Project Report

Natural Disasters Intensity Analysis and Classification Using Artificial Intelligence.

1. INTRODUCTION

1.1 Overview

Natural disasters not only disturb the human ecological system but also destroy the properties and critical infrastructures of human societies an d even lead to
permanent change in the ecosystem. Disaster can be caused by naturally occurring
events such as earthquakes, cyclones, floods, and wildfires. we have dev eloped a
multilayered deep convolutional neural network model that classifies th e natural
disaster and tells the intensity of disaster of natural The model uses an i ntegrated
webcam to capture the video frame and the video frame is compared wi th the Pre trained model and the type of disaster is identified and show cased on the OpenCV window.

1.2 Purpose

Many deep learning model have faced issues due to complex structural images and to tackle that we made model which predicts image from vid eo cams and these benefits model to learn more complex architecture.

2. LITERATURE SURVEY

2.1 Existing problem

We can solving the existing problems with many different approaches ou t of which some are explained below:

1. Better data

Satellite images of Earth at night – called“night lights” – help to track the interactions between people and river resources.Opensource is nee d of requirement to make the service accessible to everyone and every where.

2. Awareness among the people Communications around disasters requi re high awareness of their comprising connections.With wider internet a access andimproved data speeds, information can reach people faster. A I can combine Earth observation data, street level imagery ,data drawn from connected devices ,and volunteered geographical details.

2.2 Proposed solution

1. Disaster Management and IoT IoT

IOT systems are expected to successfully deal with disaster management through accurate predictions, pre-preparedness and early warning signs. Deployment of advanced IoT solutions will help us broaden our reach in remote areas and will assess the damage and further repair it – within no time. IoT will not only help mankind use resources proficiently but will also help react swiftly in order to save millions of lives.

2. AI can accelerate disaster response

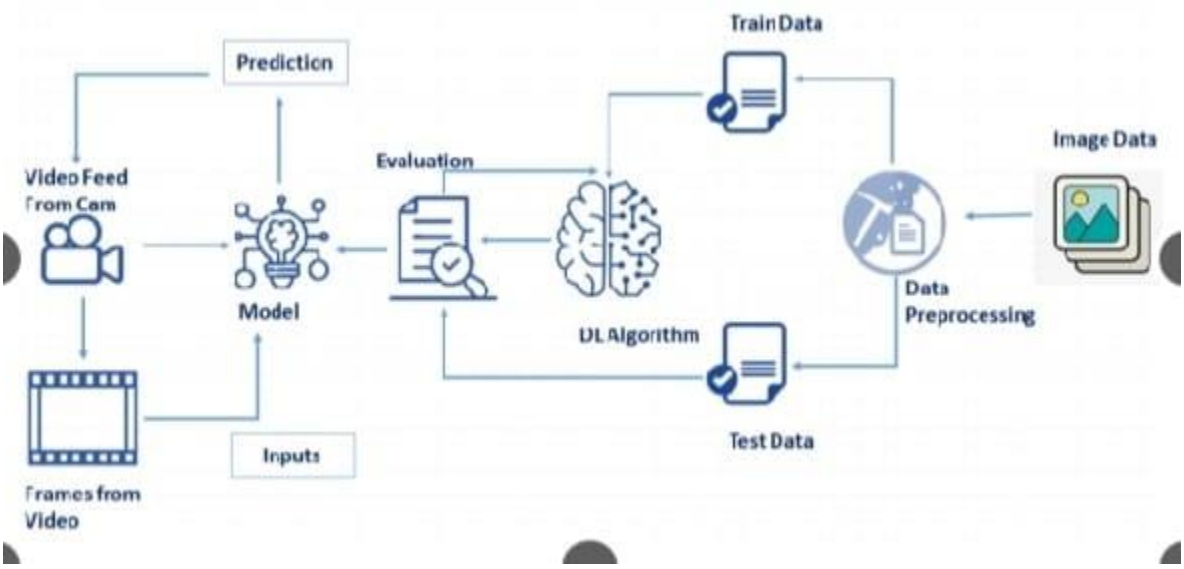
One step ahead of IoT stands AI -smart technology, which has enabled accurate and speedy solutions. If harnessed properly, the technology has the potential of predicting, preventing and providing response faster

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

3. THEORITICAL ANALYSIS

3.1 Block diagram

Below is the diagrammatic view of the project



3.2 Hardware and software designing

Hardware Requirements are just a PC with internet connection. Software Requirements are Anaconda Navigator for jupyter notebook and spyder and all necessary libraries for the project.

