHAPTER 12

FUTURE SCOPE

In the future, the research will be continued to obtain the data from all over the country, not only west java province, and with the use of more complete analysis, so that the government or related institution could make a better anticipation work as a mitigation effort.

CHAPTER 13

APPENDIX

Inserting necessary libraries

import numpy as np **#used for numerical analysis**

import tensorflow **#open source used for both ML and DL for computation**

from tensorflow.keras.models import Sequential **#it is a plain stack of layers**

from tensorflow.keras import layers **#A layer consists of a tensor-in tensor-out computation function**

#Dense layer is the regular deeply connected neural network layer

from tensorflow.keras.layers import Dense,Flatten

#Faltten-used fot flattening the input or change the dimension

from tensorflow.keras.layers import Conv2D,MaxPooling2D **#Convolutional layer**

#MaxPooling2D-for downsampling the image

from keras.preprocessing.image import ImageDataGenerator

tensorflow.__version___

tensorflow.keras.__version___

Image Data Augumentation

#setting parameter for Image Data agumentation to the training data

train_datagen =

ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_

flip=True)

#Image Data agumentation to the testing data

test_datagen=ImageDataGenerator(rescale=1./255)

Loading our data and performing Data Augumentation

#performing data agumentation to train data

x_train=train_datagen.flow_from_directory(r'C:\Users\vasanth\Desktop\IBM Project\dataset\train_set',target_size=(64, 64),batch_size=5,

color_mode='rgb',class_mode='categorical')

#performing data agumentation to test data

x_test=test_datagen.flow_from_directory(r'C:\Users\vasanth\Desktop\IBM Project\dataset\test_set',target_size=(64, 64),batch_size=5,

color_mode='rgb',class_mode='categorical')

print(x_train.class_indices)**#checking the number of classes** print(x_test.class_indices)#**checking the number of classes**

from collections import Counter as c

c(x_train .labels)

Creating the Model

 # Initializing the CNN

classifier = Sequential()

 # First convolution layer and poolingo

classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))

classifier.add(MaxPooling2D(pool_size=(2, 2)))

classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))

 # Second convolution layer and pooling

classifier.add(Conv2D(32, (3, 3), activation='relu'))

 # input_shape is going to be the pooled feature maps from the previous convolution layer

classifier.add(MaxPooling2D(pool_size=(2, 2)))

classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))

 # Flattening the layers

classifier.add(Flatten())

 # Adding a fully connected layer

classifier.add(Dense(units=128, activation='relu'))

classifier.add(Dense(units=4, activation='softmax')) **# softmax for more than 2**

classifier.summary() #**summary of our model**

 # Compiling the Model

 # Compiling the CNN

 # categorical_crossentropy for more than 2

classifier.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

 # Fitting the Model

classifier.fit_generator(

generator=x_train,steps_per_epoch = len(x_train),

epochs=10, validation_data=x_test,validation_steps = len(x_test)**)# No of images in test set**

 # Saving the Model

classifier.save('disaster.h5')

model_json = classifier.to_json()

with open("model-bw.json", "w") as json_file:

json_file.write(model_json)

 # Predicting Results

from tensorflow.keras.models import load_model

from keras.preprocessing import image

model = load_model("disaster.h5") **#loading the model for testing**

img=image.load_img(r"C:\Users\vasanth\Desktop\IBMProject\dataset\test_set\Cyclone\921.jpg",grayscale=False,target_size= (64,64)) **#loading of the image\n**

x = image.img_to_array(img**)#image to array\n",**

x = np.expand_dims(x,axis = 0)**#changing the shape\n",**

pred = model.predict_classes(x)**#predicting the classes\n",**

pred

index=['Cyclone','Earthquake','Flood','Wildfire']

result=str(index[pred[0]])

result

Links to find files, documents and result related to this project,

GitHub: **https://github.com/IBM-EPBL/IBM-Project-52433-1661004052**

Project Demo Link:

https://drive.google.com/file/d/1tcjhsaWylRm2L7NWk8bKm1BV5iCh

2_TH/view?usp=share_link