AI - NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION

A NALAIYATHIRAN THIRAN PROJECT REPORT

Submited by

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of

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HX8001-"PROFESSIONAL READINESS FOR INNOVATION,EMPLOYABILITY AND ENTRENEPRENEURSHIP

DHANALAKSHMI SRINIVASAN INSTITUTE OF TECHNOILOGY,

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ANNA UNIVERSITY::CHENNAI 60025

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AI - NATURAL DISASTER INTENSITY ANALYSIS AND CLASSIFICATION

INTRODUCTION

Natural disasters are inevitable, and the occurrence of disasters drastically affects the economy, ecosystem and human life. Buildings collapse, ailments spread and sometimesnatural disasters such as tsunamis, earthquakes, and forest fires can devastate nations. When earthquakes occur, millions of buildings collapse due to seismological effects [1]. Many machine learning approaches have been used for wildfire predictions since the 1990s. A recent study used a machine learning approach in Italy. This study used the random forest technique for susceptibility mapping of wildfire [2]. Floods are the most devastating natural disaster, damaging properties, human lives and infrastructures. To map flood susceptibility, an assembled machine learning technique based on random forest (RF), random subspace (RS) and support vector machine (SVM) was used [3]. As the populationis growing rapidly, people need to acquire land to live on, and as a result the ecosystem isdisturbed horrifically, which causes global warming and increases the number of naturaldisasters. Neural networks provide multilevel network architectures, where Convolutional Neural Networks are the most frequently implemented architecture as the direct input of multidimensional vector images, speech recognition, and image processing can be carried out with low complexity. CNNs efficiently perform feature extraction by denoising the images and removing interference and achieve highly accurate results [The proposed multilayered deep convolutional neural network method works in two blocks of convolutional neural networks. The first block, known as Block-I ConvolutionalNeural Network (B-I CNN), detects the occurrence of a natural disaster and the second one, known as Block-II Convolutional Neural Network (B-II CNN), defines the intensity ofthe natural disaster. Additionally, the first block consists of three mini convolutional blocks with four layers each and includes an image input and fully connected layers. On the other hand, the second block also consists of three mini convolutional blocks with two layers each, including an image input layer and fully connected laye.The remaining paper is divided into four sections: Section 2, describes the related work. Section 3 presents the methodology which elaborates on the proposed technique. Theresults and discussion are presented in Section 4 to explore the overall research outcomes and describe the used dataset. Finally, the proposed work is concluded in Section 5.

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 Open CV window.

1.2 PURPOSE

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 Open CV window.

2. LITRETURE SURVE

S.No	TITLE	PUBLISHED YEAR	OBJECTIVE	METHODOLOGY
1.	Quantifying change after natural disasters to estimate infrastructure damage with mobile phonedata	2018	Indicates how mobility patterns change during postdisaster time frame, is crucial in order to settle rescue centers and send helpto the mostaffected areas	Describes the approach used towork withaggregated CDR data
2.	Degree of network damage: A measurement for intensity of network damage	2014	To define degree of networkdamage (DND), a measurement used to classify the effect of a destructive event on network infrastructures, human, and traffic flows	A five-scale degree of network damage is developed to indicatethe impact of disaster events onnetworks. We combine two network metrics to determine the degree of network damage from theperspective of an ISP.
3.	Natural Disasters Intensity Analysisand Classification Based on Multispectral Images Using Multi-Layered Deep Convolutional Neural Network	2021	To build a multilayered deepconvolutional neural network that detects the occurrence of disasters and classifies natural disaster intensity.	The proposed model works in two blocks: Block-I CNN, for detection and occurrence of disasters, and Block-II CNN, for classification of natural disasterintensity types with different filters and parameters
4.	Urban Damage Detection Using Decorrelation ofSAR Interferometric Data	2002 IEEE	It indicates a fact that the building damage causes the interferometric decorrelation.	It can be detected using interferometric decorrelation ofERSand JERS-1 SAR data.

5.	Tropical Cyclone Intensity Estimation Using Multidimensiona lConvolutional	2021	Tropical Cyclone IntensityEstimation Using Multidimensional Convolutional Neural	Accurate estimation of TC intensity is important to theoretical research studies and practical applications when compared to models likeCNN.
	Neural Network From Multichannel Satellite Imagery		Network From MultichannelSatellite Imagery	

2.1 EXISTING PROBLEM

Many researchers have attempted 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 this problems, We proposed a multilayered deep convolutional neural network for detection and intensity classification of natural disasters. The proposed method work in two blocks is used to remove imbalanced class issues. The results were calculated as average statistical values: sensitivity, 97.54%; and F1-source 97.97%;for the proposed model. The proposed model achieved the highest accuracy as compared to the art.

2.2 REFERENCE

1. Salam, A.A.; khalil,T.;Akram, M.U.; Jameel, A.' Basit, I.Automated detection of glaucoma using structural and non stuctural features. springerplus **2016, 5,1519.**[CrossRef]

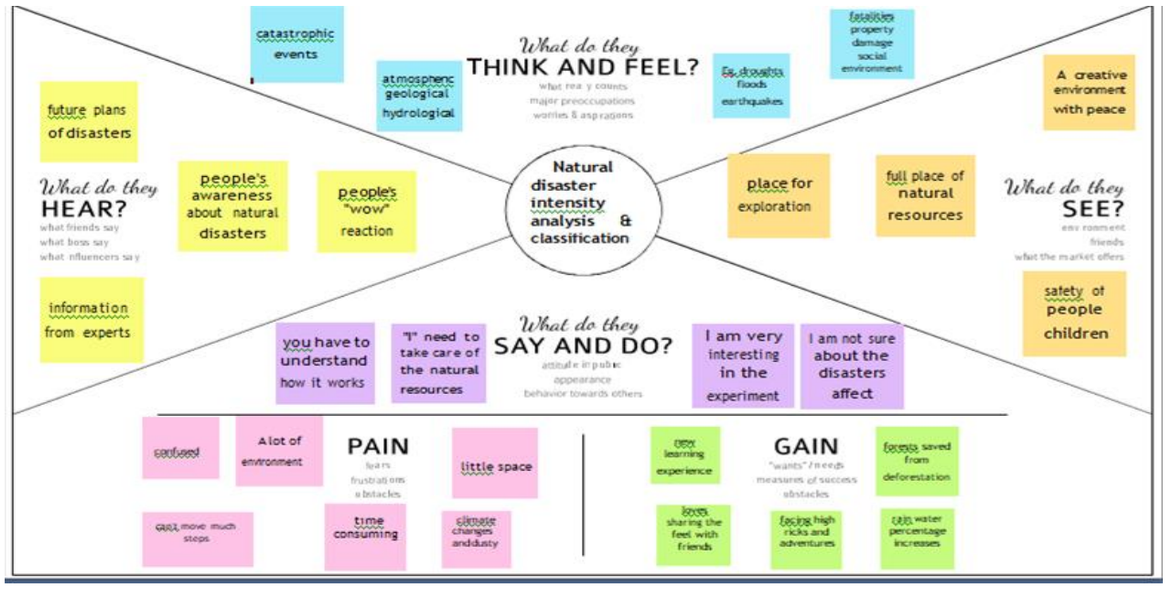
2. Li, Y.; Xie, X.; Shen, L.; Liu, S. Reverse active learning based atrous DenseNet for pathological image classification. BMC Biouniform. **2019, 20,445.[**CrossRef**]**

2.3 PROBLEM STATEMENT

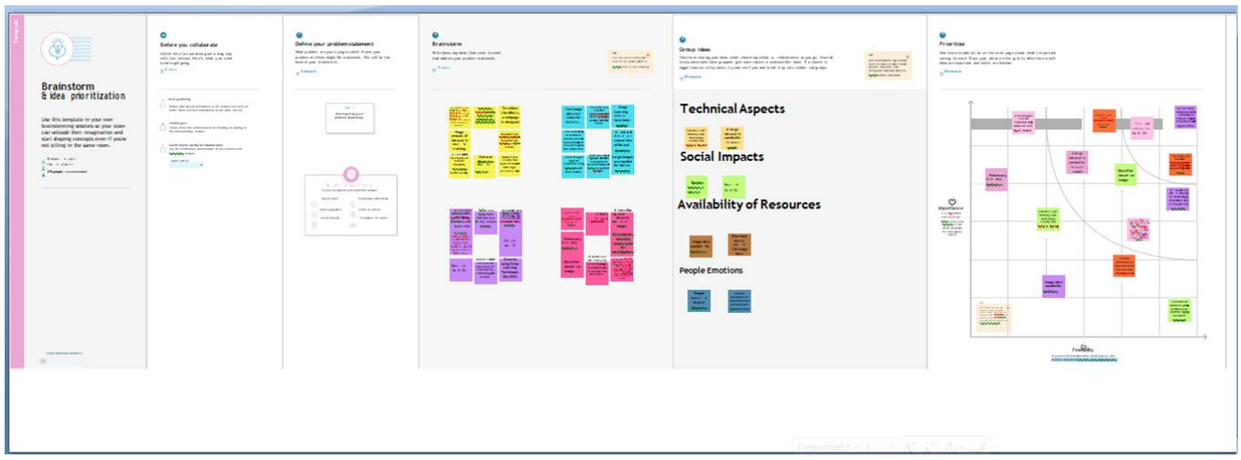
Many researchers have attempted to use different deep learning methods for detection of natural disasters. However, the detection of natural disasters by using deep learning techniques still faces various Issues due to noise and serious class imbalance problems. To address these problems, we proposed 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-source 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 can be used for various natural disaster detection process.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To monitoring and predicting thedisasters and itsintensity of impacts on the region.
2.	Idea / Solution description	To use classification algorithm to identify theimpacts of disaster.
3.	Novelty / Uniqueness	Usage of reinforcement learning algorithm tolet the AI be self-sufficient and capable of gathering essential data on its own for prediction.
4.	Social Impact/ Customer Satisfaction	This productwill help in making crucialdecision support at times of emergencies and also raise fundamental awareness of the impacts of disasters.

5.	Business Model(Revenue Model)	Revenue generated through Royalty payments,product license costs in department , research and educational platforms.
6.	Scalability of the Solution	Disintegration of geographical terrains into multiple provinces which canbe interconnectedas a gridto help alleviate its scale.

3.4 PROBLEM SOLUTION FIT

4 .REQUIREMENT ANALYSIS

4.1 Functional Requirement

FR No.	Functional Requirement(Epic)	Sub Requirement (Story / Sub-Task)
FR - 1	User Registration	1. Registering via Google Accounts 2. Registering via Product's own user managementsystem
FR - 2	User Authentication	1. Verification through OTP 2. Verification through EmailLink
FR - 3	Designation of Region	1. Ease of selection of necessary areasto bemonitored

		2. Versatile and Flexible operations on designatedareas
FR - 4	Analysis of Required Phenomenon	1. Simple and easyanalysis on the specificphenomenon to be observed
FR - 5	Accumulation of required Data	1. Fast and Efficient data gathering capabilities regarding pastevent analysis andfuture prediction
FR - 6	Organizing Unstructured data	1. Processing of raw and clustered data into clearandrefined data which is useful for analysis and prediction tasks
FR - 7	Algorithm selection	1. The freedom to choose fromseveral classes ofalgorithm to be used in the process 2. Customization of algorithm to suit the needs of aspecific purpose
FR - 8	Prediction and analysis of data	1. Accurate results of theanalysis provided by theprocess 2. Advanced visualization techniques to help visualizethe processed datafor effective observation
FR - 9	Report generation	1. Restructuring of obtained results into clearanddetailed reportfor future studies

4.2 NON FUNCTIONAL REQUIREMENT

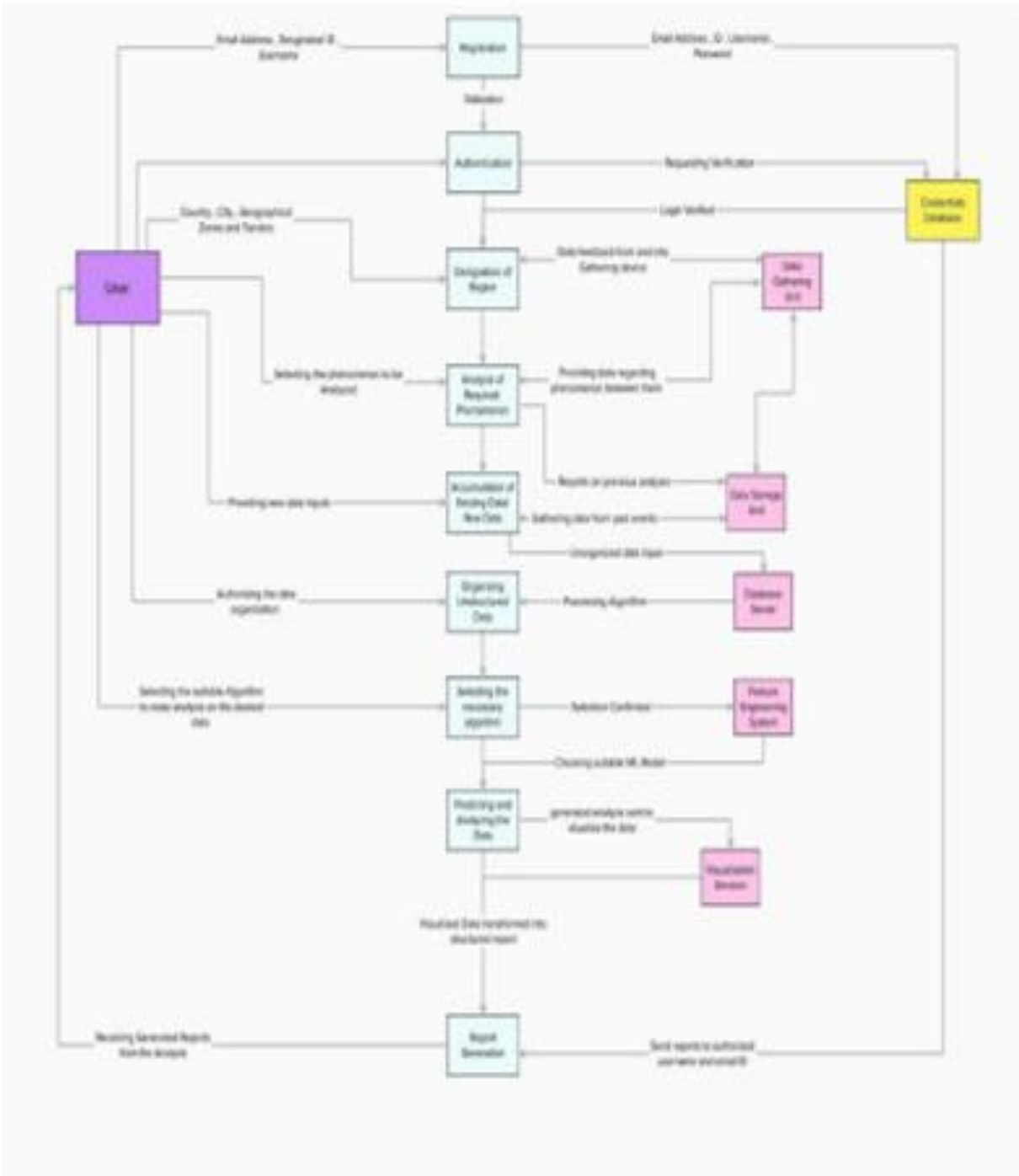
NFR No.	Non-Functional Requirement	Description
NFR - 1	**Usability**	It is well suitedfor fields requiring diverse application of processes with efficiency , precision and ease.
NFR - 2	**Security**	It provides a distinct andsecure encryption layer to the system interface for additional security standards.
NFR - 3	**Reliability**	The product is robust and is capable of execution of processes even in the mostdifficult and unpredictable environments.
NFR - 4	**Performance**	The product boasts a high precision andefficient working capacity which helps in escalating its performance to the highestdegree.