Anaconda Navigator is a free and open-source distribution of the Python and R programming languages for data science and machine learning related applications. It can be installed on Windows, Linux, and macOS. Conda is an open-source, cross platform, package management system. Anaconda comes with so very nice tools like JupyterLab, Jupyter Notebook, QtConsole, Spyder, Glueviz, Orange, Rstudio, Visual Studio Code. For this project, we will be using Jupyter notebook and Spyder.

4. EXPERIMENTAL INVESTIGATION

As the dataset size is very small model's accuracy won't increase above c ertain point.
But still models prediction are very good as we have tested it with the test dataset.Studies analyzing the intensity of natural disasters have gain significant attention inthe current decade. A Ashiquzzaman et al.utilized a video source for fire detection;processing video sources is a feasible ta sk due to convolutional neural networks(CNNs), which require high perf ormance computational resources including graphics
hardware,and thus smart and cost
effective fire detection network is posed basedon architecture of convol utional neural networks.
In convolutional neural networks, a model to detect wildfire smoke nam ed wildfiresmoke dilated dense net was proposed by Li et al., consisting of a candidate smokeregion segmentation strategy using an advanced n etwork architecture. Mangalathu etal.performed an evaluation of buildin g clusters affected by earthquakes by exploring the
deep learning method, which uses long short-term memory.

Natural disasters are unpredictable events, Hartawan et al. enhanced m ultilayerperceptron algorithm by including convolutional neural network implemented on
raspberry pi to find out the victims of natural disasters using streaming c ameras and to
aid the evacuation team to rescue the disaster victims. Amit et al.propos ed applyingautomatic natural disaster detection to a convolutional neur al network using thefeatures of disaster from resized satellite images of l andslide and flood detections.

Aerial images are able to show more specific and wider surface area of t he ground,which helps acquire a vast amount of information about the o ccurrence of disaster.Social media networks such as Twitter where peopl e share their views and informationhave been used as data sources to ca rry out disaster analysis. S. Yang et al.used theinformation related to ear thquake shared by users on Twitter as a dataset and input it to
the real time event detection system based on convolutional neural net works.Implementation of a CNN module made it possible to successfully achieve thedetection of an earthquake and its announcement by the gov ernment beforehand usinginformationbased tweets. As the tweets provi de a significant amount of information,Madichetty et al. implemented a convolutional neural network to perform featureextraction on informati ve as well as noninformative tweets, categorizing dataset
containing tweets by an artificial neural network.

Social media is considered as a main source of big data, with data shared in the form ofimages, videos and text; after the occurrence of a disaster , social platforms areoverflowed with different sorts of information whic h helps response teams to rescuethe victims. The majority of the data co ntain ambiguous contents which makes itdifficult for the rescue teams t o make the right decisions. Nunavath et al. reviewed
previous research based on convolutional neural networks using social

media as adataset and efficiently analyzed the effectiveness of big data f rom social media during disaster management. Using the two-layer architecture of a convolutional neural network (CNN), an efficient feature extraction method was applied to the extended CohnKanade dat aset tocompare three object recognition techniques: linear support vect or classification, lineardiscriminant analysis and softmax. More than 90% performance rates, with lowstandard deviations, were achieved by Boo nsuk et al.. The use of manpower is difficultin case of natural disaster oc currence in hilly areas, and continuous electric powersupply is highly aff ected in these areas due to maintenance issues of transmission lines. Therefore, in this case autopilot aerial equipment is used to gather images, andhidden content from aerial images needs to be identified in case of natural disasterssuch as landslides and heavy snowfall. Zhou et al . removed the noise from raw aerialimages and extracted disaster chara cteristics using the interframe difference technique;they implemented a convolutional neural network to analyze the type of disaster.

Insome regions, disasters such as earthquakes are inclined to occur due to geographicalfactors. To locate the victim in a short time is crucial; Suli stijono et al.acquired aerialimages, and locating the victims was made p ossible by using a dedicated groundstation server and proposed victim d etection framework based on convolution neuralnetworks. A simulation of real calamities was developed to test the framework.

