NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE

Project Report

Submitted by

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INTRODUCTION

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.

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

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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 thejoint classification of natural disaster types and intensity. Moreover, this study primarilyaims 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 non-damaged buildings. Furthermore, areas with moderate to strong disaster intensitieslikely contain damaged and nondamaged buildings. Under this assumption, a procedurethat 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. Theseframeworks 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 resultcan 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 LearningTechniques

PROPOSED WORK

In this proposed work, Disaster detection can be done through social mediaand 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 helpto 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 errorprone, 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 tecniques
- Support Vector Machine, Decision trees, random forest.

TECHNOLOGY : Machine Learning, Deep Learning

Existing Problem

Earlier we focus on post disaster relief and rehabilitation measures. Now thefocus 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-

- Prevention of danger or threat of any disaster
- Preparedness to deal with any disaster
- Prompt response to any threatening disaster situation or disaster
- Assessing the severity or magnitude of effects of any disaster
- Evacuation, rescue, and relief
- Rehabilitation and reconstruction

References

- 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]

- 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 Studyof the Liguria Region in Italy. Geosciences 2020, 10, 105. [CrossRef]

• 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]

• 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]

• 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]

Problem Statement Definition

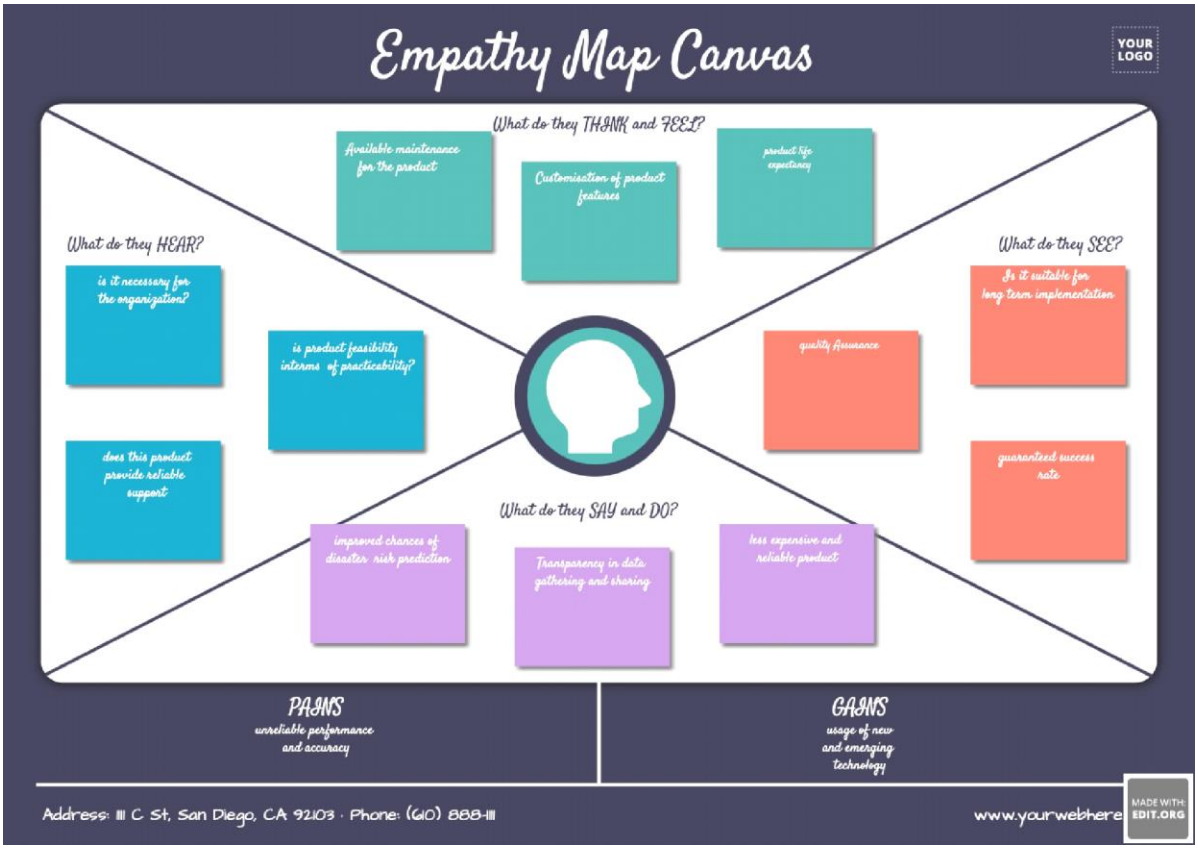
People needs a way to classify and analyse the natural disaster so that theycan prevent themselves from losses due to the disaster and millions of lives.