NFR - 5	**Availability**	Despite the complexity and degree of difficulty in its operation, the product is equipped withall-round maintenance andreadily available technical services whichprovides the necessary support any individual requires in their duties.
NFR - 6	Scalability	The product also possess enoughroom for the improvement of its specifications to upgrade its capabilities according to the needs of the userand their organization

5. PROJECT DESIGN

5.1 Data flow diagram

A data flow diagram (DFD) is a traditional visual representation of the information flows within ansystem. 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.


Registration
Validation
Authentication
Requesting Verification
Login Verified
Country, City, Geographical Zones and Farmers
Designation of Region
Data Gathering device
Selecting the phenomenon to be analyzed
Providing data regarding phenomenon between them
Analysis of Required Phenomenon
Reports on previous analysis
Providing new data inputs
Gathering data from past events
Accumulation of Existing Data/ New Data
Unorganized data input
Authorizing the data organization
Processing Algorithm
Organizing Unstructured Data
Selecting the suitable Algorithm to make analysis on the desired data
Selection Confirmed
Selecting the necessary algorithm
Choosing suitable ML Model
generated analysis used to visualize the data
Predicting and displaying the Data
Visualized Data transformed into data/Sumit report
Receiving Generated Reports from the Analysis
Report Generation
Send reports to authorized user/ name and email ID

5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.3 USER STORIES

User Type	Functional Requirement (Epic)	User Story Number (USN)	User Story / Task	Acceptance criteria	Priority	Release
End user (Customer)	Registration	USN - 1	As a user, I am able to register with the product using my valid email address	I should be able to register with my account credentials	High	Sprint - 1
End User (Customer)	Authentication	USN - 2	As a user, I am able to login into the system with my credentials	It should ensure smooth login capabilities without delay	High	Sprint - 1
End User (Customer)	Designation of Region	USN - 3	I can select the region of interest to be monitored and analyzed	I must be able to choose certain specific places without error	High	Sprint - 1
End User (Customer)	Analysis of Required Phenomenon	USN - 4	I am able to monitor certain factors that influence the actions of the phenomenon	It should consider and monitor most of the factors involved in the action	High	Sprint - 2
End User (Customer)	Accumulation of required Data	USN - 5	I am able to gather data regarding past events and a detailed report on past analysis	It should allow the storage of data of past events for certain extent	Medium	Sprint - 2
End User (Customer)	Organizing Unstructured data	USN - 6	I am able to organize and restructure the raw data into refined data	It should ensure easy and efficient processing methods	Low	Sprint - 3
End User (Customer)	Algorithm selection	USN - 7	I am able to choose the required algorithm for a specific analysis	It must provide various options for the algorithm to be used	High	Sprint - 2
End User (Customer)	Prediction and analysis of data	USN - 8	I am able to easily predict and visualize the data	It should allow easy to use prediction and visualization techniques	High	Sprint - 3
End User (Customer)	Report generation	USN - 9	I am able to generate a clear and detailed report on the analysis	Report generation must be fast and efficient and should not be complex	Medium	Sprint - 4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint planning & Estimation / Sprint Delivery Schedule

Sprint	Functional Requirement (EPIC)	User storyNumber	User story / Task	Story points	Priority	Team Members
Sprint-1	Create and configure IBM cloudservices	USN-1	As a user i need to enrol the cloud registration	3	HIGH	R. sarnitha
Sprint-1		USN-2	As a user, I will create IBM cloud account	2	MEDIUM	R. sarnitha
Sprint-1		USN-3	After creating cloud account launch IBM Watson AI platformby accessing cloud account	5	HIGH	P.prabavathi
Sprint-1		USN-4	Create the node in IBM Watson platform	7	HIGH	P.prabavathi
Sprint-1		USN-5	After creating node get device type and id	1	LOW	R.sarnitha
Sprint-1		USN-6	Simulate the node created	3	MEDIUM	P.prabavathi
Sprint-2	Create and access node-red	USN-7	As a user,I can create deep learning by appdeployment	5	HIGH	R.sarnitha
Sprint-2		USN-8	Connect IBM Watsonwith deep learning through API key	2	LOW	P.prabavathi
Sprint-2		USN-9	Design the project flow using deep learning	7	HIGH	P.prabavathi
Sprint-2		USN-10	Check for the proper connections and the outputin the node redapplication	3	MEDIUM	R.sarnitha

Sprint-3	Create a database inCloudant DB	USN-11	Launch the cloudant DB and create database to storethe location data	4	HIGH	R.sarnitha
Sprint-3	Devalop the Pythonscript	USN-12	Install the python software	2	LOW	P.prabavathi

Sprint-3		USN-13	Develop the python flask to publish details to IBM AI platform	6	HIGH	P.prabavathi
Sprint-3		USN-14	Integrate the device ID , authentication tokenin python flask	2	LOW	R.sarnitha
Sprint-3		USN-15	Develop the python code for publishing the location (latitude & longitude) to IBM AI platform	8	HIGH	R.sarnitha
Sprint-4	Create the Web application using node Red	USN-16	Develop the web applicationusing deeplearning	5	HIGH	P.prabavathi
Sprint-4		USN-17	Connect the IBM AI platform and get the location and store the datain the cloudant	2	MEDIUM	R.sarnitha
Sprint-4		USN-18	Create the multilayed deep convolution nural network mode lthat tells the intensity ofdisaster and google map to check if thechild is inside or outside the	8	HIGH	P.prabavathi
Sprint-4		USN-19	Integrate the type of disaster isidentified and show cased on the open cv window Google map to checkif the child is inside or outside the	11	HIGH	B.Subasri
Sprint-4		USN-20	Send the notification is the webcam to	4	HIGH	R.renug aDevi

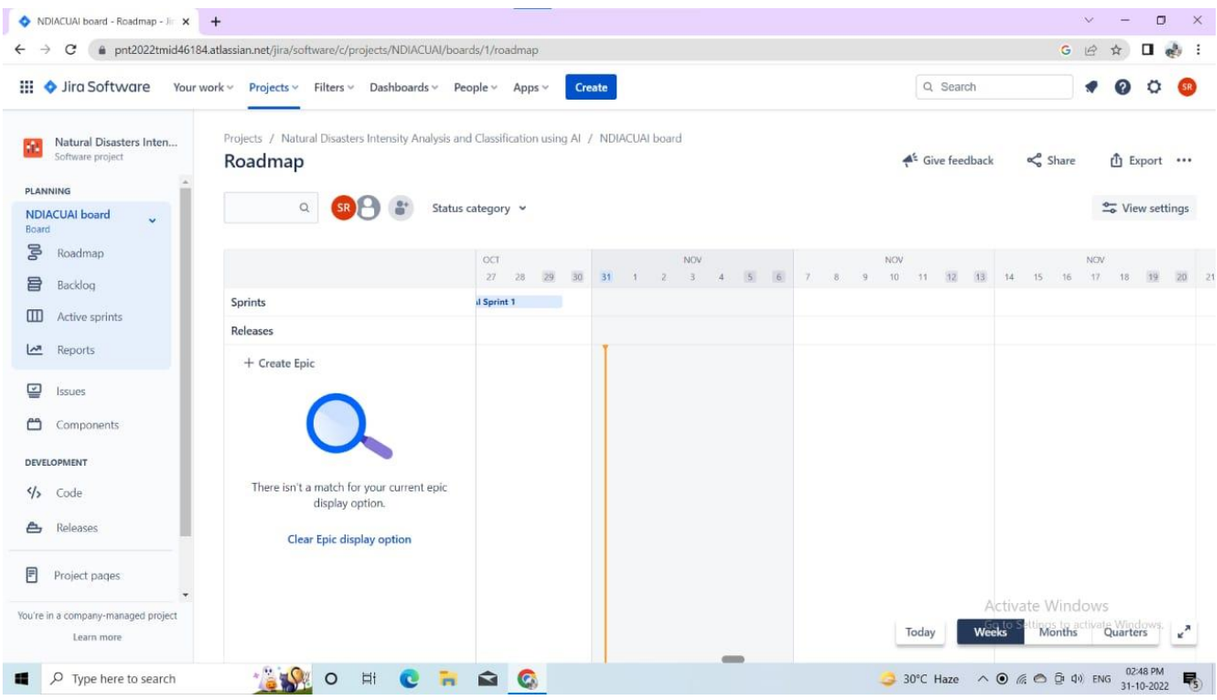
			capture the vedio frame			

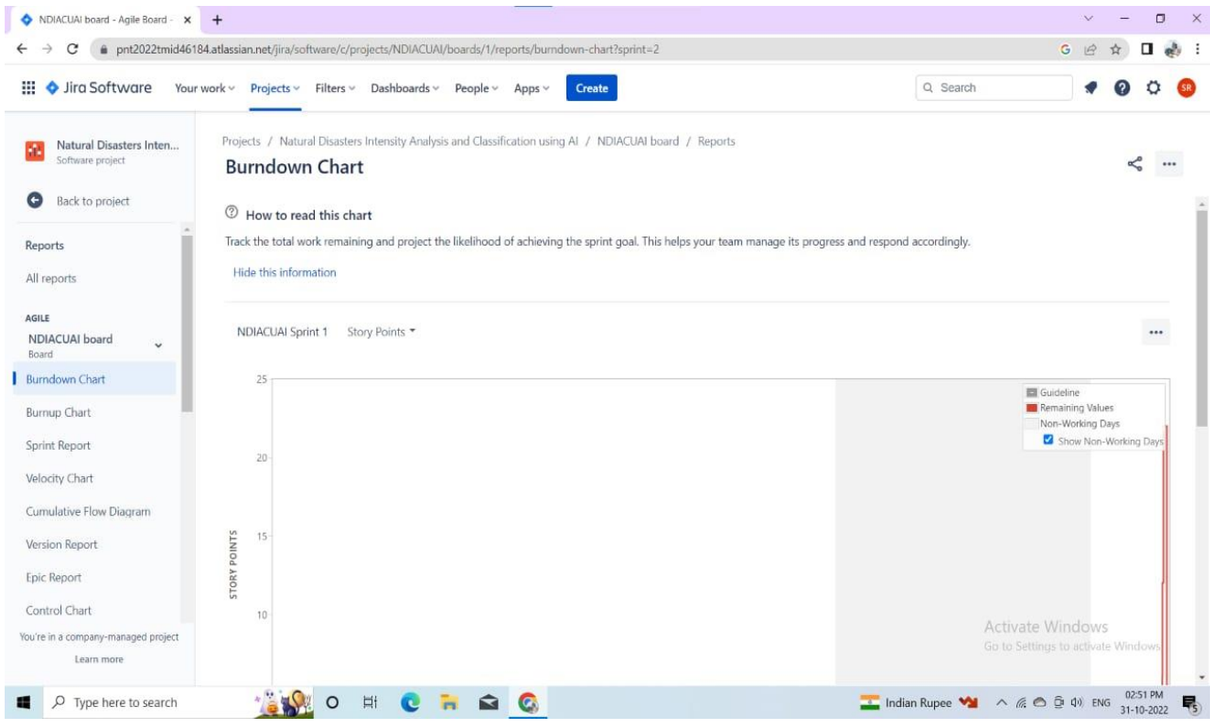
Project tracker, Velocity& Burndown Chart:(4 Marks)

Sprint	Total storypoints	Duration	Sprint startdate	Sprint End Date(planned)	Story pointcompleted(as planned End date)	Sprint ReleaseDate (Actual)
Sprint-1	21	6 Days	24 Oct 2022	29 Oct 2022	21	29 Oct 2022
Sprint-2	17	6 Days	31 Oct 2022	05 Nov 2022	17	05 Nov 2022
Sprint-3	22	6 Days	07 Nov 2022	14 Nov 2022	22	12 Nov 2022
Sprint-4	30	6 Days	14 Nov 2022	19 Nov 2022	30	19 Nov 2022

