**AI Based Natural Disaster Intensity Analysis Using IBM Watson**

**Team Name:** Triumvirate

Team Members:

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**Introduction:**

Natural Disasters are Nature's Way of making humans comprehend, that they are not the strongest forces. Not even on the planet, let alone the universe.

Nature's strong forces wipe out areas in a matter of seconds, that took mankind decades to build. Whether it be Cyclones, Earthquakes, Floods or Wildfire, the destruction caused is irreparable. We need to remember, that nature is trying to teach us a lesson. Anything we do to her, such as deforestation, pollution, genocide, trafficking, she can do worse to us, and more so, righteously.  
  
Please do your part in protecting mankind from the wrath of Mother Nature; she is vicious, ferocious, agile, and right.

The identification of natural disasters is an arena yet to be explored. Hence, we have taken this initiative, using Deep Learning Convolutional Neural Model, trained using a collection of images, to identify and display the natural disaster occurring in a live stream collected using a webcam, or uploading a video, or simply uploading images.

**Problem Statement:**

Disasters need to be managed. We can do nothing to stop them, but we can mitigate the damages caused. We need to adopt strategies used by the Asipu more than 5000 years ago (Coppola, 2007), analyze the problem, propose several alternative solutions, and predict various outcomes for these solutions. From that, the best solution, with the most efficient and least bombast solution is picked, which would actually make a positive impact on not only the rehabilitated colony, but also the ecology.

The purpose of this project is to generate a model based on previously clicked images, and identify the aftermath or ongoing disaster, and it’s intensity, by taking input in the form of video, live stream through webcam and images. The disaster will be identified and displayed on the OpenCV window.

**Impactful Projects to learn from:**

CEP Map is a much larger project, based on the same lines as this. This project singularly focusses on managing resources for the emergency management personnel through “emergency planning and preparedness, response, and recovery, by turning spatial-temporal emergency relevant data into actionable information” (DNV, 2018). It focuses on getting precise, accurate and reliable information to make up a life-saving organization. Since it is private, and doesn’t currently have Governmental Support, it has not been implemented on a international scale. Hopefully, that shall happen soon.

Through this LinkedIn article, we can see, that the funding is present. Yet, the damage is massive, even after rescue missions are conducted. In fact, biometric and climatic datasets are also present (Kumar M., 2017). Yet, there is an absence of a system that efficiently utilizes and implements these resources on a global scale.

A research article focuses of theorizing semi-human intervention in disaster risk management and the implications it shall have on the human psyche and behaviour (Fekete, 2020). It also considers, human vulnerability, which is an important factor, as to how humans will react when face to face with calamity.

**Solution Proposed:**

The focus of this project is mitigation. But analyzing the intensity of the disaster, this project can help prioritize and inform people of a natural disaster that has occurred. People could live stream, upload images or a video, to inform rescuers at the earliest, that they need help. Rescuers and the Government can then analyze the intensity of the disaster.

If it is high, they can send in rescue missions and volunteers for help, as soon as they receive the intensity information or if it is low, they can assure the people and inform them, that the damage caused is going to be minimal.

This shall help Government bodies and Rescue Missions on both sides of the coin, they would not waste an unnecessary trip to somewhere where the damage is not that severe and can be assessed later than a place which is in grave peril simultaneously. Since it identifies the type of disaster, exactly what happened shall be known, and accordingly supplies for help can be gathered. This shall help in resource allocation and energy distribution. This project doesn’t give a numerical output of the intensity quotient, it just displays the disaster that has occurred in the region, and the bodies involved, can have a look at captured video frames in order to analyze the level of intensity.

**Working:**

Training the Model:

Text

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Figure : Model Creation and Saving

This generated an output model, which was used to further create the application.

The screenshot includes the code we put.

First, we imported essential libraries required to train the model. Then we applied the Image Data Generator, to train and count the images.

We further created a sequential model and readied it to become a CNN model. We added the input layer, hidden layer, and the output layer, and worked on the test data for 50 epochs, and finally gained an accuracy close to 0.85.

We went on to save the model and integrate it with our Flask Application.

Flask:

Graphical user interface, text, application

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Text

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Text

Description automatically generated with low confidence

Figure : Flask Application

In this application, there are 5 methods, one for each web page: Home, Intro, Image, Video and Webcam. These methods take the input from the user, through the UI, and give an output to the user.

**Output:**

For the video, and the video through the camera, we have built a method that divides the media into frames, and analyzes the procured images using the pre-trained model.

The result is seen on the video output window, wherein the disaster’s name is displayed. For the image, the answer is displayed on the webpage user interface itself, because it doesn’t change dynamically.

This is the Home Page of our website. It has penned, our thoughts on Natural disasters, and generic information with respect to the disaster classes, our model has been trained for.

Text

Description automatically generated

Figure : Home Page

There is a navigation bar on the top, that can take you to the different pages on our website. This website has been powered through Flask Application, which it has been integrated with. The screen you are currently on, is highlighted on the navigation bar. As you can see, currently, HOME, is highlighted.

Moving on to the introduction page. This page just gives an overview of what the webpage does, and what it is for. These are just a few lines, that explain the motive of this application. In the navigation bar, you can see INTRO, has been highlighted.

Graphical user interface, application

Description automatically generated

Figure : Introduction

In the image page, we can upload the images that we need to check for. The model will predict what kind of disaster occurred in the picture. There is a choose button to upload an image. The name of the image can be viewed on the UI. When we click the button to submit the image, we can see the result.

Chart

Description automatically generated

Figure : Uploading an Image

For the upload video page, we again click the choose button, to choose the video we want to analyze and further click on the submit button, and the video starts playing. On the frame, the word activity displayed, and next to it, is the name of the disaster that is filmed in the video. The name of the disaster is displayed next to the word activity.

Chart

Description automatically generated

Figure : Uploading a video

Upon clicking, the webcam, the camera of the device used, is activated. As you clearly observe, the model can correctly predict, even through a live-stream, what disaster is happening.

Graphical user interface

Description automatically generated

Figure : Live Stream

**Hardware and Software Specifications:**

Software:

1. Python (3.9)
2. Anaconda Prompt
3. Jupyter Notebook
4. Libraries such as: NumPy, Pandas, TensorFlow, Keras, OpenCV and Flask

Hardware:

1. Processor
2. Ethernet or Wi-Fi connection
3. Hard Drive
4. Memory

Further we required some knowledge in CNN and OpenCV, to complete this project.

**Flowchart for the Work Process:**

Diagram

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Figure : Flowchart

**Conclusion:**

This AI and OpenCV project is helps take immediate action on protecting mankind from the aftermath of disasters that occur, and expeditious restoration of the landscape.

We hope that this project can be a starting contribution from us, to saving mankind from the wrath of mother nature. We admit that this approach, in no way, is exhaustive, it is simply a try to mitigate the disasters, whether or not they are triggered by human intervention to climatic conditions.

**Future Scope:**

This project doesn’t focus on prevention. Analysis might not be able to do that, maybe a few can be prevented by a change of habit. Analysis can only offer prediction in disaster management. An alternative project can be proposed wherein pre-disaster conditions are monitored to build a model, and a live camera is setup in places that are disaster prone, to analyze environmental movements and warn people to protect themselves and their families. This would impact the preparedness of the areas, since they would be pre-warned, that conditions are so forming, that a particular natural disaster is going to follow.

Also, a further expansion of this project would be assigning actual numbers to the intensity level of the disaster occurred.

**References:**

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