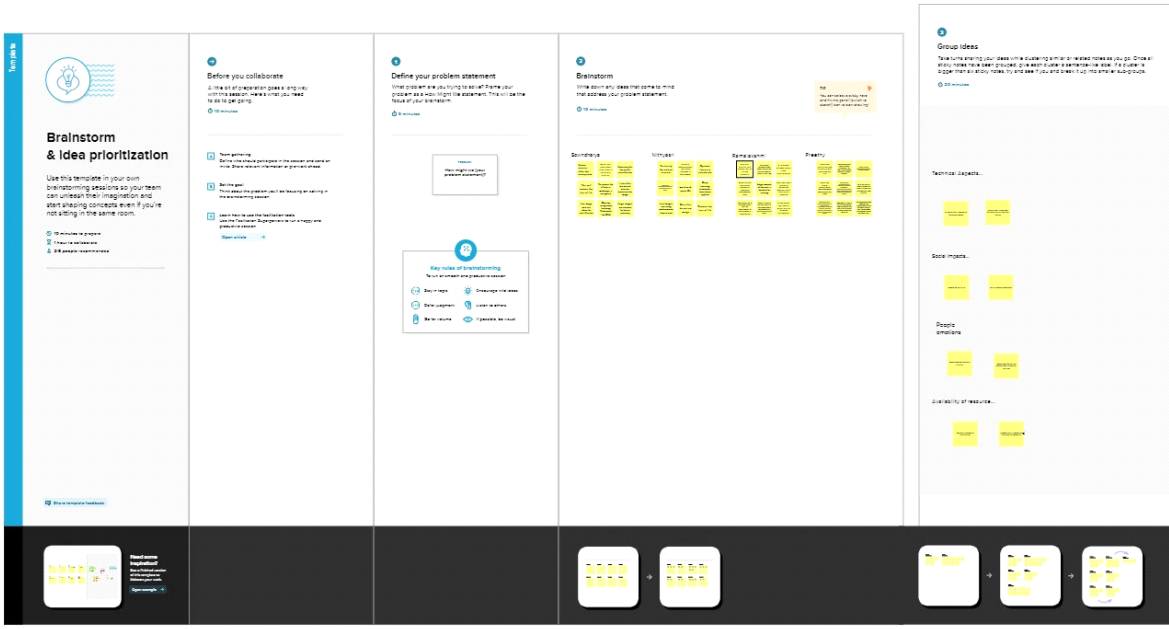
People and animals are facing so many issues like loss of life, property, resources and deterioration of the air quality due to the natural disaster. So we need toanalyse and detect natural disaster andd protect them from such disaster.

