Project Report

Natural Disasters Intensity Analysis And Classiﬁcation Using Artiﬁcial Intelligence

# INTRODUCTION

* 1. **Overview**

Natural disasters not only disturb the human ecological system but alsodestroy the properties and critical infrastructures of human societies and even lead topermanent change in the ecosystem. Disaster can be caused by naturally occurring events such as earthquakes, cyclones, ﬂoods, and wildﬁres. we have 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 OpenCVwindow.

# Purpose

Many deep learning model have faced issues due to complex structuralimages and to tackle that we made model which predicts image from video cams andthese beneﬁts model to learn more complex architecture.

# LITERATURE SURVEY

* 1. **Existing problem**

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

# Better data

Satellite images of Earth at night – called “night lights” – help to trackthe interactions between people and river resources. Open source is need of the

requirement to make the service accessible to everyone and everywhere.

# Awareness among the people

Communications around disasters require high awareness of communities and their comprising connections. With wider internet access and improved data speeds, information can reach people faster. AI can combine Earthobservation data, street-level imagery, data drawn from connected devices, and volunteered geographical details.

# Proposed solution

* + 1. **Disaster Management and 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 inremote 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 reactswiftly in order to save millions of lives.

# 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 hasthe potential of predicting, preventing and providing response faster than ever.

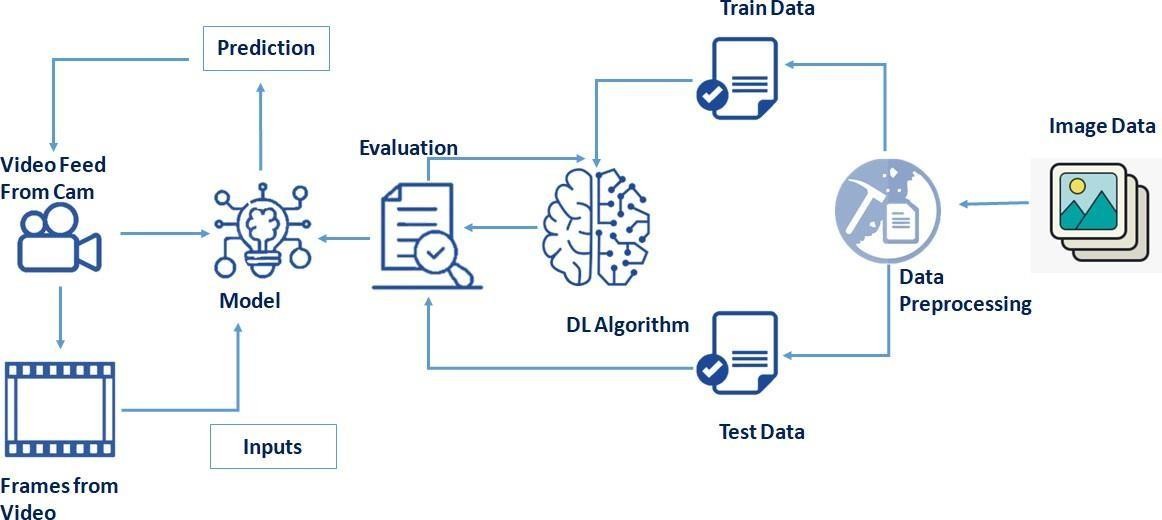
AI data setups are trained to predict seismic data to analyze the patterns of earthquake occurrences, rainfall records and monitor flooding, measure the intensity of hurricanes and read the geological data to understand volcanic

eruptions, such systems can reduce the catastrophic impact of natural disasters.

# THEORITICAL ANALYSIS

* + - 1. **Block diagram**

Below is the diagrammatic view of the project



* + - 1. **Hardware and software designing**

Hardware Requirements are just a PC with internet connection.

Software Requirements are Anaconda Navigator for jupyter notebook and spyder and allnecessary 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.