6.3 Reports From JIRA

SPRINT 1

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Jira Software
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Back to project
Reports
All reports
AGILE
NDIACUAI board
Board
Burndown Chart
Burnup Chart
Sprint Report
Velocity Chart
Cumulative Flow Diagram
Version Report
Epic Report
Control Chart
You're in a company-managed project
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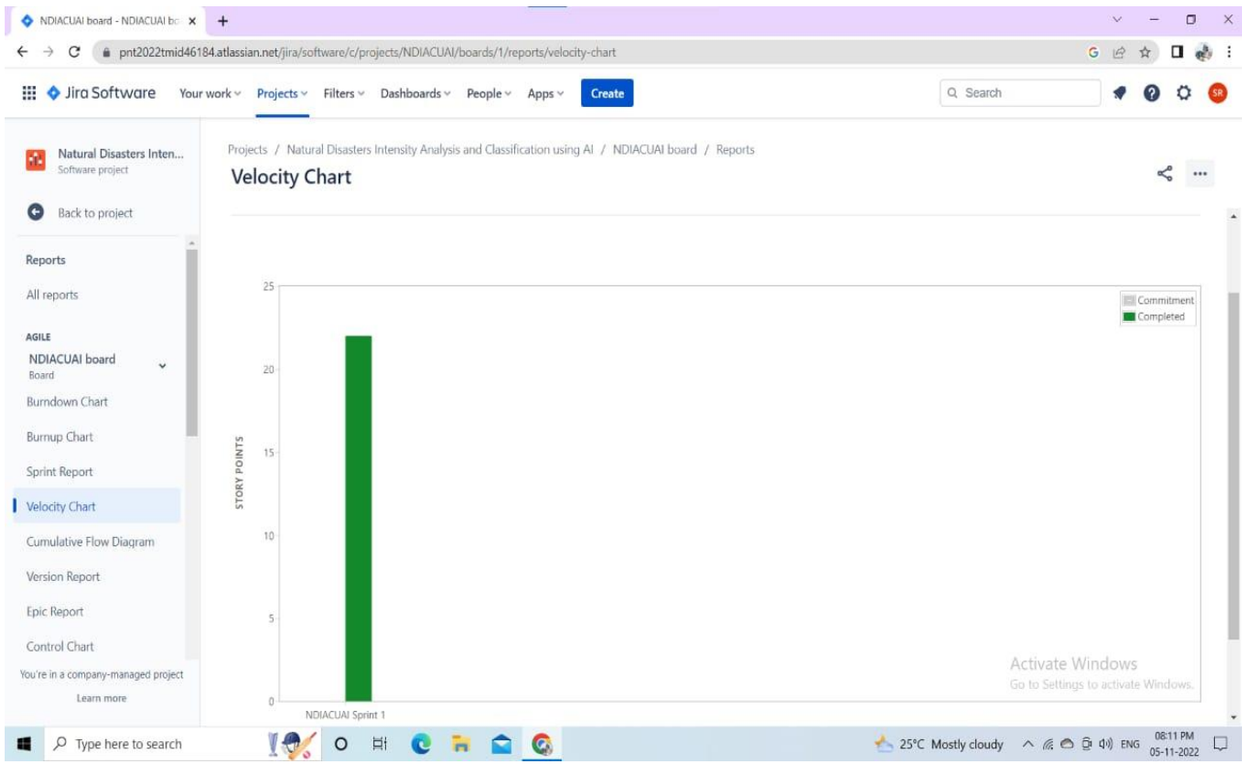
Projects / Natural Disasters Intensity Analysis and Classification using AI / NDIACUAI board / Reports
Burndown Chart
How to read this chart
Track the total work remaining and project the likelihood of achieving the sprint goal. This helps your team manage its progress and respond accordingly.
Hide this information
NDIACUAI Sprint 1
Story Points
STORY POINTS
25
20
15
10
Guideline
Remaining Values
Non-Working Days
Show Non-Working Days
Activate Windows
Go to Settings to activate Windows.
Type here to search
Indian Rupee
ENG
02:51 PM
31-10-2022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Epic Report
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Velocity Chart
STORY POINTS
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NDIACUAI Sprint 1
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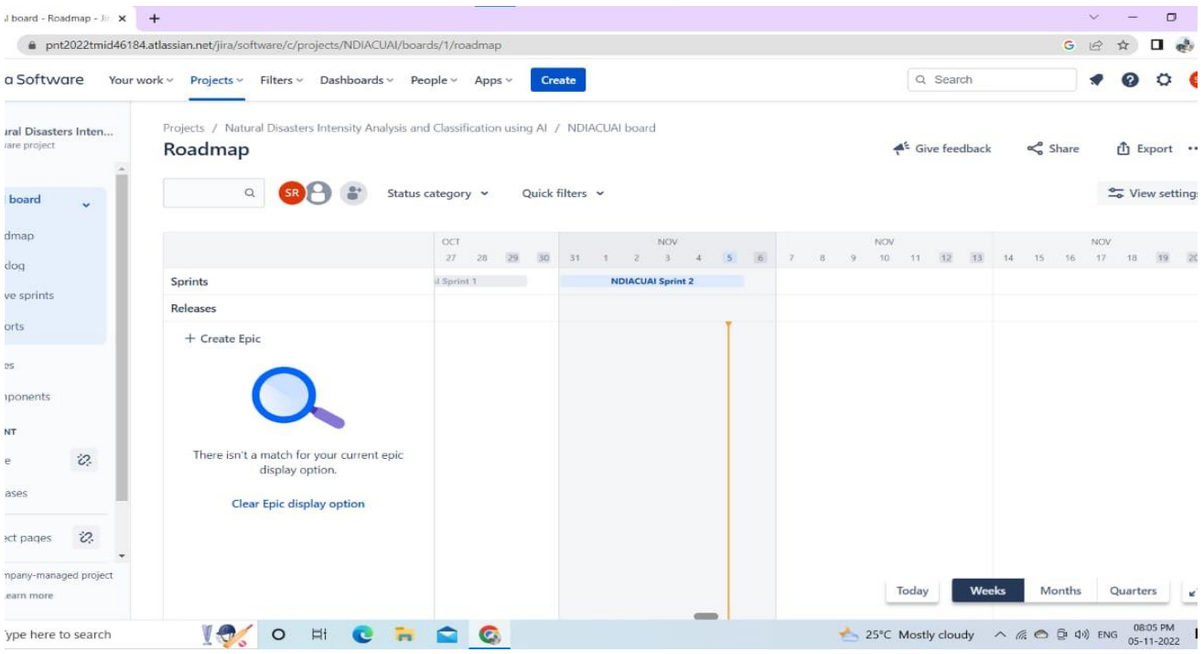
Sprint 2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Roadmap
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Quick filters
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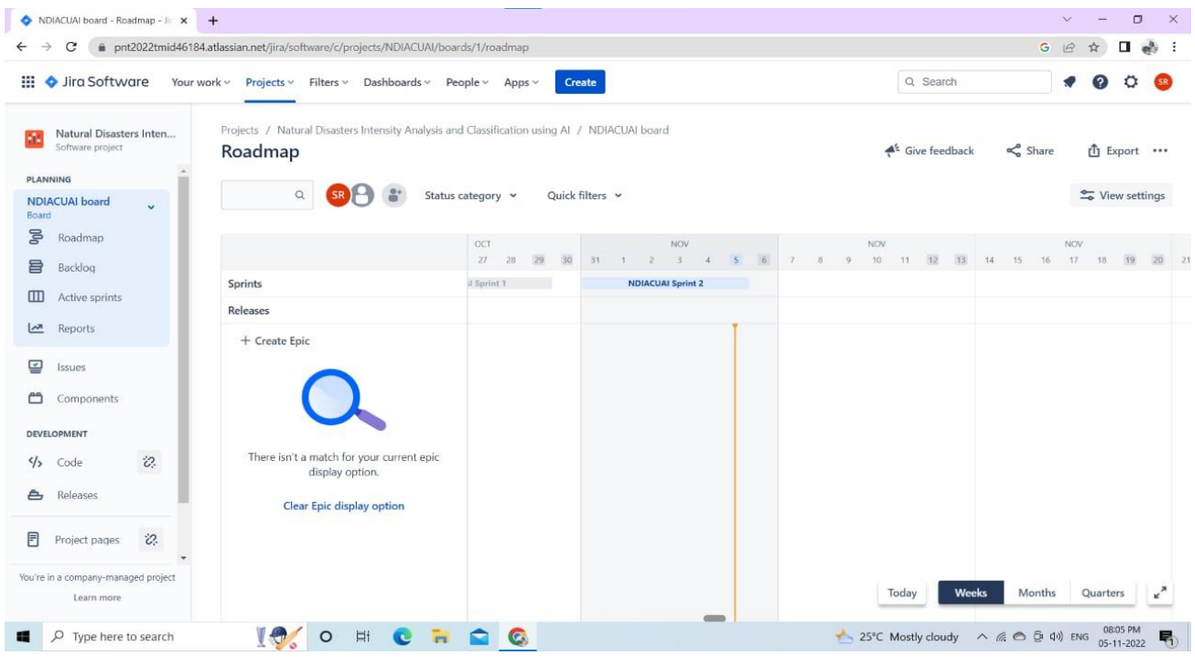
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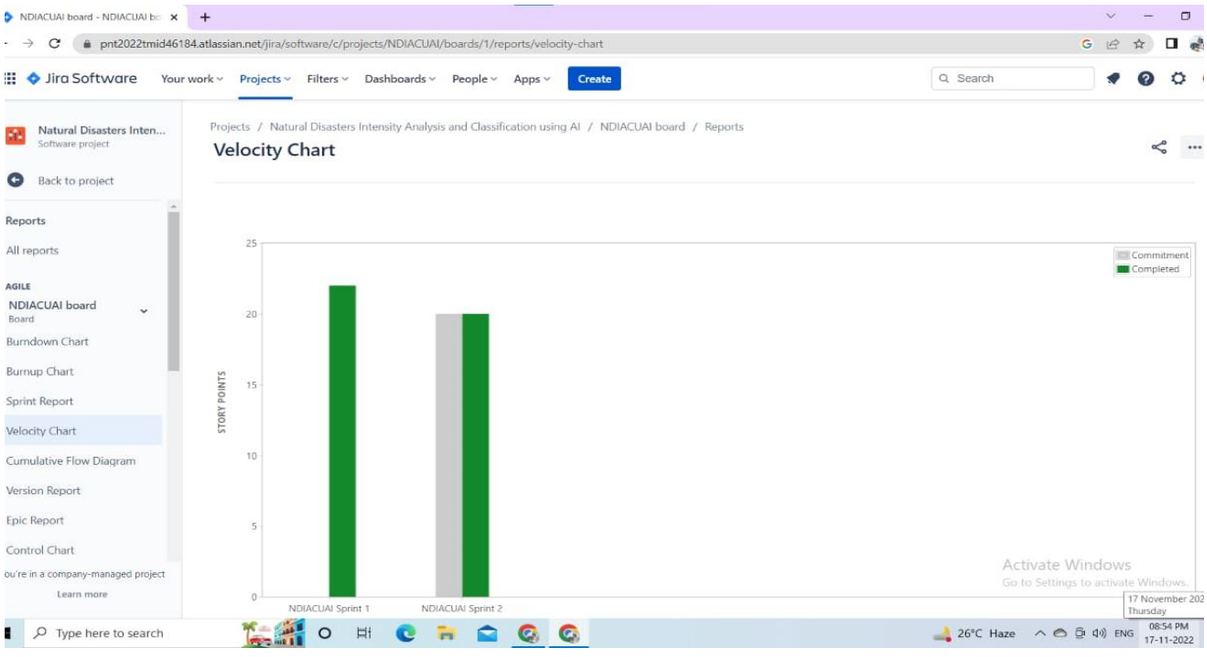
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Velocity Chart
STORY POINTS
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Commitment
Completed
NDIACUAI Sprint 1
NDIACUAI Sprint 2
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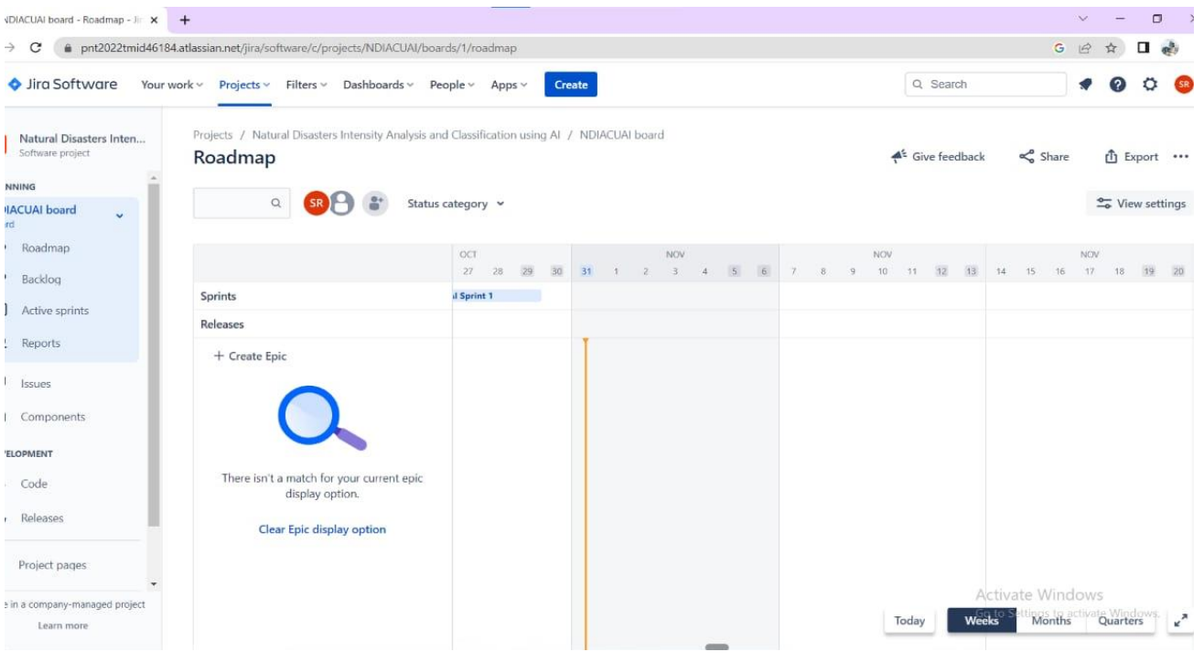
17-11-2022