CHAPTER 3

IDEATION & PROPOSED SOLUTION

Empathy Map Canvas





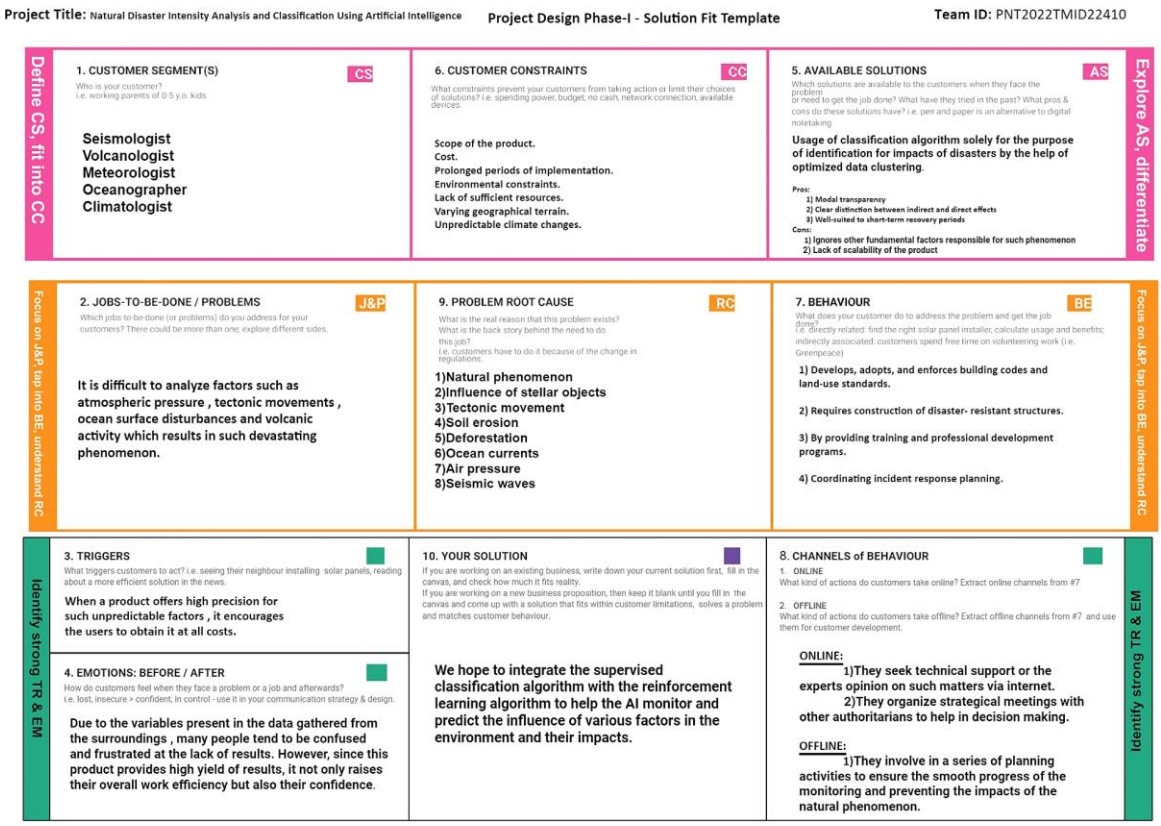
Ideation & Brainstorming

Proposed solution

S. No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	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 DeepConvolutional Neural Network (pretrained) model to classify NaturalDisaster and calculate the intensity of the Disaster
3.	Novelty/Uniqueness	To reduce the issues due to imbalance structure of images, the model uses anintegrated webcam to capture the video frame and test data is compared with pretrained data.
4.	Social impact/Customer Satisfaction	By the Application, economic damagecaused by Disaster can be reduced. Detection of Natural Disaster will become easier while using videos inDeep 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 robustnes

Problem Solution Fit



CHAPTER 4

Functional Requirement

REQUIREMENT ANALYSIS

FR No.	Functional Requirement(Epic)	Functional Requirement(Epic)
FR-1	Request Permission	Access permission from web camera.
FR-2	Disaster Detection	Based on the webcam image, natural disaster is classified.
FR-3	Accuracy	Since the training and testing images are huge, The accuracy is higher.
FR-4	Speed	The generation of results from the input Images are faster.
FR-5	Resolution	The resolution of the integrated web camera should be high enough to capturethe video frames
FR-6	User Interface	Maximizing the interactionin Web Designing Service.

Non-Functional Requirement

NFR. No.	NonFunctional Requirement	Description
NFR-1	Usability	User friendly and classify thedisaster easily.

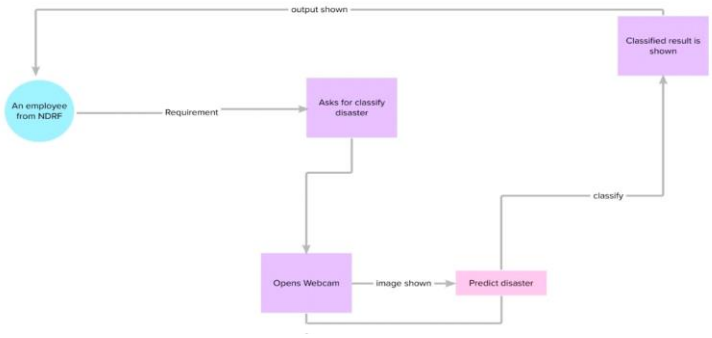
NFR-2	Security	The model is secure due to the cloud deployment models and also there is no login issue.
NFR-3	Reliability	Accurate prediction of the natural disaster and the website can alsobe fault tolerant.
NFR-4	Performance	It is shown that the model gives almost 95 Percent accuracy after continuous training.
NFR-5	Availability	The website will be madeavailable for 24 hours.
NFR-6	Scalability	The website can run on web browsers like Googlechrome, Microsoft edge and also it canbeextended to the NDRFand customers.