Floods are a calamitous and remarkable disaster. Floods impact greatly o n human lives,economically and financially affecting nations. With the he lp of a neural network, it ispossible to predict floods and save the masse s from the disaster. By implementing aconvolutional neural network and Modified Particle Swarm Optimization (MPSO),
Padmawar et al. developed a deep learning approach to foresee the floo d circumstances and identify the individuals beforehand.
Chen et al.proposed unmanned aerial vehicle imagebased forest fire det

ection imagesof forest fires, stabilized the histogram and applied filters t o smoothen the imagesbefore testing via convolutional neural network. Smoke detection was carried out usingthe local binary pattern (LBP) and support vector machine (SVM). Comparison ofprocessed and raw images was made to test the effectiveness of the proposed strategy.

Forest fires drastically affect human lives and economic situations, and l ocating thevictims in a short time is complex task. Convolutional neural networks make it possibleto help firefighters to locate the location of vic tims by detecting density of smoke fromimages acquired from the unmn ned aerial vehicle. CNN-

based simple featureextraction with a AlexNet single deconvolution (SFE wANbased proposed approachhelps develop a real time fire monitoring system (Gonzalez et al.). Samudre etal.successfully improved response ti me, reduced power consumption, and optimizedperformance by using p ipelining among network layers of a CNN, executed on a field programm able gate array. As the spatial resolution of satellite images was too low, these images could not be used for wildfire detection; Lee et al. modifie d deep convolutional networks for high spatial resolution images, VGG-13 and Google Net, utilizing UAVs, a disaster forecasting system, web-based visualization system, alersystem, and disaster response scenario d atabase and achieved highly accurate resultsfor early wildfire detection.

It is a hectic job for a disaster management organization to

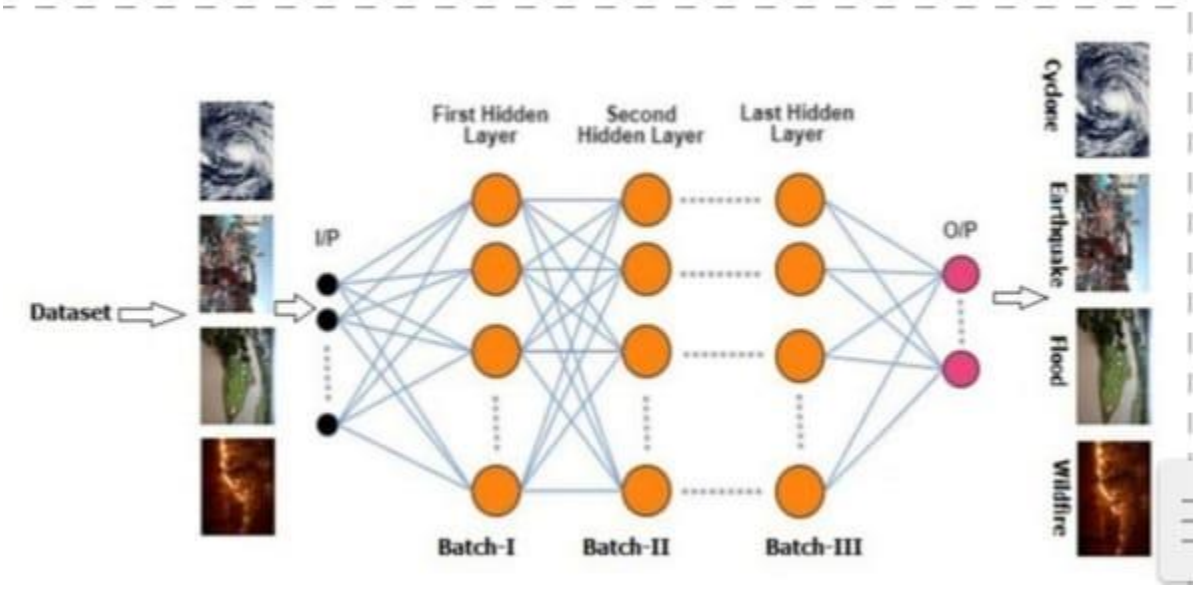
assess the damage caused by natural disasters. Using images obtained fr om socialmedia during and after the occurrence of four major natural di sasters, Nguyen et alproposed a method by adapting CNN features base d on eventspecific and cross events. Direkoglu et al. proposed a method to produce motion information imagescomputing optical flow vectors a nd employed a CNN; the proposed method efficiently

differentiated normal and abnormal behaviours of people during a natur al disaster. UMN

and PETS2009 datasets were used to performed experiments. Yuan et al. proposed a wave-
shaped neural network (WNet) to label the density of smoke in images, which isdifficult task, so virtual dataset was created. Convolutional enco der decoderarchitectures were assembled to maximize the input for info rmation extraction fromsmoke density images and WNet was proposed.