# EXPERIMENTAL INVESTIGATION

As the dataset size is very small model’s accuracy won’t increase above certain 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 gained signiﬁcant attention inthe current decade. A. Ashiquzzaman et al.utilized a video source for ﬁre detection;

processing video sources is a feasible task due to convolutional neural networks

(CNNs), which require high performance computational resources including graphics hardware, and thus a smart and cost-effective ﬁre detection network is proposed basedon architecture of convolutional neural networks.

In convolutional neural networks, a model to detect wildﬁre smoke named wildﬁre smoke dilated dense net was proposed by Li et al., consisting of a candidate smoke region segmentation strategy using an advanced network architecture. Mangalathu et

al.performed an evaluation of building clusters affected by earthquakes by exploring thedeep learning method, which uses long short-term memory.

Natural disasters are unpredictable events, Hartawan et al. enhanced multilayer

perceptron algorithm by including convolutional neural network implemented on raspberry pi to ﬁnd out the victims of natural disasters using streaming cameras and toaid the evacuation team to rescue the disaster victims. Amit et al.proposed applying automatic natural disaster detection to a convolutional neural network using the

features of disaster from resized satellite images of landslide and ﬂood detections. Aerial images are able to show more speciﬁc and wider surface area of the ground, which helps acquire a vast amount of information about the occurrence of disaster.

Social media networks such as Twitter where people share their views and informationhave been used as data sources to carry out disaster analysis. S. Yang et al.used the information related to earthquake shared by users on Twitter as a dataset and input it tothe real time event detection system based on convolutional neural networks.

Implementation of a CNN module made it possible to successfully achieve the detection of an earthquake and its announcement by the government beforehand usinginformation-based tweets. As the tweets provide a signiﬁcant amount of information,

Madichetty et al. implemented a convolutional neural network to perform feature extraction on informative 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 are

overﬂowed with different sorts of information which helps response teams to rescuethe victims. The majority of the data contain ambiguous contents which makes it diﬃcult for the rescue teams to make the right decisions. Nunavath et al. reviewed

previous research based on convolutional neural networks using social media as a dataset and eﬃciently analyzed the effectiveness of big data from social media duringdisaster management.

Using the two-layer architecture of a convolutional neural network (CNN), an eﬃcientfeature extraction method was applied to the extended Cohn-Kanade dataset to

compare three object recognition techniques: linear support vector classiﬁcation, linear discriminant analysis and softmax. More than 90% performance rates, with low standard deviations, were achieved by Boonsuk et al.. The use of manpower is diﬃcult in case of natural disaster occurrence in hilly areas, and continuous electric power supply is highly affected in these areas due to maintenance issues of transmission lines. Therefore, in this case autopilot aerial equipment is used to gather images, and

hidden content from aerial images needs to be identiﬁed in case of natural disasters such as landslides and heavy snowfall. Zhou et al. removed the noise from raw aerial images and extracted disaster characteristics using the interframe difference technique;they implemented a convolutional neural network to analyze the type of disaster. In some regions, disasters such as earthquakes are inclined to occur due to geographical

factors. To locate the victim in a short time is crucial; Sulistijono et al.acquired aerial images, and locating the victims was made possible by using a dedicated ground station server and proposed victim detection 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 on human lives, economically and ﬁnancially affecting nations. With the help of a neural network, it is possible to predict ﬂoods and save the masses from the disaster. By implementing a convolutional neural network and Modiﬁed Particle Swarm Optimization (MPSO), Padmawar et al. developed a deep learning approach to foresee the ﬂood circumstances and identify the individuals beforehand.

Chen et al.proposed unmanned aerial vehicle image-based forest ﬁre detection imagesof forest ﬁres, stabilized the histogram and applied ﬁlters to smoothen the images

before testing via convolutional neural network. Smoke detection was carried out usingthe local binary pattern (LBP) and support vector machine (SVM). Comparison of

processed and raw images was made to test the effectiveness of the proposedstrategy.