Data Flow Diagrams

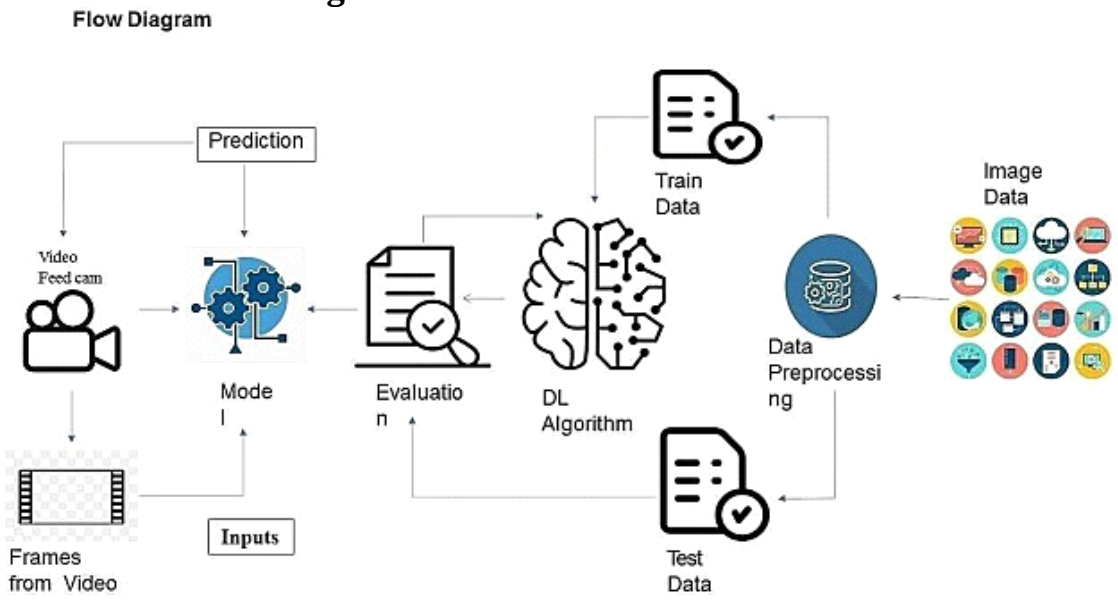
CHAPTER 5
PROJECT DESIGN

A Data Flow Diagram (DFD) is a traditional visual representation of theinformation 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.

Data Flow Diagram for "Natural Disasters Intensity Analysis and Classification using Artificial Intelligence":



Flow Diagram



Solution & Technical Architecture

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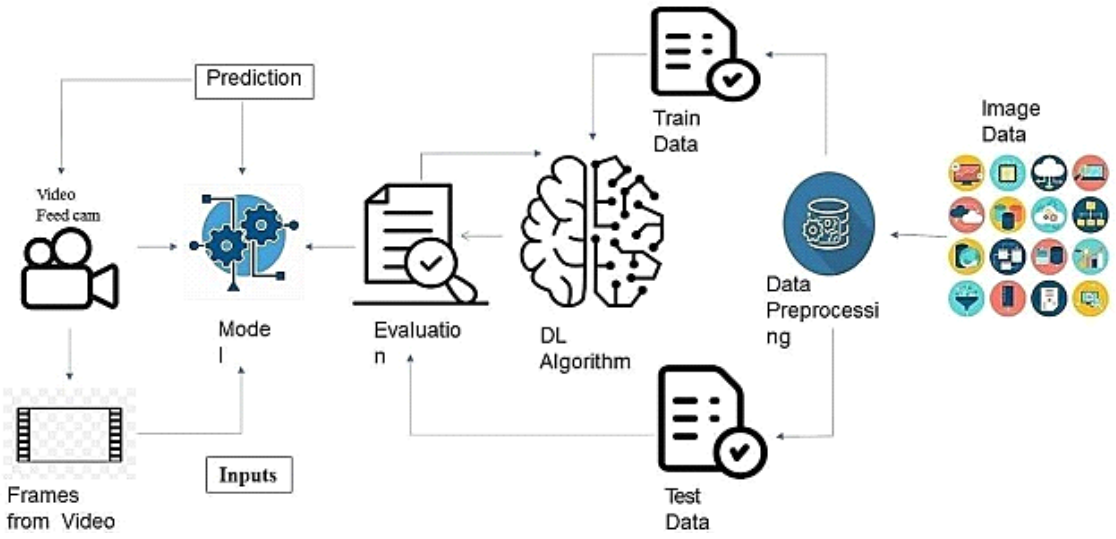
Solution architecture is a complex process – with many sub-processes

– that bridges the gap between business problems and technology solutions. Its goalsare to:

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

Solution Architecture Diagram

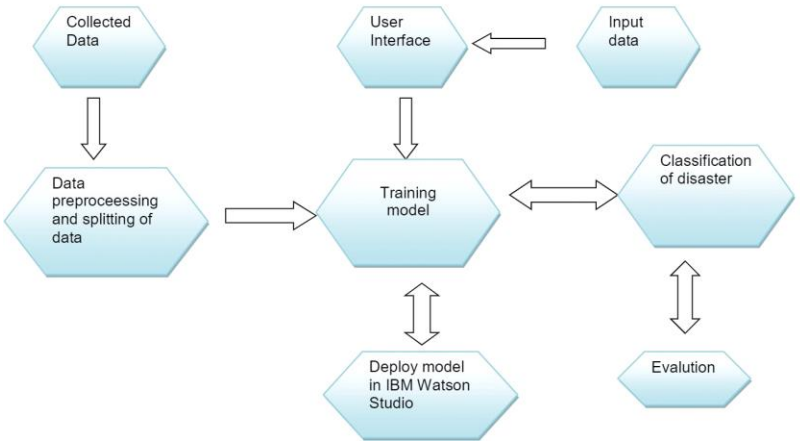
Flow Diagram



Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	19 October 2022
Team ID	PNT2022TMID38512
Project Name	Natural Disasters Intensity Analysis And Classification Using Artificial Intelligence
Marks	4