SPRINT 3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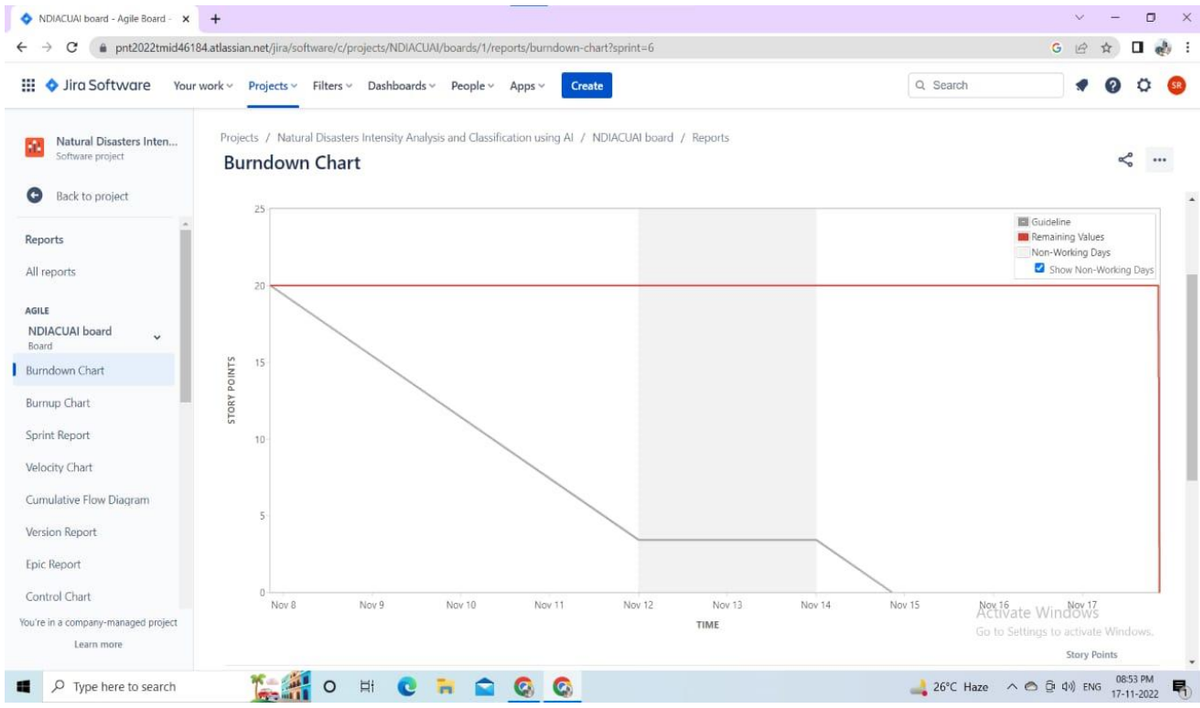
Activate Windows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Show Non-Working Days
STORY POINTS
TIME
Story Points
Activate Windows
Type here to search
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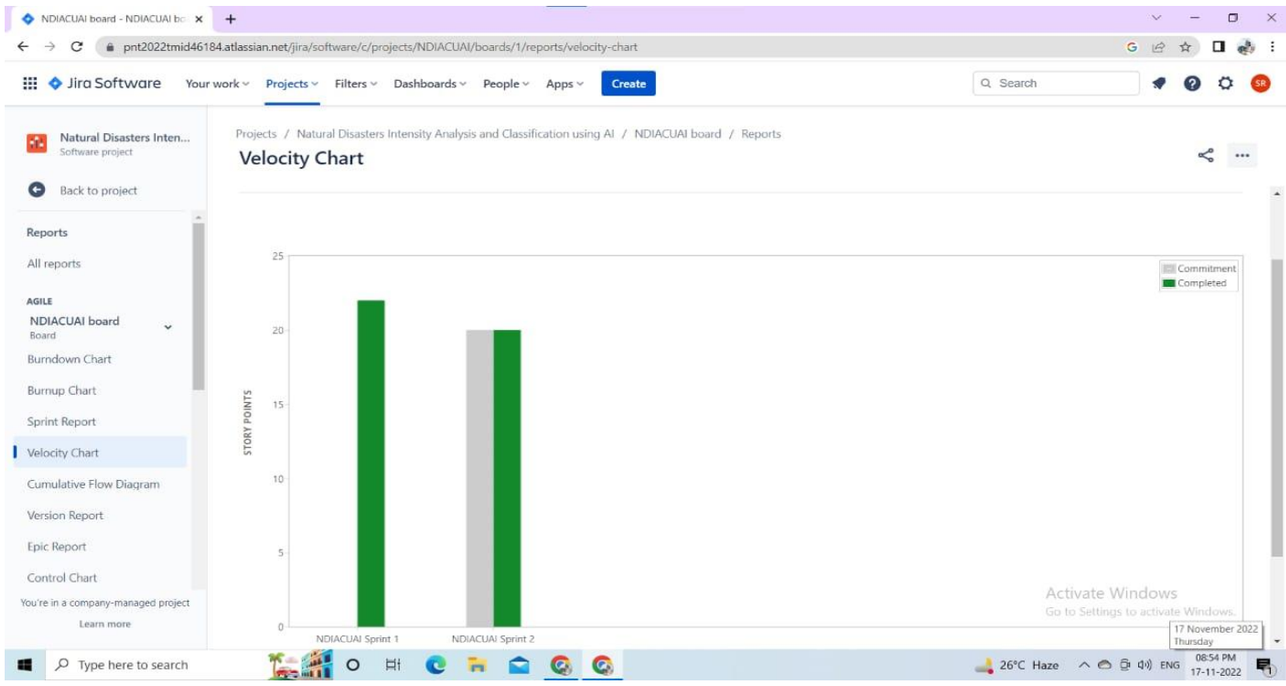
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Burndown Chart
Burnup Chart
Sprint Report
Velocity Chart
Cumulative Flow Diagram
Version Report
Epic Report
Control Chart
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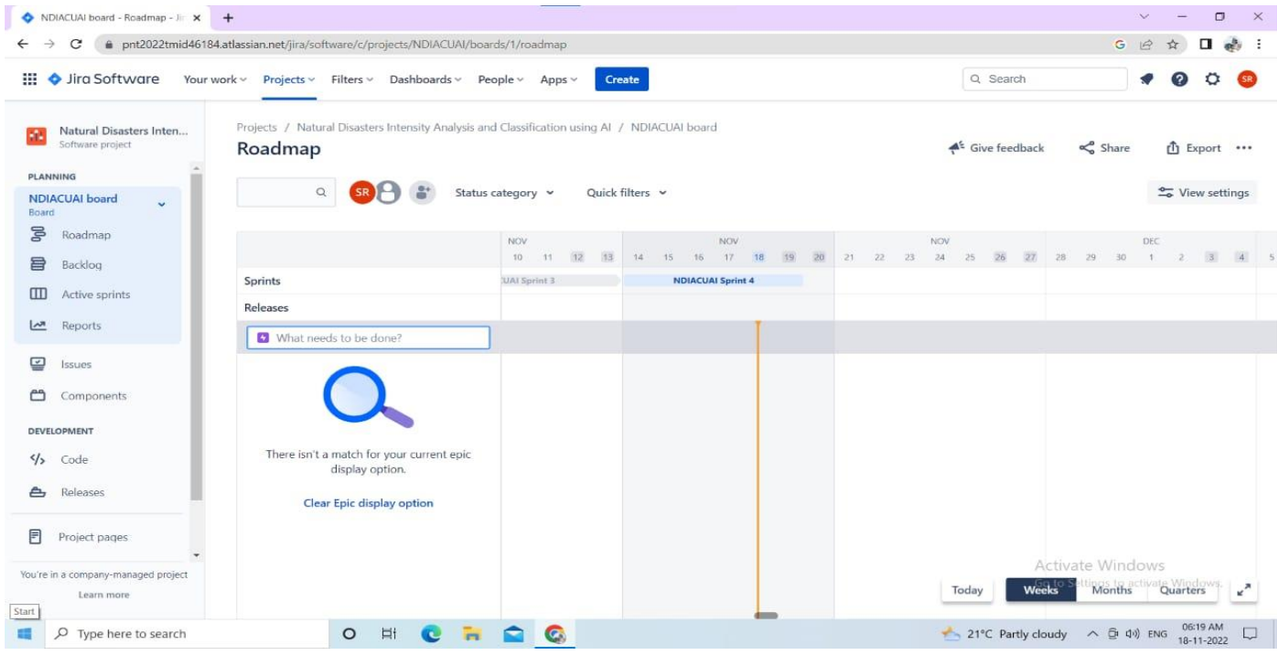
Learn more
Projects / Natural Disasters Intensity Analysis and Classification using AI / NDIACUAI board / Reports
Velocity Chart
STORY POINTS
25
20
15
10
5
0
Commitment
Completed
NDIACUAI Sprint 1
NDIACUAI Sprint 2
Activate Windows
Go to Settings to activate Windows.
17 November 2022
Thursday
Type here to search
26°C Haze
ENG
08:54 PM
17-11-2022

SPRINT 4


NDIACUAI board - Roadmap -
pnt2022tmid46184.atlassian.net/jira/software/c/projects/NDIACUAI/boards/1/roadmap
Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
Natural Disasters Inten...
Software project
PLANNING
NDIACUAI board
Board
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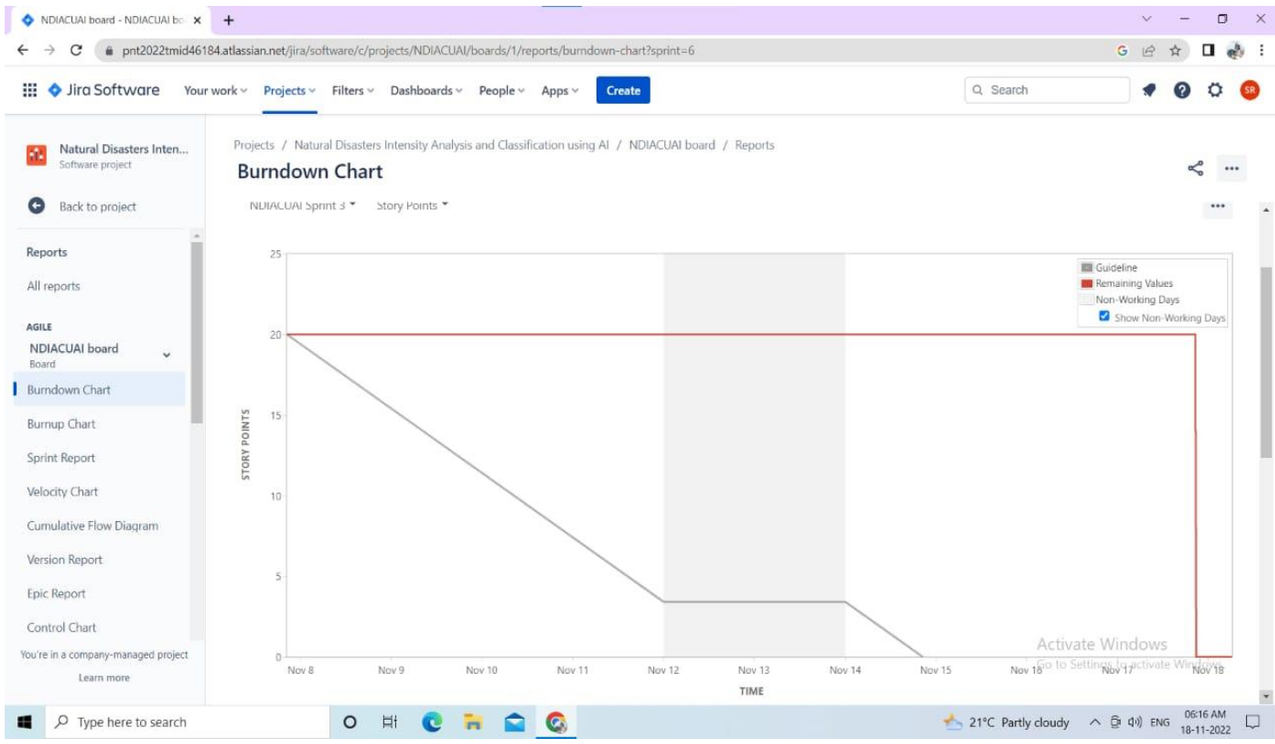
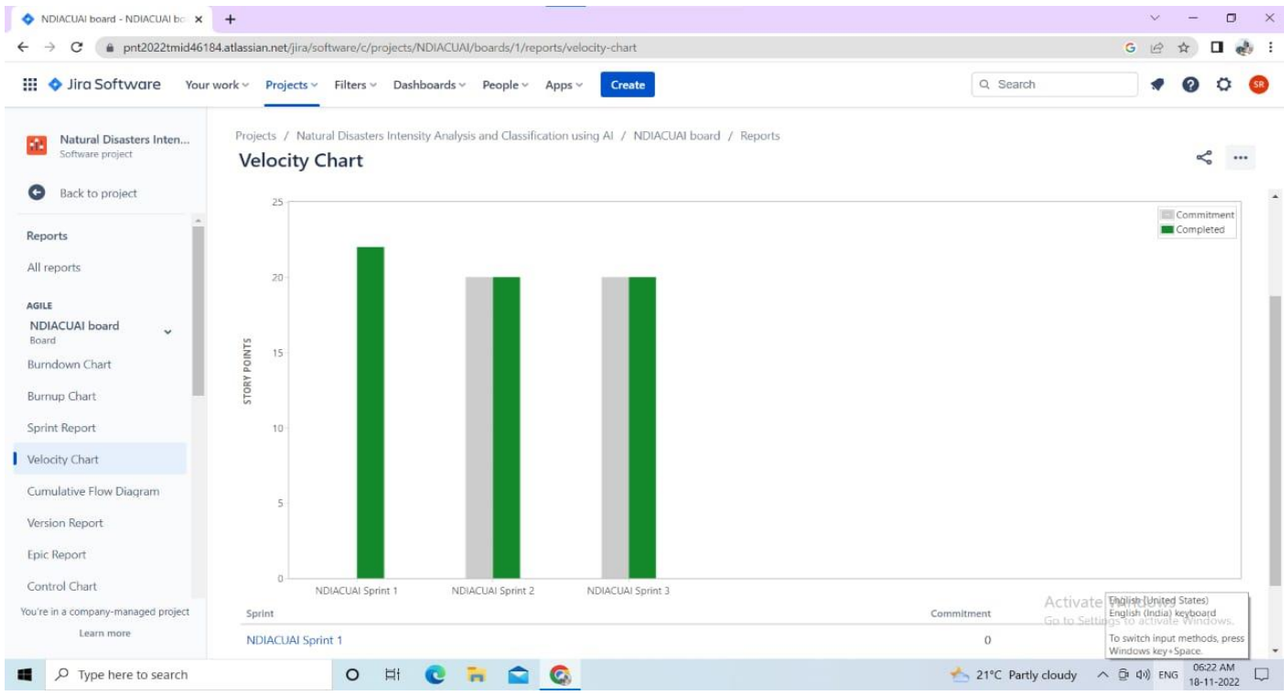
Status category
Quick filters
View settings
NOV
DEC
Sprints
NDIACUAI Sprint 4
Releases
What needs to be done?
There isn't a match for your current epic display option.
Clear Epic display option
Today
Weeks
Months
Quarters
Activate Windows
Start
Type here to search
21°C Partly cloudy
ENG
06:19 AM
18-11-2022