Forest ﬁres drastically affect human lives and economic situations, and locating the victims in a short time is complex task. Convolutional neural networks make it possibleto help ﬁreﬁghters to locate the location of victims by detecting density of smoke from images acquired from the unmanned aerial vehicle. CNN-based simple feature

extraction with a AlexNet single deconvolution (SFEwAN-SD)-based proposed approachhelps develop a real time ﬁre monitoring system (Gonzalez et al.). Samudre et al.successfully improved response time, reduced power consumption, and optimized

performance by using pipelining among network layers of a CNN, executed on a ﬁeld- programmable gate array. As the spatial resolution of satellite images was too low,

these images could not be used for wildﬁre detection; Lee et al. modiﬁed deep convolutional networks for high spatial resolution images, VGG-13 and Google Net, utilizing UAVs, a disaster forecasting system, web-based visualization system, alert system, and disaster response scenario database and achieved highly accurate results

for early wildﬁre detection. It is a hectic job for a disaster management organization toassess the damage caused by natural disasters. Using images obtained from social media during and after the occurrence of four major natural disasters, Nguyen et al.

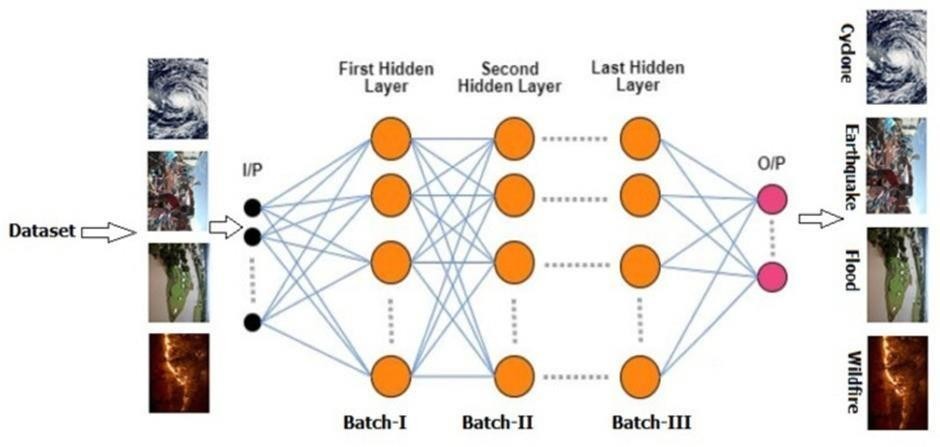
proposed a method by adapting CNN features based on event-speciﬁc and cross- events.

Direkoglu et al. proposed a method to produce motion information images

computing optical ﬂow vectors and employed a CNN; the proposed method eﬃciently differentiated normal and abnormal behaviours of people during a natural disaster. UMNand PETS2009 datasets were used to performed experiments. Yuan et al. proposed a wave-shaped neural network (W-Net) to label the density of smoke in images, which is diﬃcult task, so virtual dataset was created. Convolutional encoder decoder architectures were assembled to maximize the input for information extraction from smoke density images and W-Net was proposed. The accuracy of the proposed system is improved by feeding previous encoding 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 amount of information. The CNN model is used to extract ﬂood images from raw images and colour ﬁlters are used to reﬁne the desired detection. In the work of Layer et al., the

proposed system’s eﬃciency and accuracy were tested on several datasets and it outperformed other methods to give the highest results. The proposed multi-layeredconvolutional neural network in this research is used to detect and classify the naturaldisasters, as explained in the methodology section.

# FLOWCHART



* + 1. **RESULT**

Our model accuracy came out to be around 80 percentage. The architecture used forthis result is as follows-

Input layer

1. Convolutional Layer + ReLu activation function1 Max pooling Layer
2. Hidden Layers with 300 neurons in each layers

Output layer with 4 outputs (as we have 4 classes Earthquakes, ﬂood, cyclone, Wildﬁre) with Softmax activation function.

The number of epochs is 20. The accuracy of model is 80%

# ADVANTAGES AND DISADVANTAGES

ADVANTAGES-

The main advantage of CNN is that it automatically detects the important featureswithout any human supervision.