The accuracy of the proposed systemis improved by feeding previous en coding outputs to the decoding layers and combiningthem. Several data mining application were implemented using contents of social
media; user generated content helps in disastrous events to gain vast a mount ofinformation. The CNN model is used to extract flood images fro m raw images andcolour filters are used to refine the desired detection. In the work of Layer et al., theproposed system's efficiency and accuracy were tested on several datasets and itoutperformed other methods to g ive the highest results. The proposed multi-
layeredconvolutional neural network in this research is used to detect an d classify the natural disasters, as explained in the methodology section.

5. FLOWCHART



6. RESULT

Our model accuracy came out to be around 80 percentage. The architec ture used for this result is as follows

Input layer

1 Convolutional Layer + ReLu activation function 1 Max pooling Layer
2 Hidden Layers with 300 neurons in each layers
Output layer with 4 outputs (as we have 4 classes Earthquakes, flood, cy clone, Wildfire) with Softmax activation function.
The number of epochs is 20. The accuracy of model is 80%

7.ADVANTAGES AND DISADVANTAGES

ADVANTAGES

The main advantage of CNN is that it automatically detects the importan t features
without any human supervision. It has the highest accuracy among all al gorithms that predicts images.

DISADVANTAGES

A Convolutional neural network is significantly slower due to an operatio n such as maxpool.
If the CNN has several layers, then the training process takes a lot of tim e if the computer doesn’t consist of a good GPU.
A Convolutional neural network requires a large Dataset to process and t rain the neural network.

8.APPLICATIONS

Applications of CNN

Face Detection

Object Detection

Self-driving cars

Cancer Detection

3D medical Image segmentation

Image Captioning

Visual question answering

Document classification

Biometric authentication

X-ray image analysis

9.CONCLUSION

From this Project we are able to classify the Natural disaster from webcam. Thisapplication will be useful in real world to classify natural disasters. The Model accuracycame out to be 80 percentage. This can be increased by increasing the size of the
dataset.Many researchers have attempted to use different deep learning methods for detectionof natural disasters. However, the detection of natural disasters by using deep learningtechniques still faces various issues due to noise and serious class imbalanceproblems. To address these problems, we proposed a multi-
layered deep convolutionalneural network for detection and intensity classification of natural disasters. Theproposed method works in two blocks—

one for detection of natural disaster occurrenceand the second block is used to remove imbalanced class issues. The results were calculated as accuracy rate, 99.92% for the proposed model. The propos ed model achieved the highest accuracy as compared to other state-of-the-art methods due to its multilayered structure. The proposed model performs significantly bette r for naturaldisaster detection and classification, but in the future the m odel can be used for various natural disaster detection processes. Natural disasters not only disturb the human ecological system but alsod estroy theproperties and critical infrastructures of human societies and even lead to permanentchange in the ecosystem. Disaster can be caused by naturally occurring events such asearthquakes, cyclones, floods, and wildfires. Many deep learning techniques have beenapplied by various r esearchers to detect and classify natural disasters toovercome losses in ecosystems, but detection of natural disasters still faces issues due to thecomplex and imbalanced structures of images. To tackle this p roblem, we propose amultlayered deep convolutional neural network. T he proposed model works in twoblocks: BlockI convolutional neural net work (B-I CNN), for detection and occurrence of disasters, and Block-II convolutional neural network (B-II CNN), for classification of natural disaster intensity types with different filters and parameters. The model is testedwith around 2000 natural disaster images and performa nce is calculated and expressedas statistical value: accuracy rate (AR), 80 %. The overall accuracy for the whole model is80%, which is competitive and comparable with state-of-the-art algorithms. 10.FUTURE SCOPE Enhancements can be made by using popular CNN architectures like VG G16 or VGG19These architectures will give a very high accuracy. Along w ith these architectures if we90 percentage.An Hyperparameter tuning to the model would also Increase the accuracy of the model.