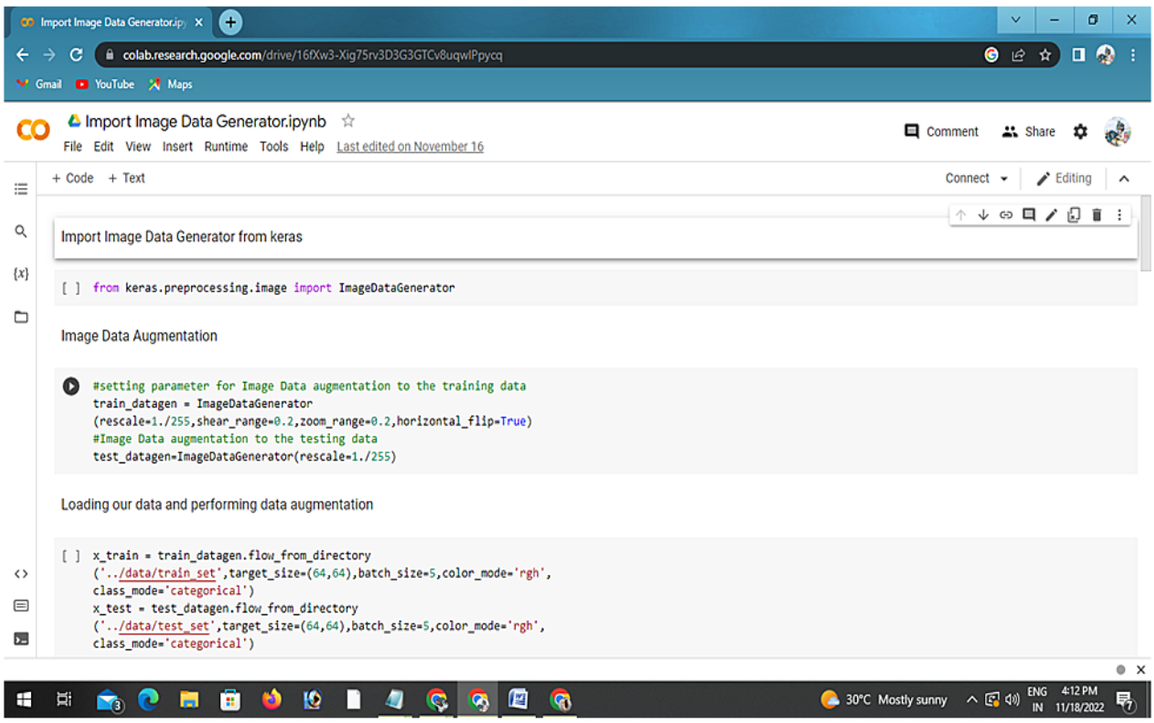


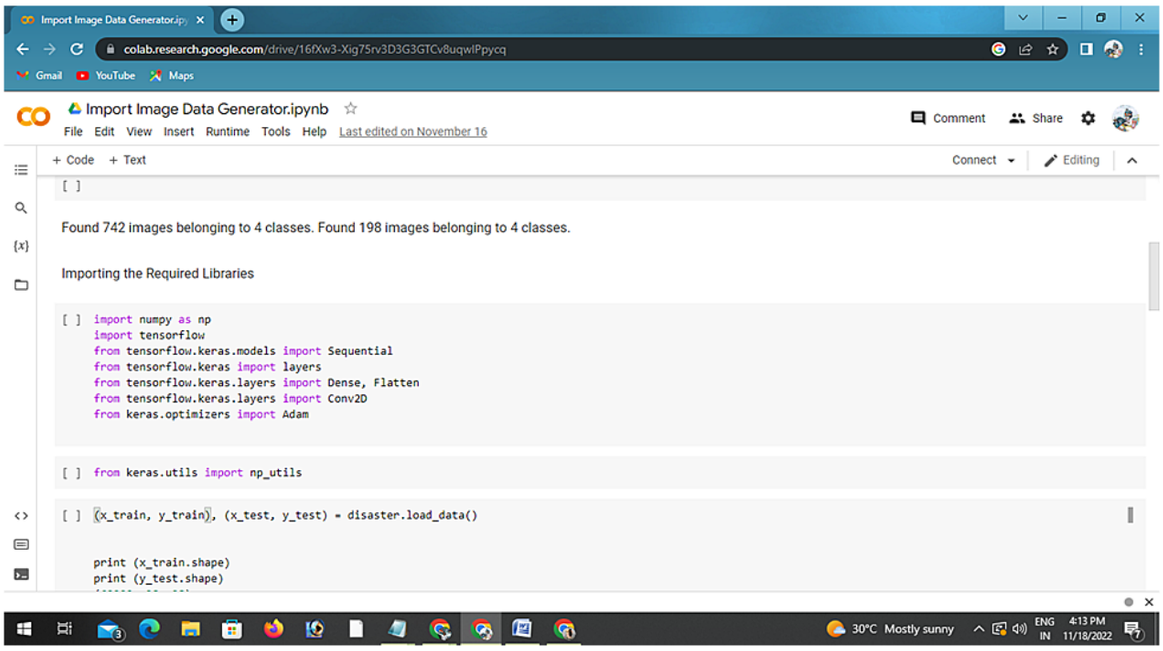


7. CODING & SOLUTIONNING (Explain the features added in the project along with code)

7.1 feature

1.Fundamental techniques CNN


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq
Gmail
YouTube
Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
Comment
Share
+ Code + Text
Connect
Editing
Import Image Data Generator from keras
[ ] from keras.preprocessing.image import ImageDataGenerator
Image Data Augmentation
#setting parameter for Image Data augmentation to the training data
train_datagen = ImageDataGenerator
(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
#Image Data augmentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)
Loading our data and performing data augmentation
[ ] x_train = train_datagen.flow_from_directory
('../data/train_set',target_size=(64,64),batch_size=5,color_mode='rgh',
class_mode='categorical')
x_test = test_datagen.flow_from_directory
('../data/test_set',target_size=(64,64),batch_size=5,color_mode='rgh',
class_mode='categorical')
30°C Mostly sunny
ENG IN
4:12 PM
11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq
Gmail
YouTube
Maps
Import Image Data Generator.ipynb
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Comment
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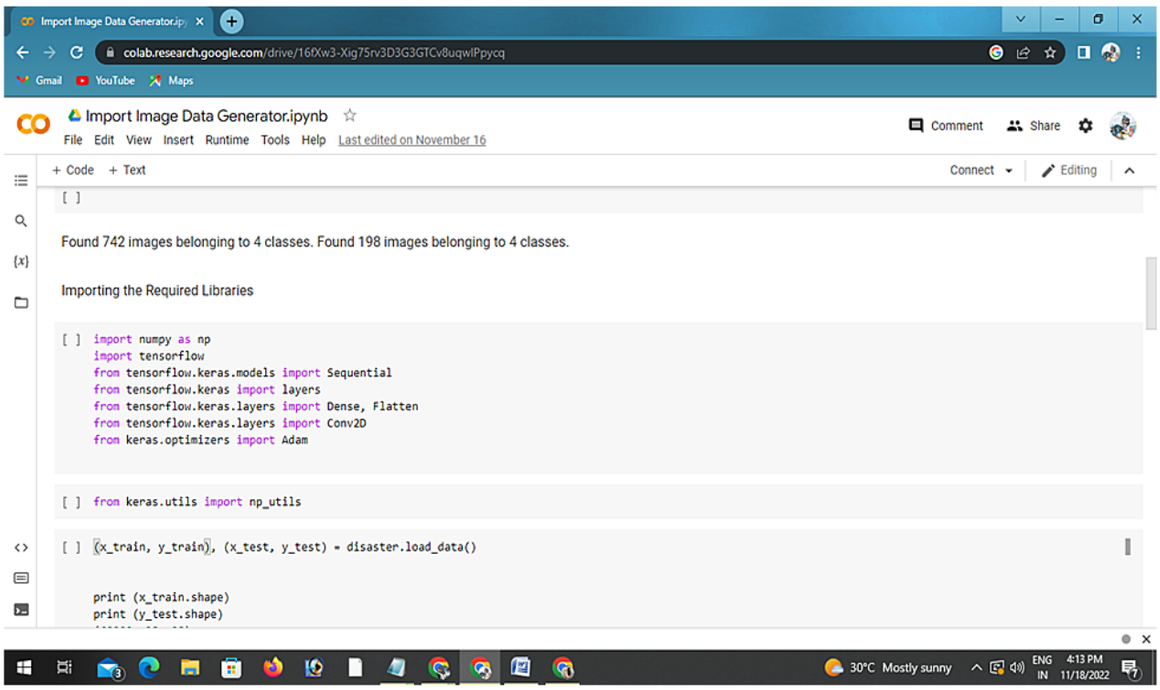
Editing
[ ]
Found 742 images belonging to 4 classes. Found 198 images belonging to 4 classes.
Importing the Required Libraries
[ ] import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.layers import Conv2D
from keras.optimizers import Adam
[ ] from keras.utils import np_utils
[ ] (x_train, y_train), (x_test, y_test) = disaster.load_data()
print (x_train.shape)
print (y_test.shape)
30°C Mostly sunny
ENG IN
4:13 PM
11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq
Gmail YouTube Maps
Import Image Data Generator.ipynb
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[ ]
Found 742 images belonging to 4 classes. Found 198 images belonging to 4 classes.
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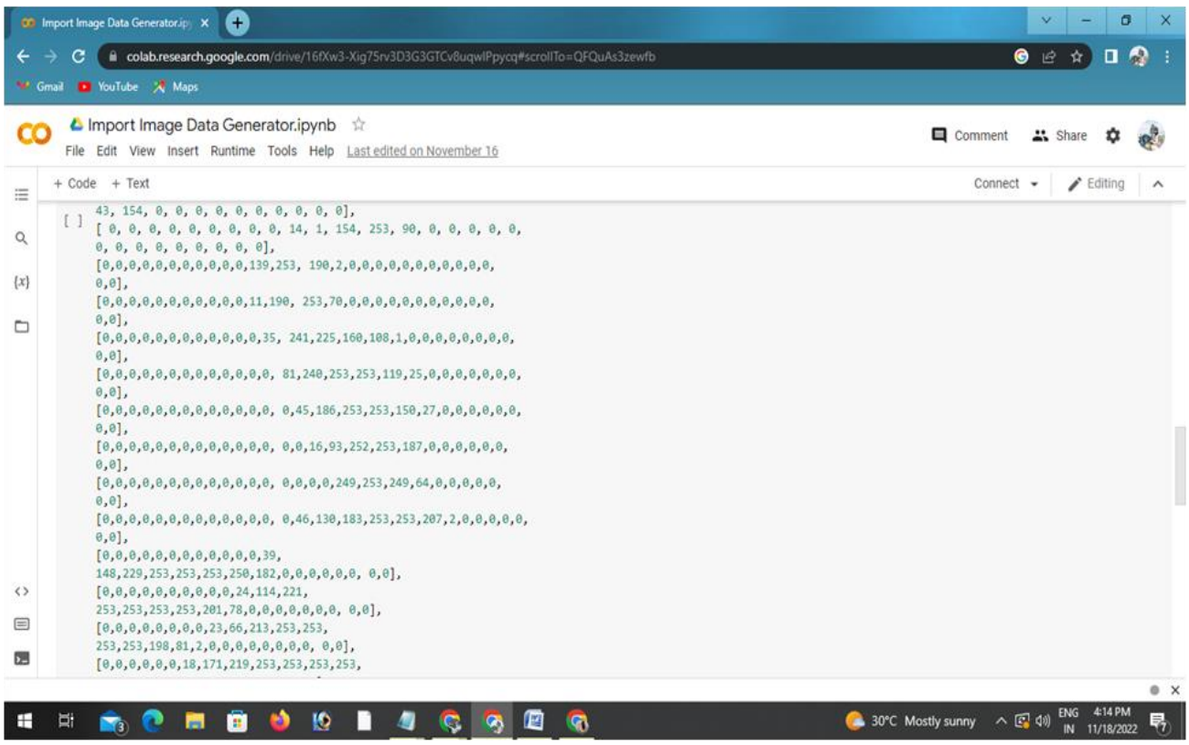
[ ] import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.layers import Conv2D
from keras.optimizers import Adam
[ ] from keras.utils import np_utils
[ ] (x_train, y_train), (x_test, y_test) = disaster.load_data()
print (x_train.shape)
print (y_test.shape)
30°C Mostly sunny
ENG IN 4:13 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq#scrollTo=QFQuAs3zewfb
Gmail YouTube Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