It has the highest accuracy among all algorithms that predicts images. DISADVANTAGES-

A Convolutional neural network is signiﬁcantly slower due to an operation such as maxpool.

If the CNN has several layers, then the training process takes a lot of time if the computer doesn’t consist of a good GPU.

A Convolutional neural network requires a large Dataset to process and train the neuralnetwork.

# 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 authenticationX- ray image analysis

# CONCLUSION

From this Project we are able to classify the Natural disaster from webcam. This application 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 imbalance

problems. To address these problems, we proposed a multi-layered 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 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 proposed model achieved the highest accuracy as compared to other state-of-the-art methods due to its multi-layered structure. The proposed model performs signiﬁcantly better for natural disaster detection and classiﬁcation, but in the future the model can be used for variousnatural disaster detection processes.

Natural disasters not only disturb the human ecological system but also destroy theproperties 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 propose a multi-layered deep convolutional neural network. The proposed model works in two

blocks: Block-I convolutional neural network (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 performance 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.

# FUTURE SCOPE

Enhancements can be made by using popular CNN architectures like VGG16 or VGG19.These architectures will give a very high accuracy. Along with these architectures if we Increase the size of the Dataset model accuracy can reach up to 88-90 percentage.

An Hyperparameter tuning to the model would also Increase the accuracy of the model.