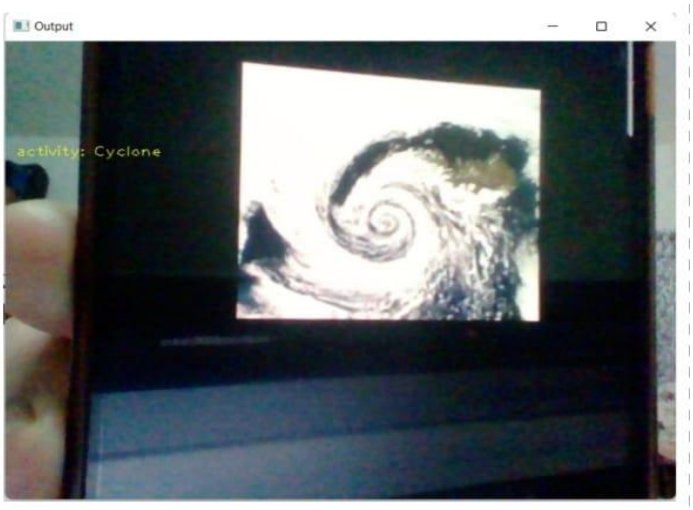
11. BIBLOGRAPHY

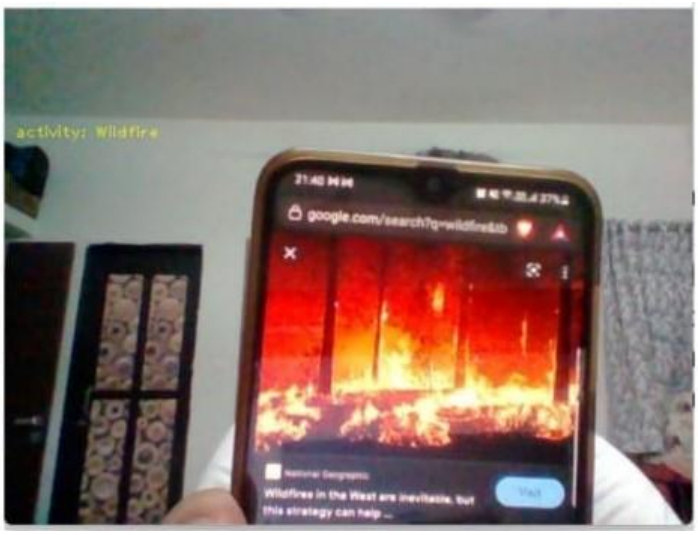
Websites and videos referred https://www.tensorflow.org/api_docs/python/tf https://pandas.pydata.org/docs/ https://youtu.be/BzouqMGJ41k

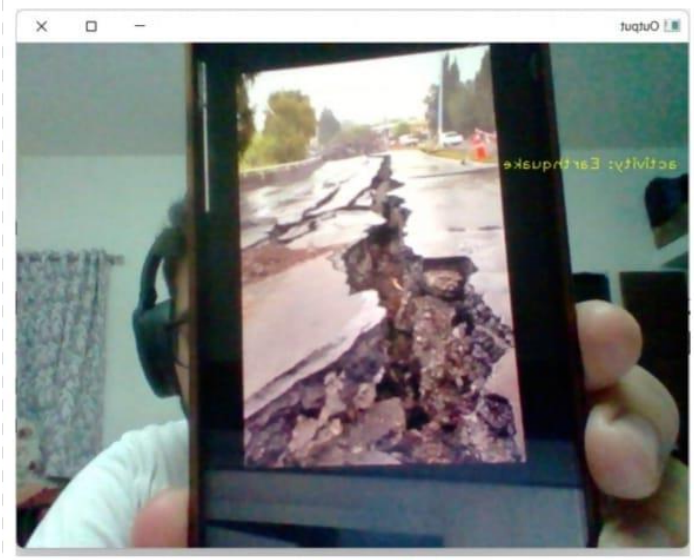
11.1APPENDIX

Link for the source code https://github.com/Deekshith213/Natural-disasters-intensity-analysis-and-classification-using-ai-

12.OUTPUT SCREENSHORTS







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