Comment Share
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Connect Editing
[ ] 43, 154, 0, 0, 0, 0, 0, 0, 0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 14, 1, 154, 253, 90, 0, 0, 0, 0, 0,
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0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,11,190, 253,70,0,0,0,0,0,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0,0,35, 241,225,160,108,1,0,0,0,0,0,0,0,
0,0],
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0,0],
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0,0],
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0,0],
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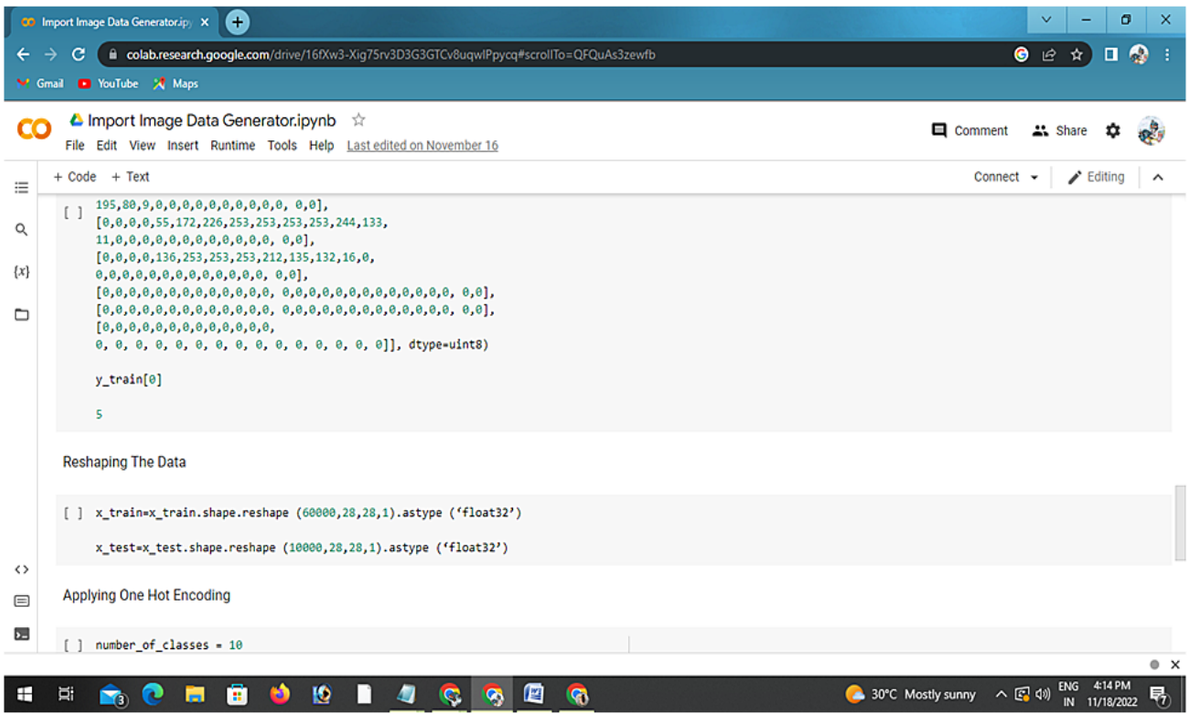
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0,46,130,183,253,253,207,2,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0,0,39,
148,229,253,253,253,250,182,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,24,114,221,
253,253,253,253,201,78,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,0,0,23,66,213,253,253,
253,253,198,81,2,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,18,171,219,253,253,253,253,
30°C Mostly sunny
ENG IN 4:14 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwIPpycq#scrollTo=QFQuAs3zewfb
Gmail YouTube Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
Comment Share
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Connect Editing
[ ] 195,80,9,0,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,55,172,226,253,253,253,253,244,133,
11,0,0,0,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,136,253,253,253,212,135,132,16,0,
0,0,0,0,0,0,0,0,0,0,0,0, 0,0],
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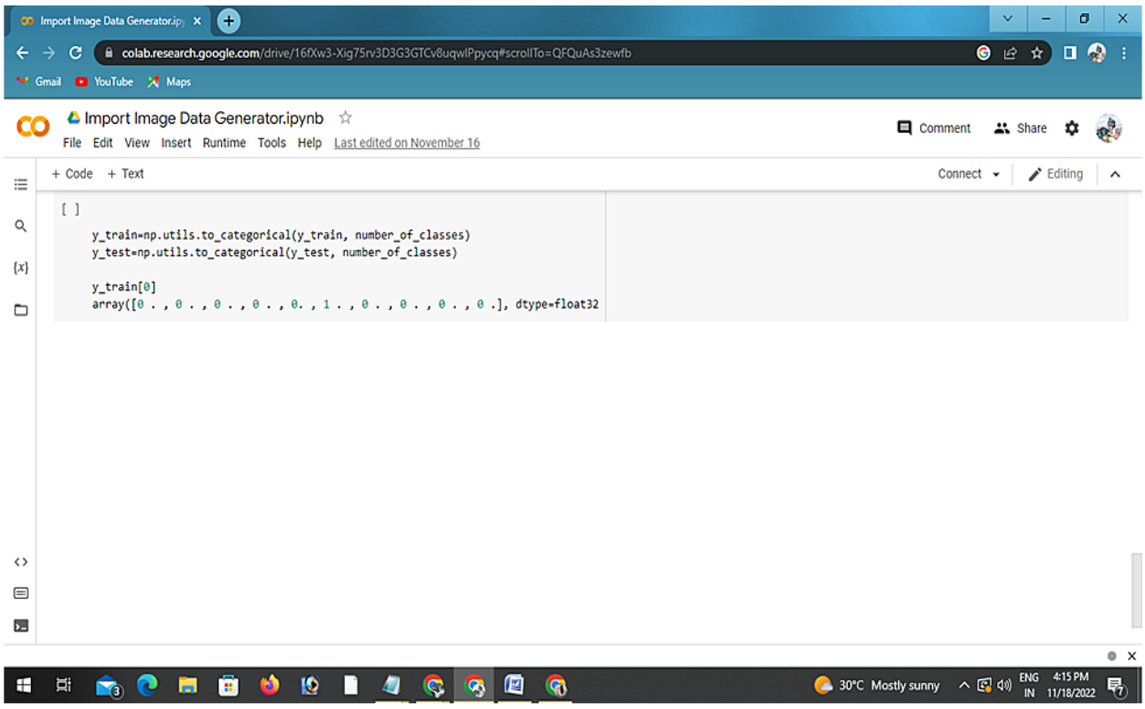
[0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]], dtype=uint8)
y_train[0]
5
Reshaping The Data
[ ] x_train=x_train.shape.reshape (60000,28,28,1).astype ('float32')
x_test=x_test.shape.reshape (10000,28,28,1).astype ('float32')
Applying One Hot Encoding
[ ] number_of_classes = 10
30°C Mostly sunny
ENG IN 4:14 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwIPpycq#scrollTo=QFQuAs3zewfb
Gmail YouTube Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
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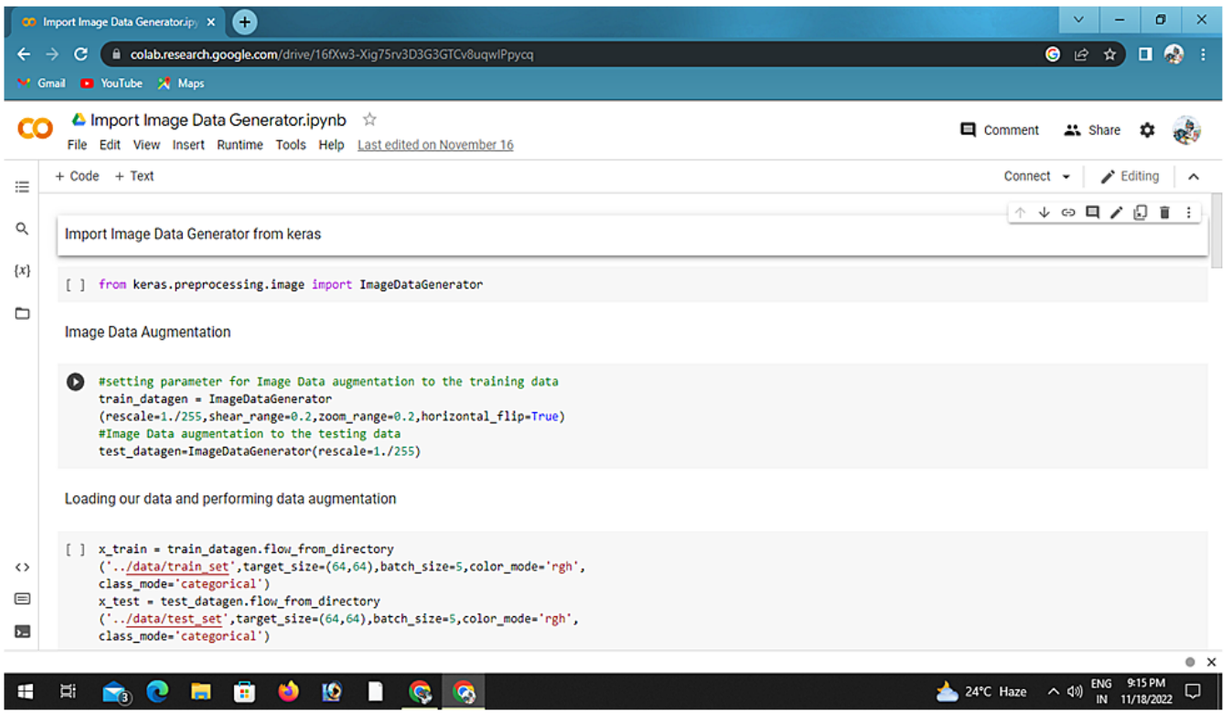
Connect Editing
[ ]
y_train=np.utils.to_categorical(y_train, number_of_classes)
y_test=np.utils.to_categorical(y_test, number_of_classes)
y_train[0]
array([0 . , 0 . , 0 . , 0 . , 0. , 1 . , 0 . , 0 . , 0 . , 0 .], dtype=float32
30°C Mostly sunny
ENG IN 4:15 PM 11/18/2022