Technical Architecture:



Components &Technologies:

S.No	Component	Description	Technology
1.	User Interface	User interacts with applicationfor the detection of any Natural disaster's intensity	HTML, CSS, JavaScript, Django, Python.

		andclassify which happened just before.	
2.	Disaster Detection	This function is used to detect, Decision Outcomes , the newtrained data to perform tasksand solve new problems.	Decision trees, Regression, Convolutional Neural networks
3.	Evaluation system	It monitors that how Algorithmperforms on data as well as during training.	Chi-Square, Confusion Matrix, etc.
4.	Input data	To interact with our model andgive it problems to solve. Usually this takes the form ofan API, auser interface, or a command line interface.	Application programminginterface, etc
5.	Data collectionunit	Data is only useful if it's accessible, so itneeds to be stored ideally in a consistent structure and conveniently inone place.	IBM Cloud, SQLServer.
6.	Database management system	An organized collection of data stored in database, so that it can be easily accessedand managed.	MySQL, DynamoDB etc.

Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	An open source framework is atemplate for software development that is designed bya 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 keep sour models secure and makes sure only those who havepermission can use them	Encryption and Decryption (OTP)
3.	Application interface	User uses mobile application andweb application to interact with model	Web Develop ment (HTML,C SS)
4.	Availability (both Online and Offline work)	Its include both online and offlinework. As good internet connection is need for online work to explore the software perfectly. Offline work includesthe saved data to explore for later time	Caching, backend server.
5.	Regular Updates	The truly excellent softwareproduct needs a continuous process of improvements and updates. Maintain your server and make sure that your contentis always	Waterfall Approach, Incremental Approach, Spiral Approach

		up-todate. Regularly update an app and enrich it with new features.	
6.	Personalization	Software has features like flexible fonts, backgrounds, settings, colour themes, etc. which make a software interface looks good and functional.	CSS

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 datasetfor monitoring and analyzing	Enough data collected for training Model.
Home Page	USN-2	As a user, I can collect the datasetfor monitoring and analyzing	I can get the ideaabout the Application.
Intro page	USN-3	As a user, I want to about theintroduction of Disaster in particular areas.	I can get idea aboutthe disaster and where it occurs.
Open webcam	USN-4	As a user, I adapt with the webcamto analyze and classify the Disaster from video capturing	I can capture a videoor 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 andreport on past event analysis.	Model should beeasy to use & working fine from the

			web app
Algorithm selection	USN-6	As a user, I can choose the required algorithm for specificanalysis.	Selection must givethe better accuracy and better output
Training and Testing	USN-7	As a user, I can train and test themodel using the algorithm.	Training the model toclassify 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 videoor image of particular disaster to analyze and detect.
Model building	USN-9	As a user I can build with the webapplication.	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 usemodel 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 deploythe AI model in IBM Cloud.	Model's prediction should be availablefor users to make decision.

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PROJECT PLANNING & SCHEDULING

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 collectthe dataset for monitoring and analysing.	**5**
Sprint-1	Home page	USN-2	As a user, I want to knowto about the basics of frequently occurring Disasters.	**5**
Sprint-1	Intro page	USN-3	As a user, I want to aboutthe 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 regulatecertain factors influencing the action and report on past event analysis.	**5**

Sprint-2	Algorithm selection	USN-6	As a user, I can choosethe required Algorithm for specific analysis.	**5**
Sprint-2	Training and Testing	USN-7	As a user, I can train andtest the model using the algorithm.	**10**
Sprint-3	Detection and analysis of data	USN-8	As a user, I can detectand 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 webapp with the AI model	USN-10	As a user, I can use Flaskapp to use model easily through web app.	**10**
Sprint-4	Model deployment	USN-11	As an administrator, I can deploy the AI model in IBM Cloud.	**10**

Sprint Delivery schedule

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Story Points Completed (as onPlanned End Date)**	**Sprint ReleaseDate (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

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 doversus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurableprogress over time.

CHAPTER 7

CODING & SOLUTIONING

Feature 1

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

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

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 thedataset.

CHAPTER 8

TESTING

Test cases

Test Case ID	Component	Test Scenario	Expected Result	Actual Result	Status
TC_001	Home Page	Verify user is able to seethe Home page	Home page shouldDisplay	Working as expected	Pass
TC_002	Home Page	Verify the UI elementsinHome page	Application should show below UI elements: Home page button Intro page buttonOpen webcam button	Working as expected	Pass

TC_003	Home Page	Verify user is able to seethe 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 seethe Intro page	Intro page shoulddisplay	Working as expected	Pass
TC_006	Intro Page	Verify the UI Elements in Intropage	Application should show below UI elements: Homepage Intro page Open webcam button	Working as expected	Pass
TC_007	Intro Page	Verify the user is able tosee 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 isdisplayed	Working as expected	pass
TC_010	Webcam page	Verify the Emergencypull button is visible while the webcam is not connected	Application shouldshow below UI elements: a. Emergency pull button	Working as expected	pass
TC_011	Webcam page	Verify user is able to see the output window	Application shoulddetect the type of	Working as expected	pass

			Disaster from the real time video		

User Acceptance Testing

It is to briefly explain the test coverage and open issues ofthe 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 bugsat 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	3	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

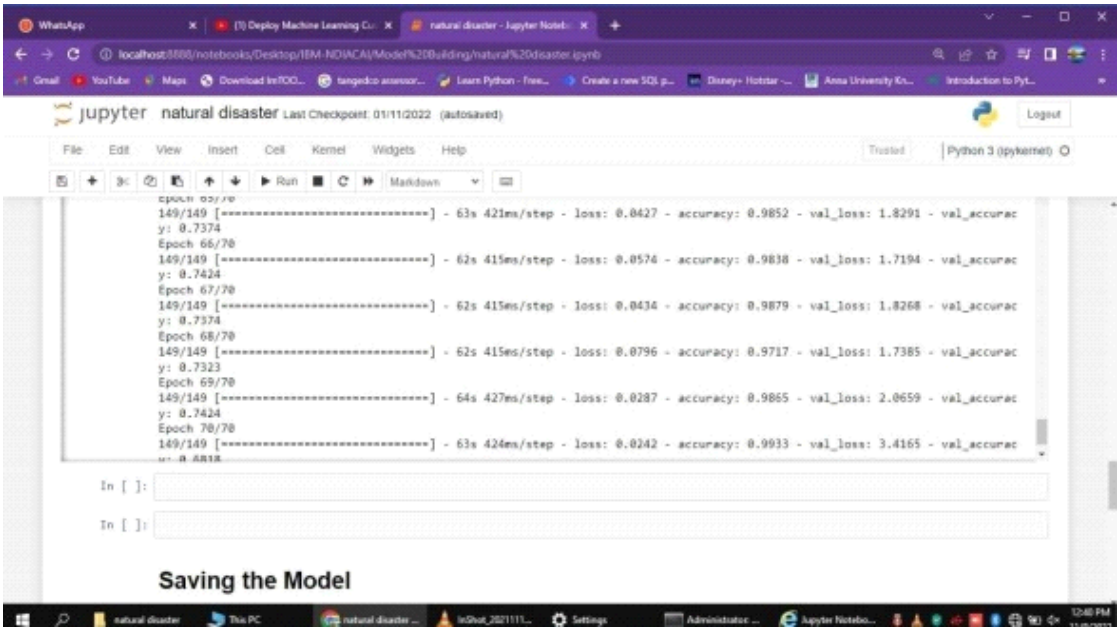
CHAPTER 9

Performance Metrics

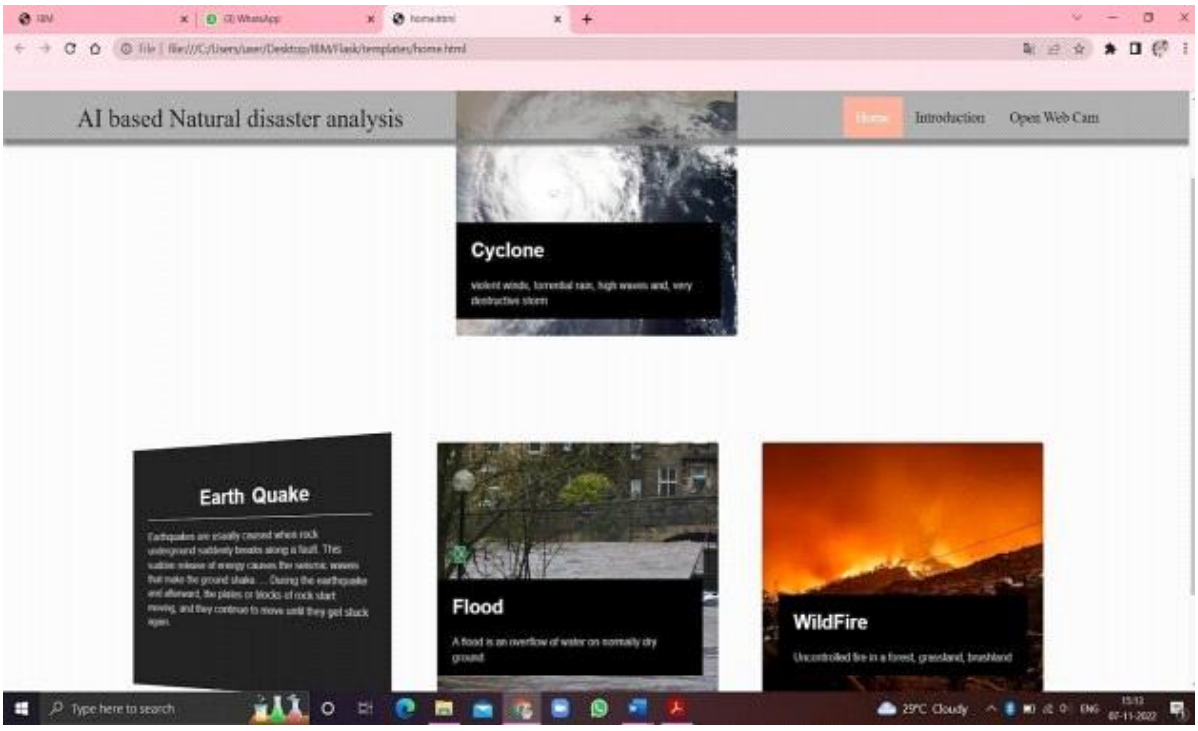
RESULTS

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 testedwiththe data which is separate from the trained data and has predicted the data well.

Output of application


jupyter natural disaster Last Checkpoint: 01/11/2022 (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3 (ipykernel)
Run
Markdown
149/149 [==========] - 63s 421ms/step - loss: 0.0427 - accuracy: 0.9852 - val_loss: 1.8291 - val_accurac
y: 0.7374
Epoch 66/70
149/149 [==========] - 62s 415ms/step - loss: 0.0574 - accuracy: 0.9838 - val_loss: 1.7194 - val_accurac
y: 0.7424
Epoch 67/70
149/149 [==========] - 62s 415ms/step - loss: 0.0434 - accuracy: 0.9879 - val_loss: 1.8268 - val_accurac
y: 0.7374
Epoch 68/70
149/149 [==========] - 62s 415ms/step - loss: 0.0796 - accuracy: 0.9717 - val_loss: 1.7385 - val_accurac
y: 0.7323
Epoch 69/70
149/149 [==========] - 64s 427ms/step - loss: 0.0287 - accuracy: 0.9865 - val_loss: 2.0659 - val_accurac
y: 0.7424
Epoch 70/70
149/149 [==========] - 63s 424ms/step - loss: 0.0242 - accuracy: 0.9933 - val_loss: 3.4165 - val_accurac
In [ ]:
In [ ]:
Saving the Model