# BIBLOGRAPHY

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

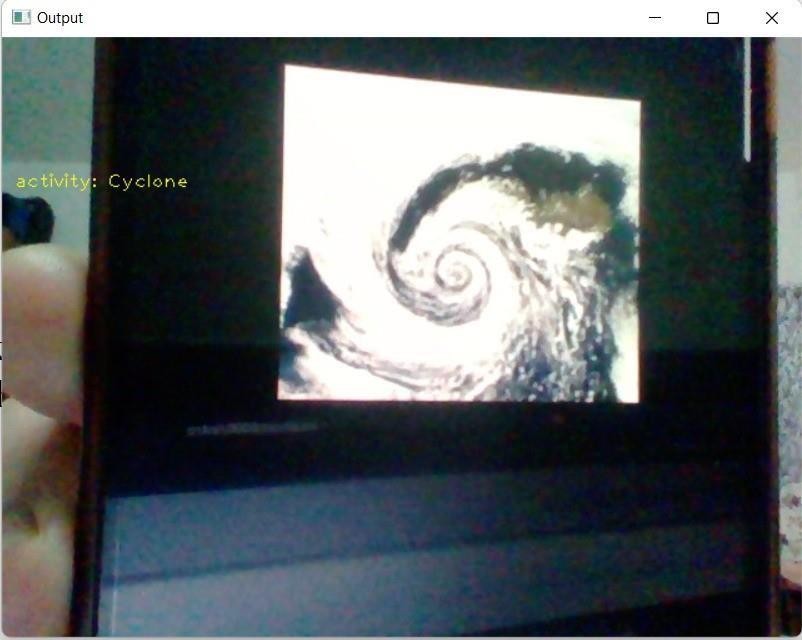
# APPENDIX

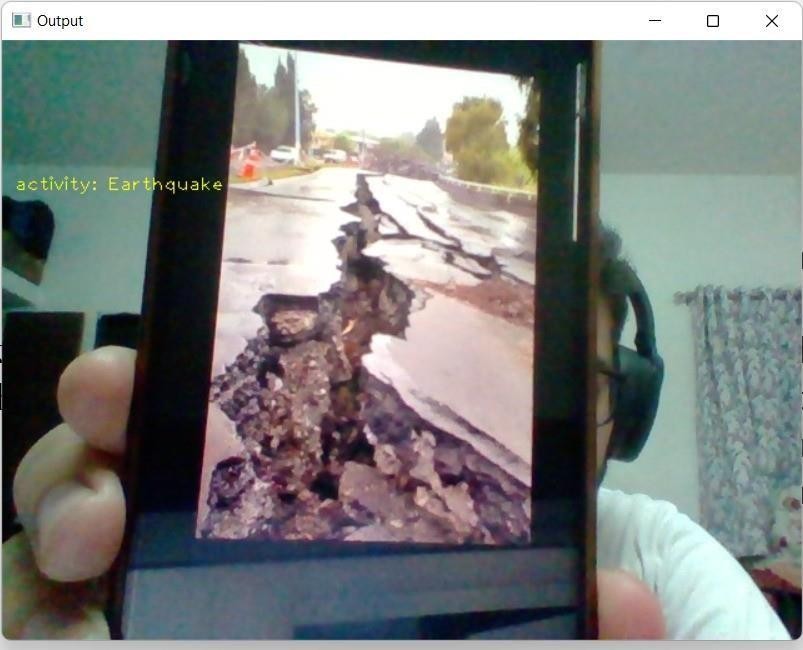
Link for the source code-

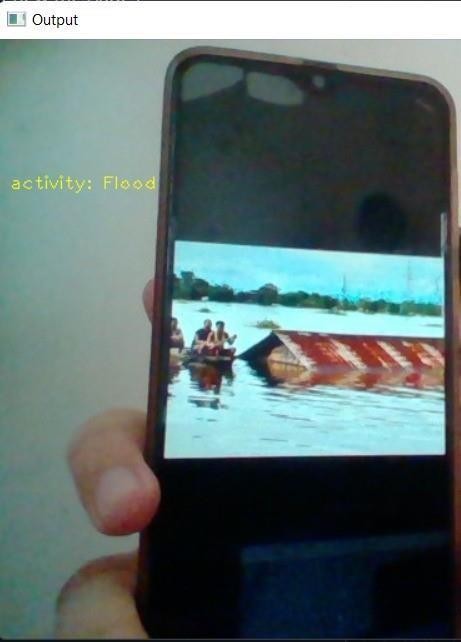
<https://github.com/poornamanikantasai/Natural-disasters-intensity-analysis-and-classification-using-Artifical-Intelligence.git>

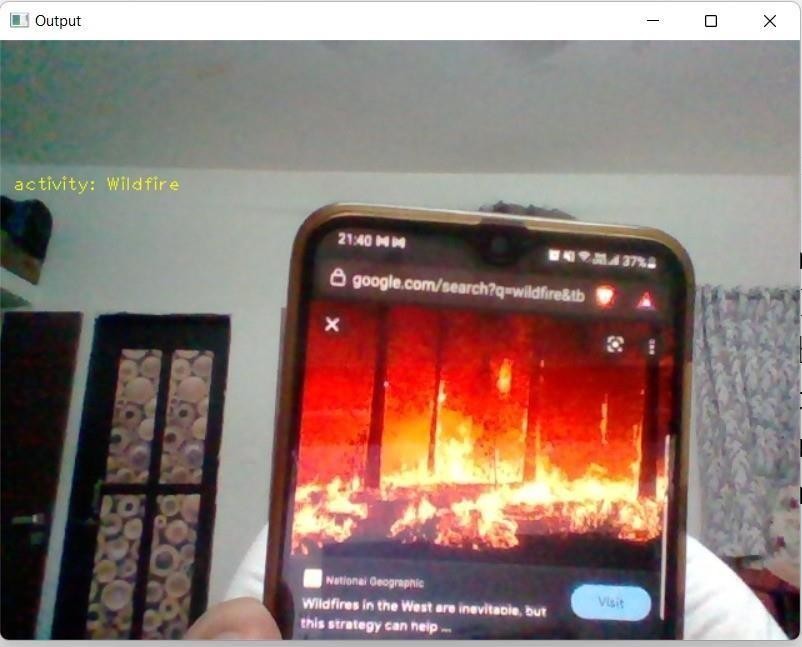
link for project demo -https://youtu.be/OhAZF3ygV84

# OUTPUT SCREENSHORTS









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