7.2 Feature 2


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq
Gmail YouTube Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
Comment Share
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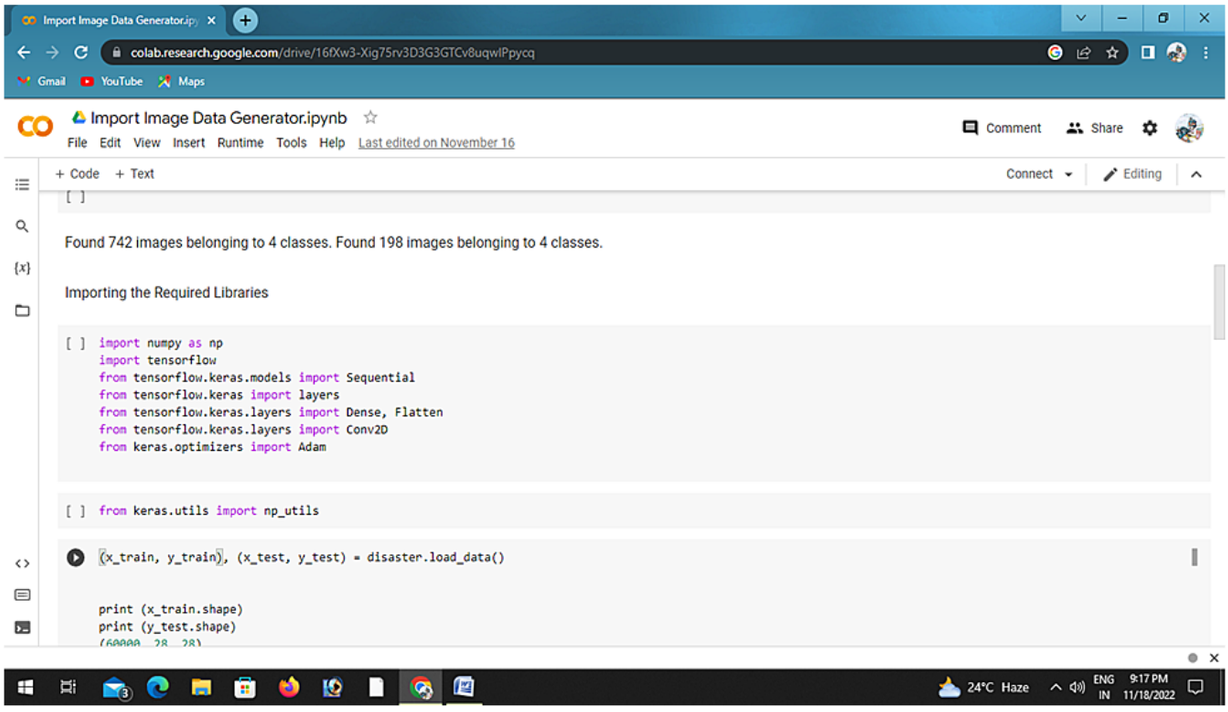
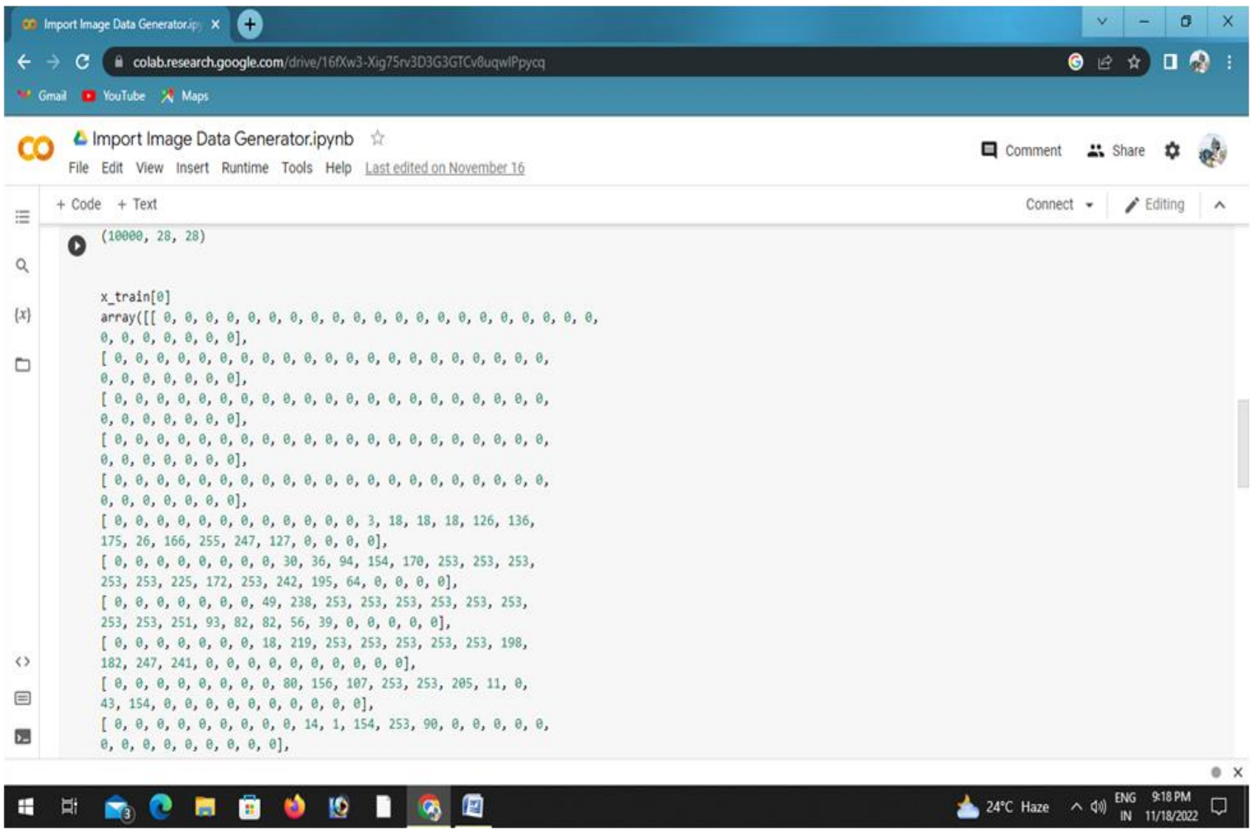
Connect Editing
Import Image Data Generator from keras
[ ] from keras.preprocessing.image import ImageDataGenerator
Image Data Augmentation
#setting parameter for Image Data augmentation to the training data
train_datagen = ImageDataGenerator
(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
#Image Data augmentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)
Loading our data and performing data augmentation
[ ] x_train = train_datagen.flow_from_directory
('../data/train_set',target_size=(64,64),batch_size=5,color_mode='rgh',
class_mode='categorical')
x_test = test_datagen.flow_from_directory
('../data/test_set',target_size=(64,64),batch_size=5,color_mode='rgh',
class_mode='categorical')
24°C Haze
ENG IN
9:15 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwlPpycq
Gmail YouTube Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
Comment Share
+ Code + Text
Connect Editing
[ ]
Found 742 images belonging to 4 classes. Found 198 images belonging to 4 classes.
Importing the Required Libraries
[ ] import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from tensorflow.keras.layers import Dense, Flatten
from tensorflow.keras.layers import Conv2D
from keras.optimizers import Adam
[ ] from keras.utils import np_utils
(x_train, y_train), (x_test, y_test) = disaster.load_data()
print (x_train.shape)
print (y_test.shape)
24°C Haze
ENG IN
9:17 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwIPpycq
Gmail
YouTube
Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
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(10000, 28, 28)
x_train[0]
array([[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
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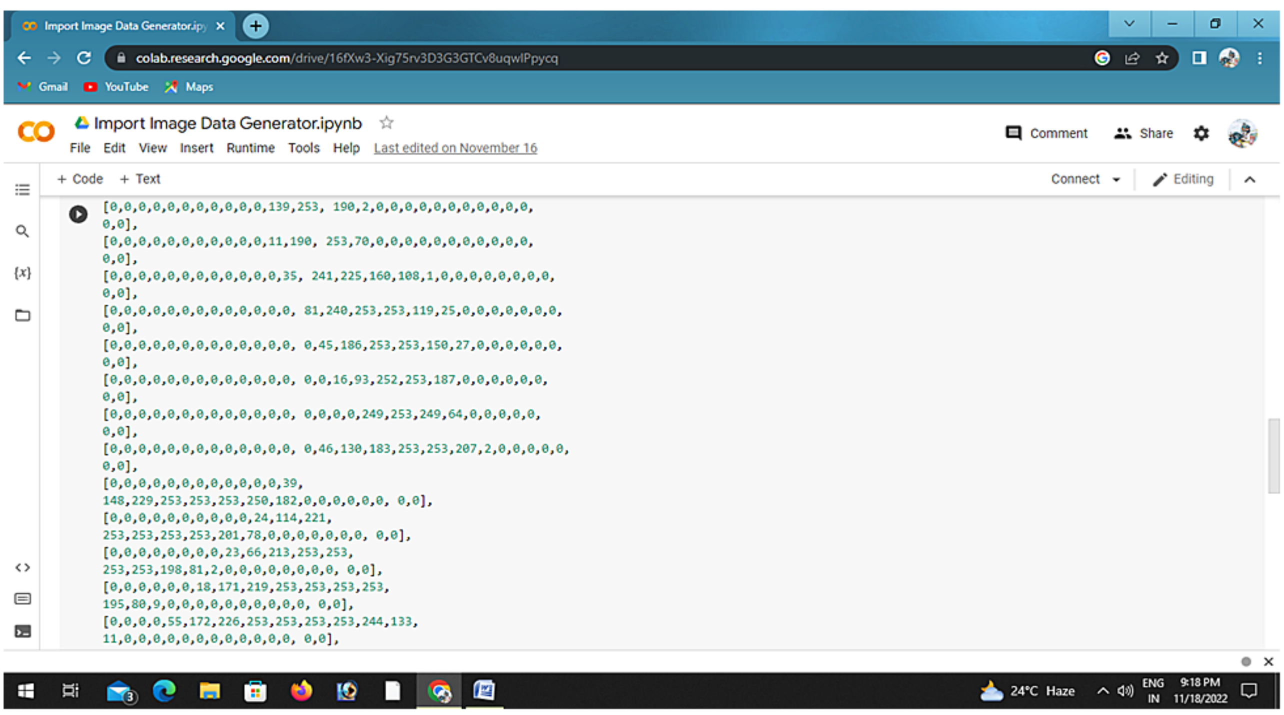
[0, 0, 0, 0, 0, 0, 0, 0, 80, 156, 107, 253, 253, 205, 11, 0,
43, 154, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 14, 1, 154, 253, 90, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0],
24°C Haze
ENG IN
9:18 PM 11/18/2022


Import Image Data Generator.ipynb
colab.research.google.com/drive/16fXw3-Xig75rv3D3G3GTCv8uqwIPpycq
Gmail
YouTube
Maps
Import Image Data Generator.ipynb
File Edit View Insert Runtime Tools Help Last edited on November 16
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[0,0,0,0,0,0,0,0,0,0,0,139,253, 190,2,0,0,0,0,0,0,0,0,0,0,0,
0,0],
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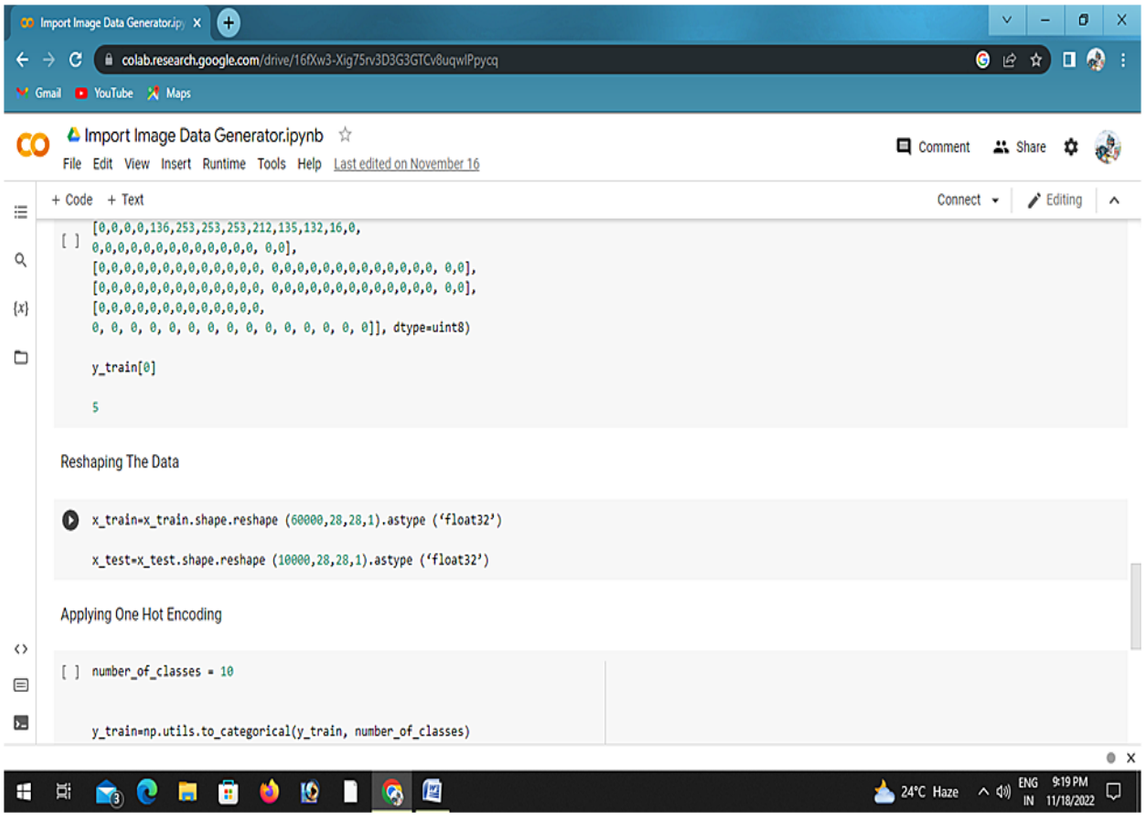
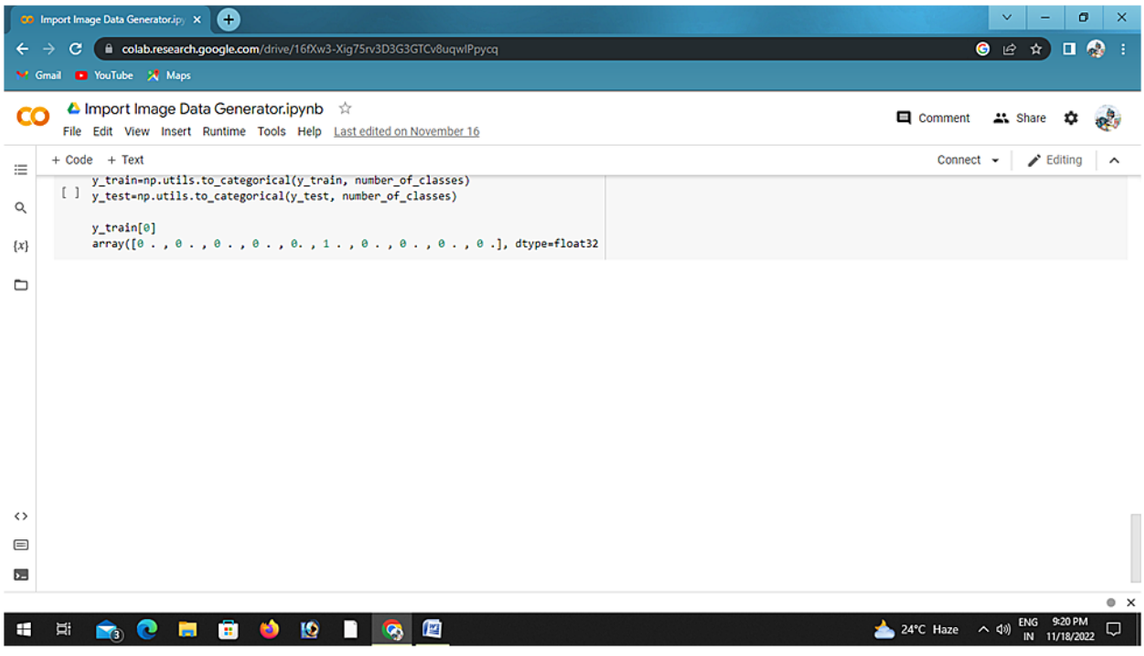
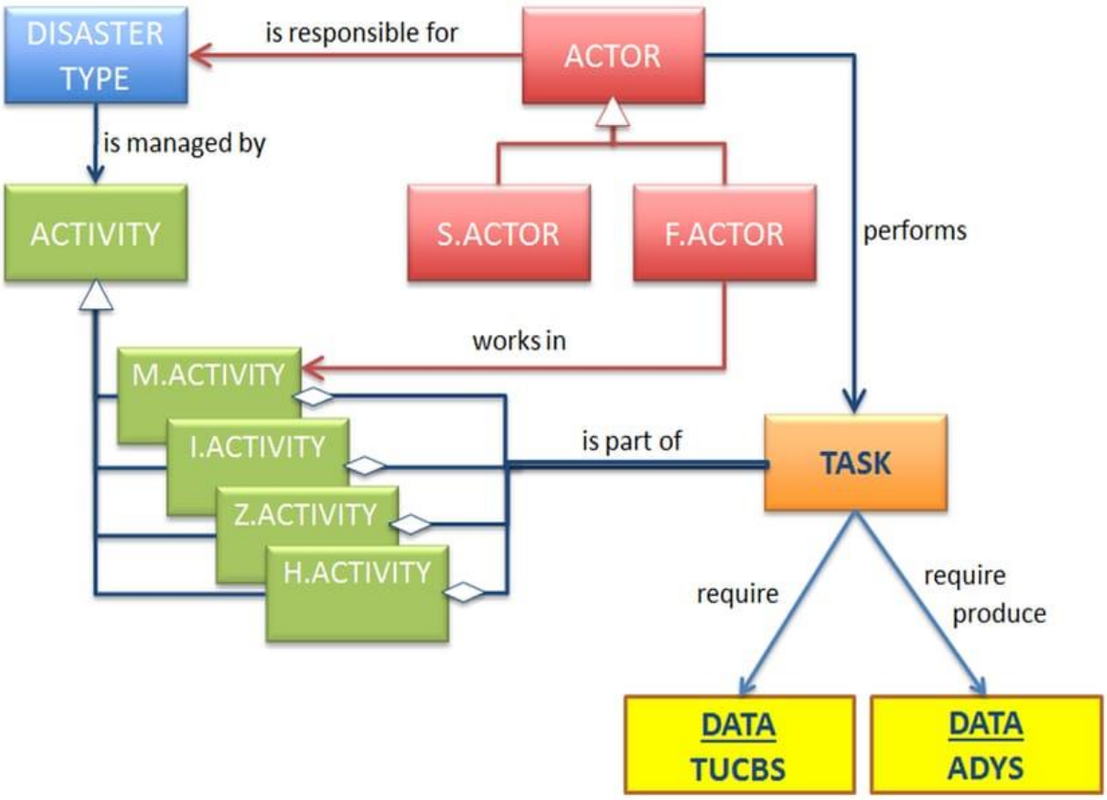
[0,0,0,0,0,0,0,0,0,0,0,0,35, 241,225,160,108,1,0,0,0,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0, 81,240,253,253,119,25,0,0,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0, 0,45,186,253,253,150,27,0,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,16,93,252,253,187,0,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0, 0,0,0,0,249,253,249,64,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,0, 0,46,130,183,253,253,207,2,0,0,0,0,0,
0,0],
[0,0,0,0,0,0,0,0,0,0,0,0,39,
148,229,253,253,253,250,182,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,0,0,0,24,114,221,
253,253,253,253,201,78,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,0,0,23,66,213,253,253,
253,253,198,81,2,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,0,0,18,171,219,253,253,253,253,
195,80,9,0,0,0,0,0,0,0,0,0,0, 0,0],
[0,0,0,0,55,172,226,253,253,253,253,244,133,
11,0,0,0,0,0,0,0,0,0,0,0,0, 0,0],
24°C Haze
ENG IN
9:18 PM 11/18/2022