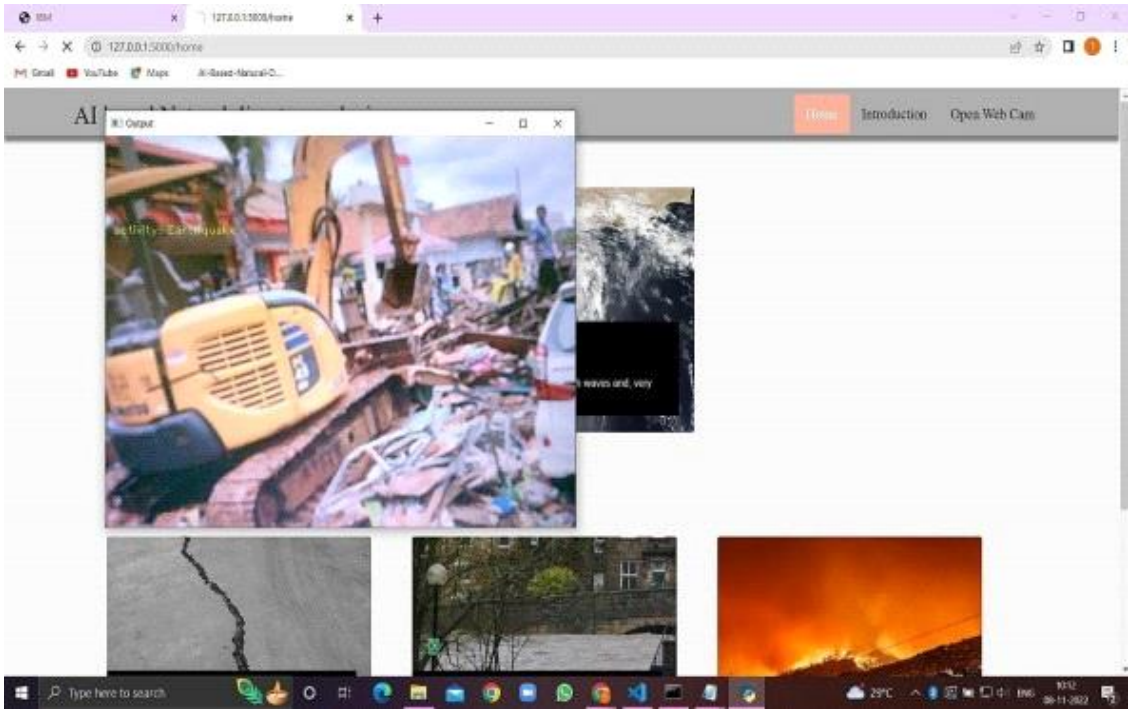
HOME PAGE

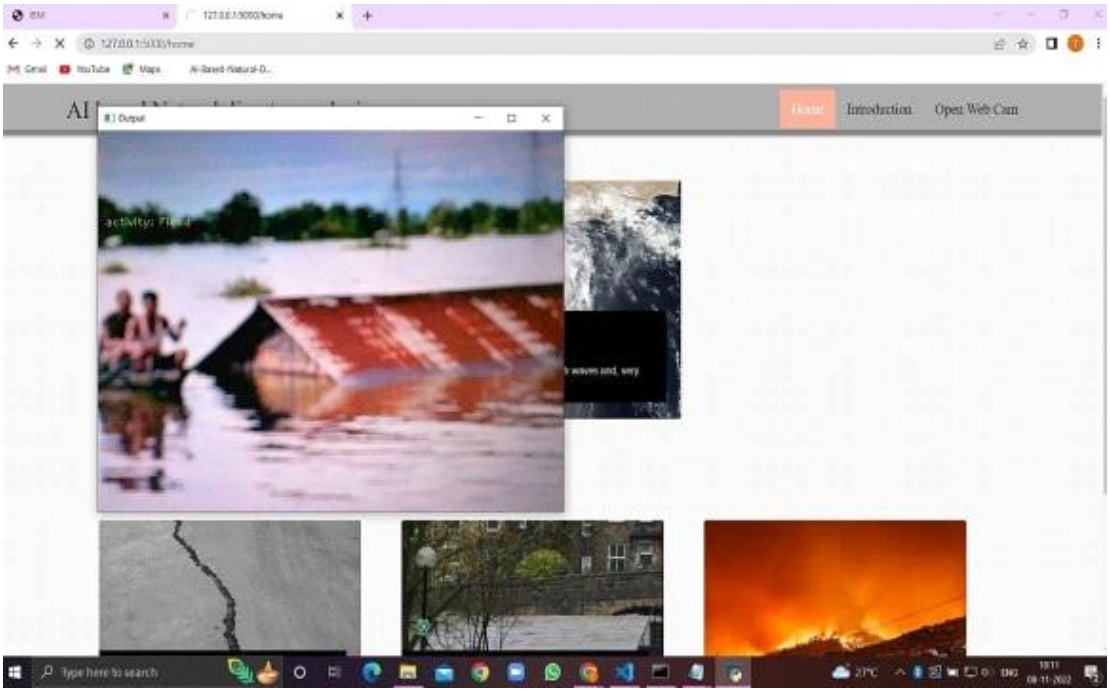

AI based Natural disaster analysis
Home
Introduction
Open Web Cam
Cyclone
violent winds, torrential rain, high waves and, very destructive storm
Earth Quake
Earthquakes are usually caused when rock underground suddenly breaks along a fault. This sudden release of energy causes the seismic waves that make the ground shake. ... During the earthquake and afterward, the plates or blocks of rock start moving, and they continue to move until they get stuck again.
Flood
A flood is an overflow of water on normally dry ground
WildFire
Uncontrolled fire in a forest, grassland, brushland
Type here to search
29°C Cloudy
ENG

China, India and the United States are among the countries of 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. However, whether or not you are likely to be affected by a natural disaster greatly 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 web cam, which in turn is given to the pre trained model . The model predicts the type of disaster and displayed on UI.

INTRODUCTION PAGE

WEB CAM
DETECTION OF NATURE DISASTER


Introduction
Open Web Cam
Output


Introduction
Open Web Cam
Output

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ADVANTAGES & DISADVANTAGES

ADVANTAGES

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

- The model is to detect and classify the type of disaster and The model havea high accuracy rate (99.33).

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

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

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

DISADVANTAGES

- The resultant model unable to validate the model performance underuncontrolled conditions.

- The model cannot be used for various natural disaster

CHAPTER 11 CONCLUSION

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

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In the future, the research will be continued to obtain thedata 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.

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Inserting necessary libraries

APPENDIX

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 layersfrom tensorflow.keras import

layers **#A layer consists of a tensor-in tensor-**

outcomputation 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 **#Convolutionallayer**

#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_rang

e=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\rajeshwari\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\rajeshwari\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

collectio

ns

import

Counter

asc

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), act

 # 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 convolutionlayer

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 testset

 # Saving the Model

classifi

er.sav

e('dis

aster.

h5')

model

_json

=

classi

fier.to

_json(

)

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

json_file:json_file.write(model_json)

 # Predicting Results

from

tensorflow.keras.models

import load_modelfrom

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\Cy

c lone\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']

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[0]

])

res

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```

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

GitHub: **https://github.com/IBM-EPBL/IBM-Project-47730-1660801833**