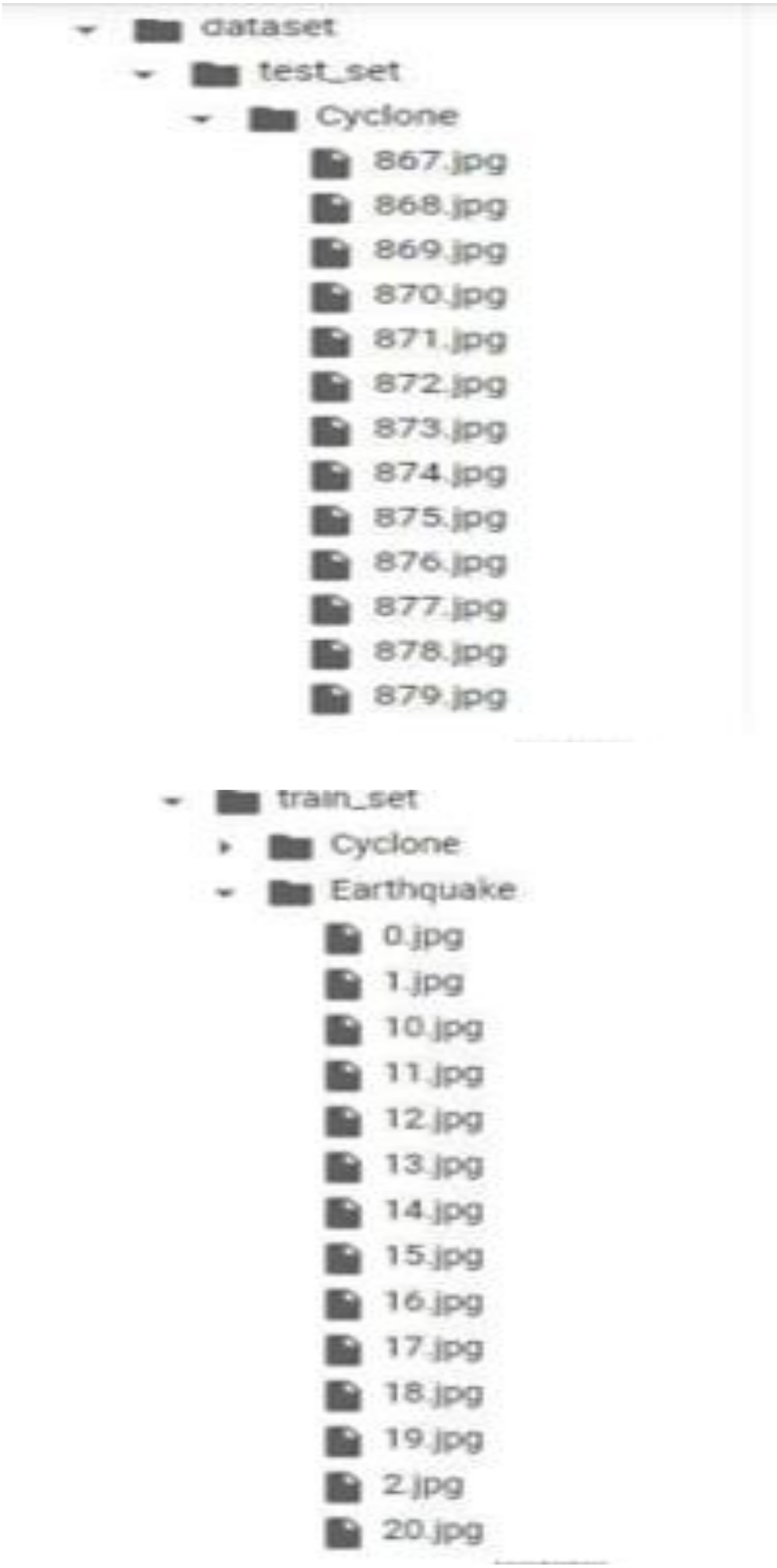




7.3 Data base Schema (if Applicable)


DISASTER TYPE
is responsible for
ACTOR
is managed by
ACTIVITY
S.ACTOR
F.ACTOR
performs
works in
M.ACTIVITY
I.ACTIVITY
Z.ACTIVITY
H.ACTIVITY
is part of
TASK
require
require
produce
DATA TUCBS
DATA ADYS


dataset
test_set
Cyclone
Earthquake
Flood
Wildfire
train_set
Cyclone
Earthquake
Flood
Wildfire
readme.txt



8. TEST ING

8.1 Test Cases

Test Scanarios

1.Verify user is able to see login page - verified

2.Verify user is able to login into application or not - verified

3.Verify user is able to navigate to create your account page - verified

4.Verify user is able to recovery password - verified

5.Verify login phase elements - verified

8.2 User acceptence testing

Test case ID	Features type	Componenets	Testing scanarioes	Pre - requires	Steps to exicute	Test date	Expected result	Actual result	Status		
logic page-TC-632	Functional	Home pages	The user interacts with the u1 to open the integrated webcam	IBM	1.Enter URIand click go 2.click on my account 3.Verify login and displaced or not	https;//shooenzer.com	Login should display	Login should display	Pass		
Logic page - TC-098	U1	Home pages	the vedio frames are capture and analysed by the model which is integrated with flask applicatio n	IBM	1.Enter URI and click go 2.click on my account 3.verify 4.email text box 5.password text box 6.login button	https;//shooenzer	Application should show email text box b.pass word textbox	working as expected	pass		
Logic page-TC-006	Functional	Home pages	Once model analysed the vedio frames the prediction	IBM	1.Enter URI 2.Click on my account 3.Enter vaild user name 4.Enter vaild password	user name: Dora @gamil.com	User should navigat e to user account homepa ge	working as expected			

9. RESULTS

9.1. Performence Metrics

NFT - Risk Assessment

Project name	Scope/ feature	Functional changes	Hardware changes	Software changes	Load/volume changes	Risk score
Natural disaster intensity analysis	Scope of disaster is based on number of people adversity affected by extreme event	Moderate	No changes	Moderate	No changes	Low

NFT - Detailed Test Plan

S.no	Project overview	NFT - test approches	Assemptions/ Risks	Approvals/sign
1	CBDM is the approach in which local communites	Task load	1. Developer team support 2.need requirement to testing load	Approved

END OF TEST REPORT

S.NO	Project overview	NFT - Test Approach	NFR - Met	Test outcome	Go/No-go decision	Recomedation
1	CBDM is the approach in which cocal communities are support to analysis hazards and provide strategy.	1.Test scope 2.Developed and testers would test in white box format to ensure sentive data.	We have to met the NFR.	The property value and living conditon iin some area will redevelop.	1.Justification. 2.Feasibnility. 3.Find right solution 4.Identity alternative	1.Check on people first 2.Have a communication plan.

10.ADVANTAGES & DISADVANTAGES

ADVANTAGES

the property value and living conditions in some areas will improve through the redevelopment of imfrastructure.

DISADVANTAGE

A natural disaster may cause loss of life ,injury or other haelth impacts ,property damage,loss of liveli hoods and services,social and economic disruption or environmental damage.

11.CONCLUTION

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 issuesdue to noise and seriousclass imbalance problems.To address these problems, we proposed a multilayered deep convolutional neural net- work for detection and intensity classification of natural disasters. The proposed method works in two blocks—one for detection of natural disasteroccurrence and the second block is used to remove imbalanced class issues. The results were calculated as average statistical values: sensitivity, 97.54%; specificity, 98.22%; accuracy rate, 99.92%; precision, 97.79%; and F1-score, 97.97% for the proposed model. The proposed model achieved the highest accuracy as compared to other state-of-the-art methods due to its multilayered structure. The proposed model performs significantly better for natural disaster detection and classification, but in the future the model can be used for various natural disaster detection processes.

12. FUTURE SCOPE

This project is far from complete and there is a lot of room for improvement.

Some of the improvements that can be made to this project are as follows:

i. Add support to detect from digits multiple images and save the results
ii. Add support to detect multiple digits
iii. Improve model to detect digits from complex images
iv. Add support to different languages to help users from all over the world

This project has endless potential and can always be enhanced to become better. Implementing this concept in the real world will benefit several industries and reduce the workload on many workers, enhancing overall work efficiency.

APPENDIX

SOURCE CODE

MODEL CREATION

FLASK APP

```
# Load the necessary packages
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from keras.utils import np_utils
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, Dense, Flatten
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.models import load_model
from PIL import Image, ImageOps

# Load the data
(X_train, y_train), (X_test, y_test) = mnist.load_data()

# Data pre-processing
X_train = X_train.reshape(60000, 28, 28, 1).astype('float32')
X_test = X_test.reshape(10000, 28, 28, 1).astype('float32')

number_of_classes = 10
Y_train = np_utils.to_categorical(y_train, number_of_classes)
Y_test = np_utils.to_categorical(y_test, number_of_classes)
```

```
# Create the model
model = Sequential()
model.add(Conv2D(64, (3, 3), input_shape=(28, 28, 1), activation="relu"))
model.add(Conv2D(32, (3, 3), activation="relu"))
model.add(Flatten())
model.add(Dense(number_of_classes, activation="softmax"))

model.compile(loss='categorical_crossentropy', optimizer="Adam", metrics=["accuracy"])

# Train the model
model.fit(X_train, Y_train, batch_size=32, epochs=5, validation_data=(X_test,Y_test))

# Evaluate the model
metrics = model.evaluate(X_test, Y_test, verbose=0)
print("Metrics (Test Loss & Test Accuracy): ")
print(metrics)

# Save the model
model.save("model.h5")
```

```
# Test the saved model
model=load_model("model.h5")

img = Image.open("sample.png").convert("L")
img = img.resize((28, 28))
img2arr = np.array(img)
img2arr = img2arr.reshape(1, 28, 28, 1)
results  = model.predict(img2arr)
results = np.argmax(results,axis = 1)
results = pd.Series(results,name="Label")
print(results)
```

```
from flask import Flask,render_template,request
from recognizer import recognize

app=Flask(__name__)

@app.route('/')
def main():
    return render_template("home.html")


@app.route('/predict',methods=['POST'])
def predict():
    if request.method=='POST':
      image = request.files.get('photo', '')
      best, others, img_name = recognize(image)
      return render_template("predict.html", best=best, others=others, img_name=img_name)


if __name__=="__main__":
    app.run()
```

```
# Import necessary packages
import os
import random
import string
from pathlib import Path
import numpy as np
from tensorflow.keras.models import load_model
from PIL import Image, ImageOps
```

```
def random_name_generator(n: int) -> str:
    """
    Generates a random file name.

    Args:
        n (int): Length the of the file name.

    Returns:
        str: The file name.
    """
    return ''.join(random.choices(string.ascii_uppercase + string.digits, k=n))
```

```python
def recognize(image: bytes) -> tuple:
    """
    Predicts the digit in the image.

    Args:
        image (bytes): The image data.

    Returns:
        tuple: The best prediction, other predictions and file name
    """

    model=load_model(Path("./model/model.h5"))

    img = Image.open(image).convert("L")

    # Generate a random name to save the image file.
    img_name = random_name_generator(10) + '.jpg'
    if not os.path.exists(f"./static/data/"):
        os.mkdir(os.path.join('./static/', 'data'))
    img.save(Path(f"./static/data/{img_name}"))

    # Convert the Image to Grayscale, Invert it and Resize to get better prediction.
    img = ImageOps.grayscale(img)
    img = ImageOps.invert(img)
    img = img.resize((28, 28))

    # Convert the image to an array and reshape the data to make prediction.
    img2arr = np.array(img)
    img2arr = img2arr / 255.0
    img2arr = img2arr.reshape(1, 28, 28, 1)

    results  = model.predict(img2arr)
    best = np.argmax(results,axis = 1)[0]

    # Get all the predictions and it's respective accuracy.
    pred = list(map(lambda x: round(x*100, 2), results[0]))

    values = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
    others = list(zip(values, pred))

    # Get the value with the highest accuracy
    best = others.pop(best)

    return best, others, img_name
```

```css
@import url("https://fonts.googleapis.com/css2?family=Overpass:wght@200;300;400;500;600;700;900&display=swap");

* {
    padding: 0;
    margin: 0;
}

body {
    color: black;
    font-family: "Overpass", sans-serif;
}
```

```html
            <div class="heading">
                <h1 class="heading__main">Handwritten Digit Recognizer</h1>
                <h2 class="heading__sub">Easily analyze and detect handwritten digits</h2>
            </div>
            <div class="upload-container">
                <div class="form-wrapper">
                    <form class="upload" action="/predict" method="post" enctype="multipart/form-data">
                        <label id="label" for="upload-image"><i data-feather="file-plus"></i>Select File</label>
                        <input type="file" name="photo" id="upload-image" hidden />
                        <button type="submit" id="up_btn"></button>
                    </form>
                    <img id="loading" src="{{url_for('static',filename='images/loading.gif')}}">
                </div>
            </div>
        </div>
    </body>
</html>
```

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GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-7546-1658889794

PROJECT DEMO LINK: