NATURAL DISASTERS INTENSITY ANALYSIS AND CLASSIFICATION USING ARTIFICIAL INTELLIGENCE

IBM – DOCUMENTATION

UNDER THE GUIDANCE OF

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1. INTRODUCTION:

1.1 Project Overview:

Natural Disasters are catastrophic events with atmospheric and historic origins (hurricanes, floods, tsunamis, earthquakes). That can cause fatalities, property damage and social environment disruption.

Natural disasters are the results of a hazard overwhelming highly vulnerable community, often resulting in mortality and morbidity. Over the past decade, over 300 natural disasters occur yearly around the world affecting millions and cost billions. The disaster cycle is a framework used to base a coordinated plan to respond, recover, prevent and prepare for a disaster. Access to clean water, proper sanitation, food/nutrition, shelter and the threat of communicable diseases are concerns that have potential to be detrimental to the management of a natural disaster, slowing the recovery process.

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 OpenCV window.

1.2 Purpose:

Basically, the main objective of natural disaster management is to reduce the damage. However, there are several objectives that are integrated with it. Those are,

1. Identifying the hazard and its cause.

2. Reducing vulnerability and potential losses of hazard.

3. Assessing, reviewing and controlling the risk.

4. Applying efficient, effective, sustainable relief (food, shelter and money), medical and other facilities in disaster affected people thus they can survive.

5. Reducing the damage, death, sufferings and destruction of any natural and human induced disaster.

6. Giving protection to victims.

7. Supply of essential commodities. Rehabilitation of disaster victims.

8. Protective measures to reduce the intensity of future disasters.

9. Rescue of victims by the event and disposal of losses suffered.

10. Increasing the strength among people to survive against disasters.

11. Building up capacity in every sector like- individual, social, economic, environmental, regional,national and international.

12. Ensuring the availability of local emergency equipment and transportation.

Promote the culture of disaster risk prevention and mitigation at all levels. Disaster management aims to **reduce, or avoid, the potential losses from hazards,assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery**. Artificial intelligence (AI), in particular machine learning(ML), is playing an increasingly important role in disaster risk reduction (DRR) – from **the forecasting of extreme events and the development of hazard maps to the detection of events in real time, the provision of situational awareness and decision support.**

2.LITERATURE SURVEY:

2.1 Existing problem:

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.

2.2 References:

1.dos Santos Vergilio, C.; Lacerda, D.; de Oliveira, B.C.V.; Sartori, E.; Campos, G.M.; de Souza Pereira, A.L.; de Aguiar, D.B.; da Silva Souza, T.; de Almeida, M.G.; Thompson, F.; et al. Metal Concentrations and Biological Effects from One of the Largest Mining Disasters in the World (Brumadinho, Minas Gerais, Brazil). Sci. Rep. 2020, 10, 5936. [Cross Ref] [PubMed].

2.Thompson, F.; de Oliveira, B.C.; Cordeiro, M.C.; Masi, B.P.; Rangel, T.P.; Paz, P.; Freitas, T.; Lopes, G.; Silva, B.S.; Cabral, A.S.; et al. Severe Impacts of the Brumadinho Dam Failure (Minas Gerais, Brazil) on the Water Quality of the Paraopeba River. Sci. Total Environ. 2020, 705, 135914. [Cross Ref].

3. Aamir M, Ali T, Irfan M, Shaf A, Azam MZ, Glowacz A, Brumercik F, Glowacz W, Alqhtani S, RahmanS, et al. 2021. Natural disasters intensity analysis and classification based on multispectral images usingmulti-layered deep convolutional neural network. Sensors. 21(8):2648.

4. Abraham A. 2005. Artificial neural networks. Handbook of measuring system design. Hoboken, NJ, USA: John Wiley & Sons, Ltd.

5. Alam N, Alam MS, Tesfamariam S. 2012. Buildings' seismic vulnerability assessment methods: a comparative study. Nat Hazards. 62(2):405–424.Alexander D. 2000. Scenario methodology for teaching principles of emergency management. Disaster Prev Manag. 9(2):89–97.

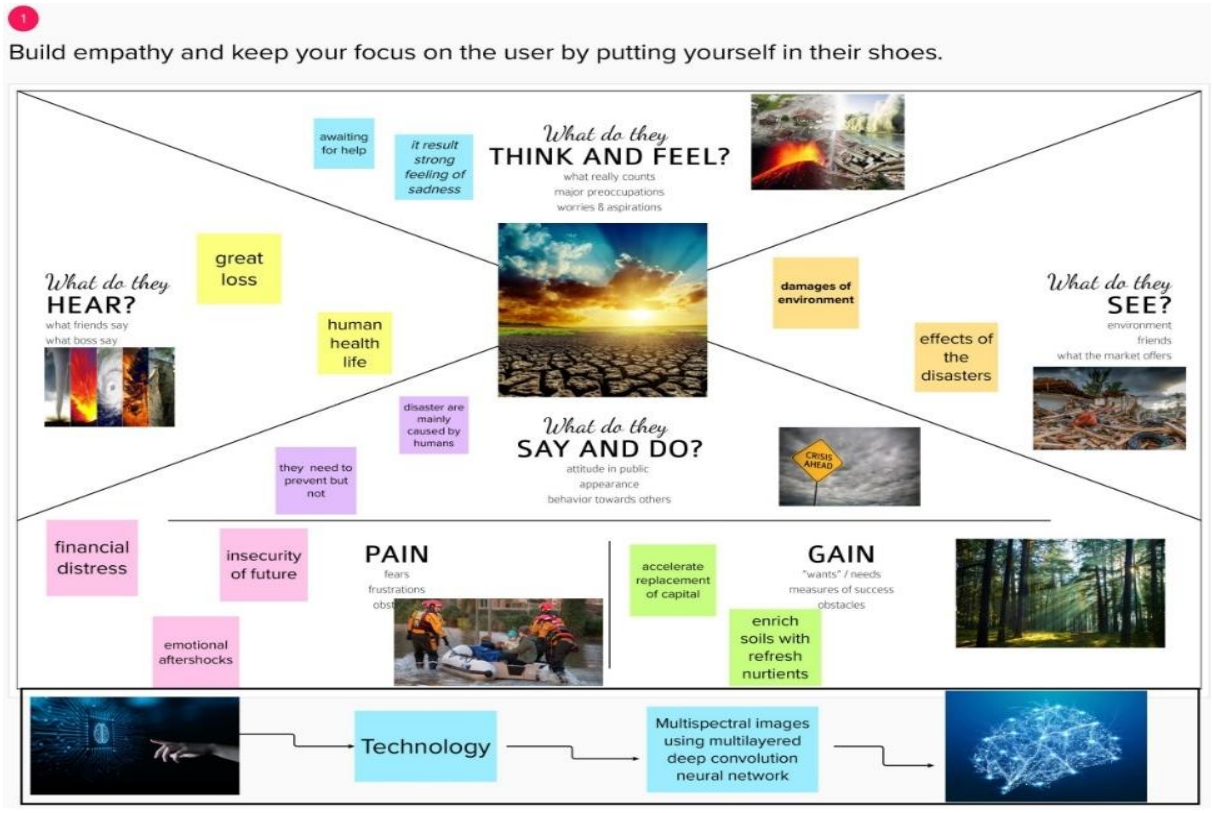
2.3 Problem Statement Definition:

The purpose of the problem statement is to identify the issue that is a concern and focus it in a way thatallows it to be studied in a systematic way. It defines the problem and proposes a way to research a solution, or demonstrates why further information is needed in order for a solution to become possible.

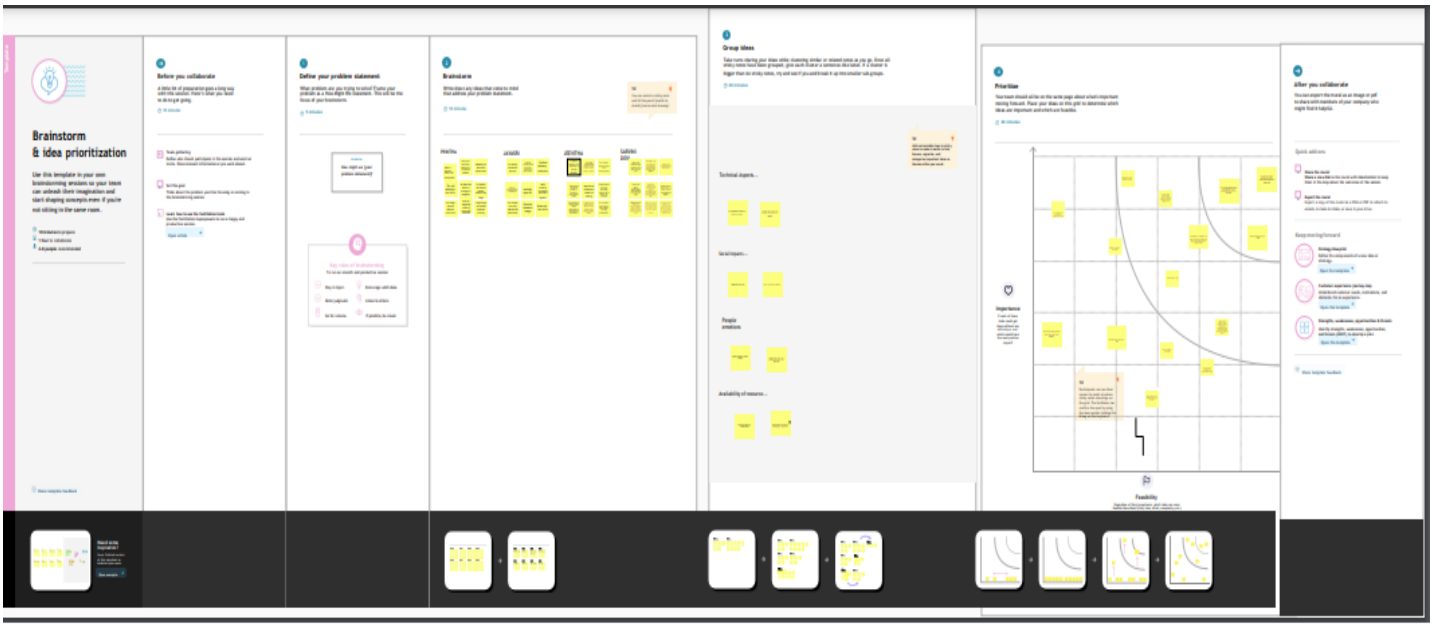
I am	Describe customer with 3-4 key characteristics - *who are they?*	Describe the customer and their attributes here
I'm trying to	*List their outcome or "job" the care about - what are they trying to achieve?*	List the thing they are trying to achieve here
but	Describe what problems or barriers stand in the way – *what bothers them most?*	Describe the problems or barriers that get in the way here
because	Enter the "root cause" of why the problem or barrier exists – *what needs to be solved?*	Describe the reason the problems or barriers exist
which makes me feel	Describe the emotions from the customer's point of view – *how does it impact them emotionally?*	Describe the emotions the result from experiencing the problems or barriers

3 IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.1 Ideation & Brainstorming:



Cyclone intensity evaluation:

An application of state-of-art neuro evolution method can be developed for prediction of wind-intensity for tropical cyclones in the South Pacific region. The method employed data from cyclone wind-intensity taken for the last three decades. This employs Cooperative Coevolution method for training Elman recurrent neural networks for the prediction.

Flood intensity evaluation:

A hybrid deep learning based flood forecasting can be developed. This approach has been made use of daily lagged IF and precipitation time series data to determine flood situations at multiple forecast horizons. The practicality of the model can be tested using datasets from nine locations in Fiji.

Storm intensity evaluation:

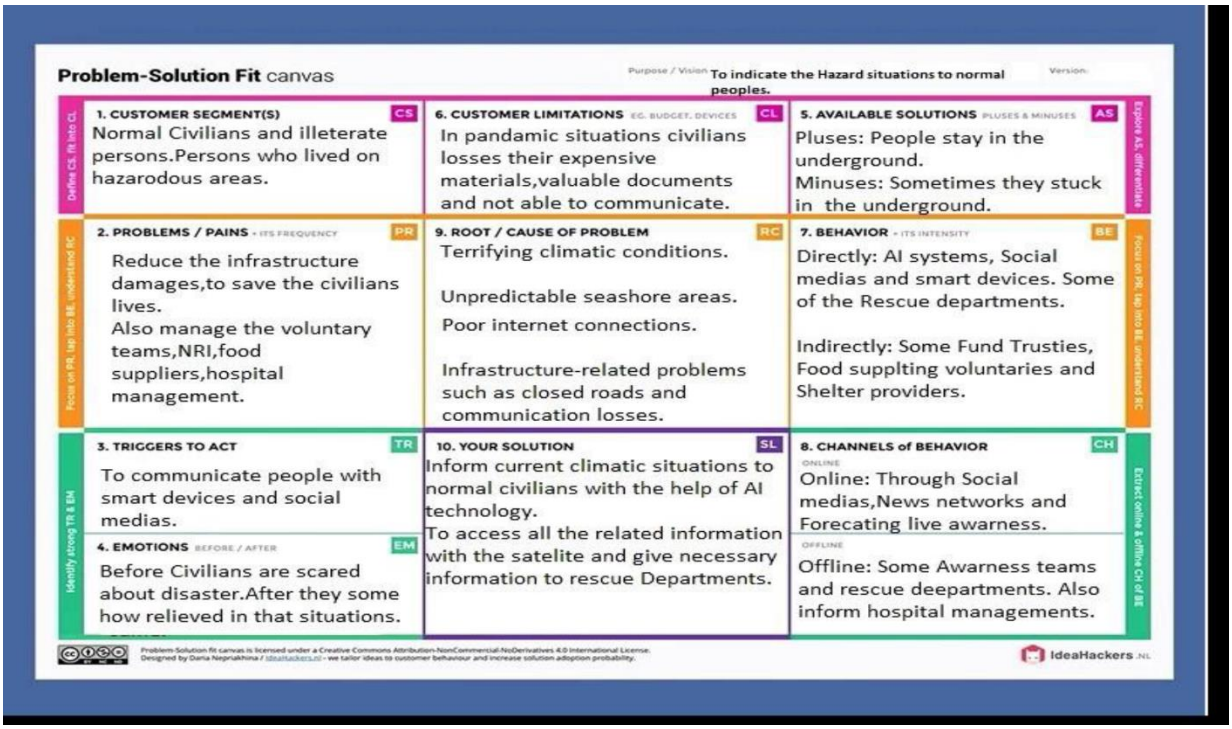
A storm scale ensemble post-processing system based on ensemble machine learning algorithms, radar mosaic verification, and ensemble variable statistics can provide improved precipitation forecasts.
Multiple machine learning models of varying complexity were applied to forecasts. Probabilistic, deterministic, and interval forecasts of 1-hour precipitation accumulation were created with the

different models. Verification statistics showed that random forests, multiple logistic regression, and MARS provided significant improvements for probabilistic and continuous forecasts by both increasing the range of precipitation and probabilistic values predicted and by increasing the areal coverage of the precipitation forecasts.

3.2 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement	To classify the natural disaster and calculate the intensity of the disaster.
2.	Idea / Solution description	To develop a multilayered deep convolutional neural network model (CNN) that classifies the Natural Disaster and tells the intensity of disaster.
3.	Novelty / Uniqueness	We are implementing neural networks to train our model instead using machine learning algorithms which expected to provide with better accuracy.
4.	Social Impact / Customer Satisfaction	With better accuracy in predicting intensities precautions are taken respectively.
5.	Business Model (Revenue Model)	The software is cheap, and the minimum requirements are affordable.
6.	Scalability of the Solution	Better accuracy in measuring the intensities of the natural disaster and in classifying it.

3.3 Problem -Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through an online application using Gmail.
FR-2	User Confirmation	Confirmation via Email
FR-3	User Preparation	Ensures safety of all people and provision of food.
FR-4	User Evacuation	Safe evacuation ways would be advised.

4.1 Non-functional Requirements:

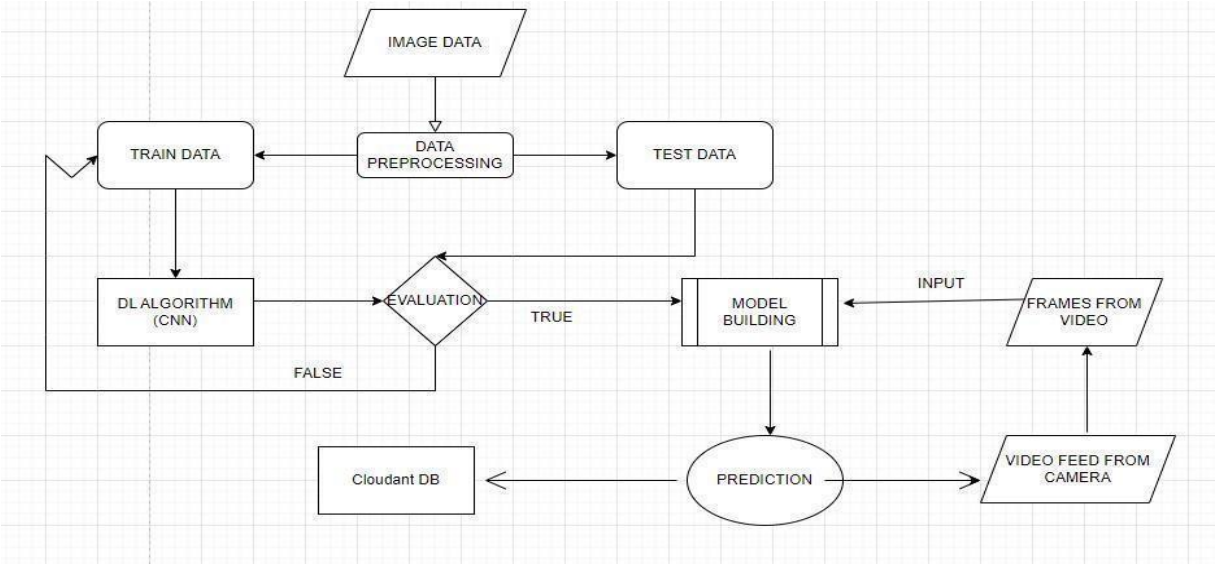
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Prediction of disaster intensity can be done with ease.
NFR-2	**Security**	The secure pattern shares components with monitorand control for logging and control access for providing audit trails.
NFR-3	**Reliability**	High reliability since it deals with lives of people.
NFR-4	**Performance**	Depends on the throughput of the application and feed of images(dataset).
NFR-5	**Availability**	It is available 24/7 as far as WIFI exists.
NFR-6	**Scalability**	Disaster can affect people that can be examined by taking note of the number of fatalities and injuries.

5. PROJECT DESIGN:

5.1 Data Flow Diagrams:

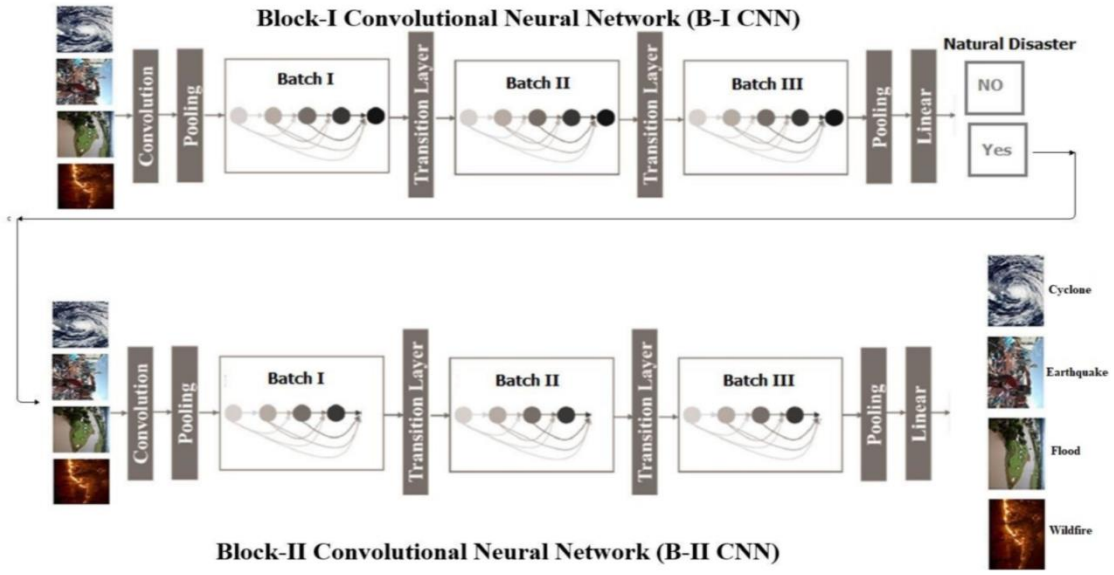
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat andclear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stor

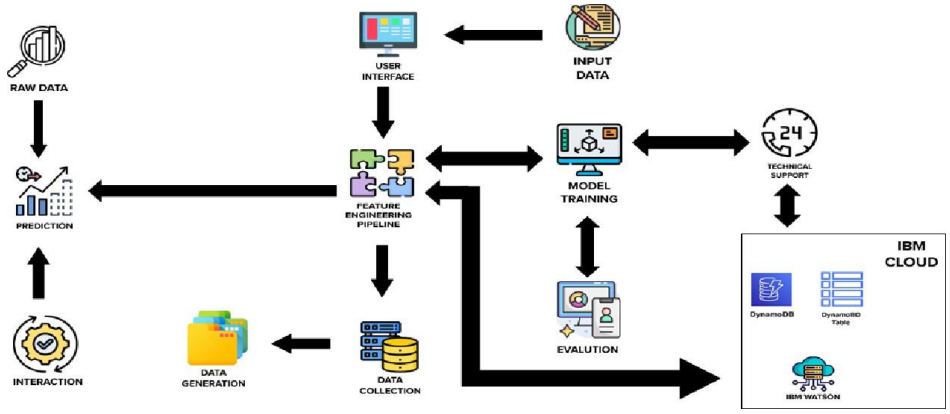


5.2 Solution & Technical Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap betweenbusiness problems and technology solutions. Its goals are to:

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





Components & Technologies:

1. User

Interface

Description

User interacts with the application for the prediction of Any Natural disaster which will happen in futureminutes.

Technology

HTML, CSS, JavaScript, Django, Python.

2. Feature Engineering

PipelineDescription

Algorithms can't make sense of raw data. We have to select, transform, combine, and otherwise prepareour data so the algorithm can find useful patterns.

Technology

Image processing, pattern extraction, etc.

3. Model Training

kitDescription

It learns patterns from the data. Then they use these patterns to perform particular tasks

Technology

Multiclass Classification Model, Regression Model, etc.

4. Prediction

unitDescription

This function is used to predict outcomes from the new trained data to perform new tasks and solve newproblems.

Technology

Decision trees, Regression, Neural networks.

5. Evaluation

systemDescription

It monitors that how Algorithm performs on data as well as during training

Technology

Chi-Square, Confusion Matrix, etc.

6. Interactive

servicesDescription
To interact with our model and give it problems to solve. Usually this takes the form of an API. a userinterface or a command-line interface
Technology
Application programming interface, etc.

7. Data collection

unitDescription

Data is only useful if it's accessible, so it needs to be stored ideally in a consistent structure andconveniently in one place.
Technology
IBM Cloud, SQL Server.

8. Data generation

systemDescription

Every machine learning application lives off data. That data has to come from somewhere. Usually, it'sgenerated by one of your core business functions
Technology
Synthetic data generation.
9. Database management system

Description

An organized collection of data stored in a database, so that it can be easily accessed and managed.
Technology
MySQL, DynamoDB etc.

10. IBM Cloud

servicesDescription

Processed data stored in cloud service which can be access by the admin anywhere over the internet.
Technology
IBM Cloud etc.

Application Characteristics:

1. Open-Source

FrameworksDescription
An open source framework is a template for software development that is designed by a social network of software developers. These frameworks are free for public use and provide the foundation for building asoftware application.

Technology
K eras, tensor flow.

2. Authenticatio

nDescription

This keeps our models secure and makes sure only those who have permission can use them.
Technology
Encryption and Decryption (OTP).

3. Application

interfaceDescription

User uses mobile application and web application to interact with model
Technology
Android and Web Development (PhoneGap, React Native, and Native Script).

4. Availability (both Online and Offline work)

Description

It includes both online and offline work. A good internet connection is needed for online work to explorethe software perfectly. Offline work includes the saved data to explore for later time.
Technology
Caching, backend server.

5. Regular

Updates

Description

The truly excellent software product needs a continuous process of improvements and updates. Maintainyour server and make sure that your content is always up-to-date. Regularly update an app and enrich it with new features.
Technology

- Waterfall Approach
- Incremental Approach
- Spiral Approach

6. Personalization
Description

Software has features like flexible fonts, backgrounds settings, colour themes, etc. which make a softwareinterface look good and functional.
Technology

- HubSpot
- Proof

5.3 User Stories:

User Type	Functional Requirement(Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Upload Data	USN-1	As a user, I can upload either a live stream, video or photo of the disaster	I can upload the data.	High	Sprint-1
Functional Requirement (Epic)	Obtain Output	USN-2	As a user, I can receive the classification and the intensity of thedisaster	I can receive the information about the disaster	High	Sprint-1
Customer (Mobile user)	Upload Data	USN-1	As a user, I can upload either a live stream, video or photo of the disaster	I can upload the data.	High	Sprint-1
Customer (Mobile user)	Obtain Output	USN-1	As a user, I can receive the classification and the intensity of thedisaster.	I can receive the information about the disaster	High	Sprint-1

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint planning and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Collection of Dataset	USN-1	Acquisition of the Natural Disasters dataset	5	High	Printha M, Jeevitha.B, Jayasri.S, Sarvinidevi.M
Sprint-1	Dataset Preprocessing	USN-2	The natural disaster images should be preprocessedusing Image Data Generator Library and configured.	15	High	Printha M, Jeevitha B Jayasri.S, Sarvinidevi.M
Sprint-2	Building the CNN Model	USN-3	Build a CNN Model for classifying the disasters by using the appropriate layers, and split the preprocessed dataset	4	High	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M
Sprint-2	Train, Test, and Validate	USN-4	Train the model, validate it using the Metrics and test the model on an anonymous image/video, using the partitioned dataset.	8	High	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M
Sprint-2	Optimization and Intensity detection	USN-5	Improve on the accuracy and time complexity of the model,and include features for predicting the intensity of classified disaster	8	High	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M
Sprint-3	User Interface Dashboard and Login	USN-6	As a user, I can register for the application by entering my email, password, and verifying account via mail	10	Medium	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M

Sprint -3	Upload images to the application	USN-7	As a web user, I must capture and upload any images of natural disaster occurrences with better clarity.	10	High	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M
Sprint -4	Models Outputs through UI and alerts	USN-8	Ensure accurate classification of disaster, and provide the necessary alerts based on intensity to the user.	10	High	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M
Sprint -4	Login using Third party Service Accounts	USN-9	As a user, I can use the feature of OAuth to login using Gmail.	5	Low	Printha M, Jeevitha B, Jayasri.S, Sarvinidevi.M

6.1 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	13 Nov 2022	15 Nov 2022	20	17 Nov 2022
Sprint-2	20	6 Days	14 Nov 2022	15 Nov 2022	20	17 Nov 2022
Sprint-3	20	6 Days	15 Nov 2022	16 Nov 2022	20	17 Nov 2022
Sprint-4	20	6 Days	16 Nov 2022	16 Nov 2022	20	18Nov 2022

7 CODING & SOLUTIONING:

Feature 1:

A convolutional neural network is a class of artificial neural networks. It is a Deep Learning algorithm that can take in an input image, assign importance to various objects in the image and be able to differentiate one from the other. The pre-processing required in a Convnet is much lower as compared toother classification algorithms.

The advantage of CNNs is to provide an efficient dense network which performs the prediction oridentification efficiently.

Feature 2:

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 andshowcased on the OpenCV window. A multilayer neural network with appropriate weights has been shown **to be able to approximate any input-output function making it an attractive tool for modeling and forecasting**.

8. TESTING:

8.1 Test Cases

8.2 User Acceptance Testing

This document serves as a quick reference for the Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy project's test coverage and open issues as of the project's release for user acceptance testing.

Defect Analysis:-

This shows how many bugs were fixed or closed at each severity level and how theywere fixed.

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	4	5	2	3	14
Duplicate	1	0	3	1	5
External	2	3	0	1	6
Fixed	9	2	4	15	30
Not Reproduced	0	0	1	0	1
Skipped	1	0	1	1	3
Won't Fix	0	5	2	1	8
Totals	17	14	13	22	64

Test-Case Analysis

This report shows the number of test cases that have passed, failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	9	0	0	9
Client Application	40	0	0	40
Security	3	0	0	3
Out-source Shipping	3	0	0	3
Exception Reporting	8	0	0	8
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 Performance Metrics:

S.no.	Parameter	Values (Percentage)
1.	Model Summary	-96%
2.	Accuracy	Training Accuracy - 96.5% Validation Accuracy -92.3%
3.	Confidence Score (Only YoloProjects)	Class Detected - Nil Confidence Score - Nil

Our Project marks the successive performance by implementing in order to be cost effective andmore reliable to use and to predict the future from the natural disaster that we are ahead of. The successive way includes the objectives, activities and the approaches for the project. It mainly includes the trained dataset which gives an excessive measure of success which helps to overcome the future from this natural disaster.

10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- The use of AI to forecast natural disasters would save millions of lives. Furthermore, the information evaluated by AI-powered systems can aid in understanding the scale and patterns of natural catastrophes such as floods, earthquakes, and tsunamis, which would aid in improved infrastructure development in disaster-prone areas.

- Disaster management plays an integral role in keeping communities safe. It involves coordinatingthe resources, such as pollution control systems, and responsibilities, such as following best practice policies, needed to prevent, prepare for, respond to, and recover from emergencies

DISADVANTAGES:

- A forest fire is a natural disaster that cannot be forecasted.

- Sometimes the prediction may fail and result in huge loss.

11. CONCLUSION

Natural disasters inflict severe damage on almost the entire spectrum of social and natural habitats, ranging from housing and shelter, water, food, health, sanitation, and waste management to information and communication networks, supply of power and energy, and transportation infrastructure. The major challenges faced in all disasters include pre-disaster early warning infrastructure; the supply of food and clean drinking water; health and sanitation; information and communication; power and energy for lighting and cooking; waste collection and disposal, including rapid disposal of dead bodies of humans and animals; disaster-proof housing and shelter; emergency and post-disaster shelters; rescue and relief operations; and transport infrastructure. Though it is not possible to prevent most of the disasters, still their effects can be alleviated or mitigated in magnitude by anticipated preparedness. Advanced disaster management technology could provide a critical support system for disaster management authorities at times of disaster-related crises. Such a technology also provides important inputs for any disaster management plan of action in modern times. Communities and individuals have to be educated on pre-disaster planning and preparedness. Awareness must be created amongst masses, for which first-aid training at grass roots level is essential. There should be a National Disaster Plan that defines the tasks of the communities and local health personnel.

For the evaluation of the model ROC and 30% landslide point's residual was used. The

resultsshowed that the accuracy of the model was estimated by ANFIS in the study area of 77.48% (good accuracy); this data-mining method depends on the number of pairs of training, experimental and fuzzy data used in the research, and, in particular, by increasing the number of fuzzy rules of the process, more accurate simulation can be provided. So far, different methods have been proposed for landslide susceptibility zonation. The accuracy or the error of each of these methods, as well as the use and comparison of each of these methods, requires knowledge of the foundations on which the methods are based. So far, different approaches to landslide susceptibility zonation have been proposed, but what is certain is that all these methods can provide accurate results with minimal data and costs and at very low levels. Combining these models with GIS and RS systems not only increases the accuracy of dealing with complex issues and uncertainties, but also leads to the emergence and development of new theories and methodsin a variety of issues.

12. FUTURE SCOPE

The term "Natural Disaster" encompasses the complete realm of disaster-related activities. Traditionally people tend to think of disaster management only in terms of the post-disaster actions taken by relief and reconstruction officials; yet disaster management covers a much broader scope, and many modern disaster managers may find themselves far more involved in pre-disaster activities than in post-disaster response. Those are:

1. The refugee field of disaster management is highly specialized and requires not only many development skills but also a broader awareness of political, legal, and humanitarian issues.
2. DM aims and objectives, elements, Natural/man-made Disasters, Victims, Relief Systems.
3. Phases of Disaster Response/Relief Operations, Government's Role.

To Safeguard and make available vital materials, supplies and equipment to ensure the safety and recovery of records from predictable Disasters. To reduce the risk of disasters caused by human error, deliberate destruction, and building or equipment failures. Be better prepared to recover from a major natural catastrophe.

In this project we help to build preparedness for threats and hazards by providing a low-risk, cost- effective environment to: **Test and validate plans, policies, procedures and capabilities**. Identify resource requirements, capability gaps, strengths, areas for improvement, and potential best practices. Disaster management aims to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. Disaster Risk Management includes the sum total of all activities, programmers and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover fromits losses.

13. APPENDIX:

Source Code

home html:

```
<!DOCTYPE html>
<html lang="en" >
<head>
  <meta charset="UTF-8">
  <title>Natural disaster</title>
  <link href="https://fonts.googleapis.com/css?family=Assistant:400,700" rel="stylesheet">
  <link rel="stylesheet" href="{{ url_for('static', filename='style.css') }}">
</head>
<body>
<!-- partial:index.partial.html -->
<section class='login' id='login'>
  <div class='head'>
  <h1 class='company'>Natural Disaster Classification & Intensity Analysis</h1>
  </div>
  <p class='msg'>Welcome!!!</p>
<br>
<br>
  <div class='form'>
    <form>
  <input type="text" placeholder='Enter your name' class='text' id='username' required><br>
  <!--<input type="password" placeholder='Password' class='password'><br>-->
<br>
<br>
<br>
 <center> <a href="/intro" class='btn-login' id='do-login'>Introduction</a></center>
<br>
<br>
<br>
 <center> <a href="/run" class='btn-login' id='do-run'>Run</a></center>
<!-- <a href="#" class='forgot'>Forgot?</a>-->
<!--placeholder='••••••••••••••'-->
    </form>
<br>
<br>
<br>
  </div>
</section>
<!-- partial -->
```

```
  <script  src="{{ url_for('static', filename='script.js') }}"></script>

</body>
</html>
```

intro.html:

```
<!DOCTYPE html>
<html lang="en" >
<head>
  <meta charset="UTF-8">
  <title>Classic Login Form Example</title>
  <link href="https://fonts.googleapis.com/css?family=Assistant:400,700" rel="stylesheet">
  <link rel="stylesheet" href="{{ url_for('static', filename='style.css') }}">
</head>
<body>
   <section class='login' id='login'>
      <p>Hi, </p>
      <br>
      <p>We hope you are safe :)
         <br>
         <br>
         This application aims to solve real life problem of disaster identification
         <br>along with its estimated intensity on a level of 1-5.
         <br>1 denotes low level intensity while 5 denotes the highest intensity level.
         The users are requested<br>
         to use the run button to upload good, clarity pictures to run
         our convolutional network ... </p>
         <br>
         <br>
         <div class="form">
         <center><a href="/run" class='btn-login'>Run</a></center></div><br>
```

```
            <br>
        </section>
        <script  src="{{ url_for('static', filename='script.js') }}"></script>
         </body>
           </html>
```

upload.html:

```
        <html lang="en">
    <head>
        <title>Register</title>
        <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
    <style>
    .header {       position: relative;
                        top:0;
                        margin:0px;
                        z-index: 1;
                        left: 0px;
                        right: 0px;
                        position: fixed;
                        background-color: #F36262 ;
                        color: white;
                        box-shadow: 0px 8px 4px grey;
                        overflow: hidden;
                        padding-left:20px;
                        font-family: 'Josefin Sans';
                        font-size: 2vw;
                        width: 100%;
                        height:8%;
                        text-align: center;
                    }
                    .topnav {
      overflow: hidden;
      background-color: #FCAD98;
    }

    .topnav-right a {
      float: left;
      color: black;
      text-align: center;
      padding: 14px 16px;
      text-decoration: none;
      font-size: 18px;
    }

    .topnav-right a:hover {
      background-color: #FCAD98;
```

```
  color: black;
}

.topnav-right a.active {
  background-color: #FCAD98;
  color: white;
}

.topnav-right {
  float: right;
  padding-right:100px;
}

body {

  background-color: ;
  background-repeat: no-repeat;
  background-size:cover;
  background-image:
url("https://i.pinimg.com/originals/b2/1d/c6/b21dc69346915015bc4e19bd502f401b.gif");
    background-size: cover;
  background-position: 0px 0px;
  }
  .button {
  background-color: #091425;
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 12px;
  border-radius: 16px;
}
.button:hover {
  box-shadow: 0 12px 16px 0 rgba(0,0,0,0.24), 0 17px 50px 0 rgba(0,0,0,0.19);
}
form {border: 3px solid #f1f1f1; margin-left:400px;margin-right:400px;}

input[type=text], input[type=password] {
  width: 100%;
  padding: 12px 20px;
  display: inline-block;
  margin-bottom:18px;
  border: 1px solid #ccc;
  box-sizing: border-box;
}

button {
  background-color: #091425;
  color: white;
```

```
  padding: 14px 20px;
  margin-bottom:10px;
  border: none;
  cursor: pointer;
  width: 17%;
  border-radius:4px;
  font-family:Montserrat;
}

button:hover {
  opacity: 0.8;
}

.cancelbtn {
  width: auto;
  padding: 10px 18px;
  background-color: #f44336;
}

.imgcontainer {
  text-align: center;
  margin: 24px 0 12px 0;
}

img.avatar {
  width: 30%;
  border-radius: 50%;
}

.container {
  padding: 16px;
}

span.psw {
  float: right;
  padding-top: 16px;
}

/* Change styles for span and cancel button on extra small screens */
@media screen and (max-width: 300px) {
  span.psw {
     display: block;
     float: none;
  }
  .cancelbtn {
     width: 100%;
  }
}

.home{
          margin:80px;
```

```
  width: 84%;
  height: 500px;
  padding-top:10px;
  padding-left: 30px;

}
.login{
          margin:80px;
          box-sizing: content-box;
  width: 84%;
  height: 420px;
  padding: 30px;
  border: 10px solid blue;
}
.left,.right{
 box-sizing: content-box;
 height: 400px;
 margin:20px;
 border: 10px solid blue;
}



mySlides {display: none;}
img {vertical-align: middle;}

/* Slideshow container */
.slideshow-container {
  max-width: 1000px;
  position: relative;
  margin: auto;
}

/* Caption text */
.text {
  color: #f2f2f2;
  font-size: 15px;
  padding: 8px 12px;
  position: absolute;
  bottom: 8px;
  width: 100%;
  text-align: center;
}
/* The dots/bullets/indicators */
.dot {
  height: 15px;
  width: 15px;
  margin: 0 2px;
  background-color: #bbb;
  border-radius: 50%;
```

```
  display: inline-block;
  transition: background-color 0.6s ease;
}

.active {
  background-color: #FCAD98;
}

/* Fading animation */
.fade {
  -webkit-animation-name: fade;
  -webkit-animation-duration: 1.5s;
  animation-name: fade;
  animation-duration: 1.5s;
}

@-webkit-keyframes fade {
  from {opacity: .4}
  to {opacity: 1}
}

@keyframes fade {
  from {opacity: .4}
  to {opacity: 1}
}

/* On smaller screens, decrease text size */
@media only screen and (max-width: 300px) {

  .text {font-size: 11px}
}
.bar
{
margin: 0px;
padding:20px;
background-color:white;
opacity:0.6;
color:black;
font-family:'Roboto',sans-serif;
font-style: italic;
border-radius:20px;
font-size:25px;
}
a
{
color:grey;
float:right;
text-decoration:none;
font-style:normal;
padding-right:20px;
}
```

```
a:hover{
background-color:black;
color:white;
border-radius:15px;0
font-size:30px;
padding-left:10px;
}
body
{
   background-image: url("https://images.unsplash.com/photo-1532883130016-
f3d311140ba8?ixid=MXwxMjA3fDB8MHxwaG90by1wYWdlfHx8fGVufDB8fHw%3D&ixlib=rb-
1.2.1&auto=format&fit=crop&w=1050&q=80");
   background-size: cover;
}
p
{
color:white;
font-style:italic;
font-size:30px;
}
</style>
</head>

<body>

<div class="header">
<div style="width:50%;float:left;font-size:2vw;text-align:left;color:black; padding-top:1%;padding-
left:5%;">AI based Natural disaster analysis</div>
  <div class="topnav-right"style="padding-top:0.5%;">

   <a  href="\F:\College Academics\PRIEE\AI-Based-Natural-Disaster-Intensity-Analysis-
main\Flask\templates\home.html">Home</a>
   <a href="F:\College Academics\PRIEE\AI-Based-Natural-Disaster-Intensity-Analysis-

main\Flask\templates\intro.html">Introduction</a>
   <a class="active" href="F:\College Academics\PRIEE\AI-Based-Natural-Disaster-Intensity-Analysis-
main\Flask\templates\upload.html">Open Web Cam</a>
  </div>
</div>
```

Loading our data and performing data agumentation

AI based Natural disaster analysis

Importing Neccessary Libraries

```
[ ] import numpy as np#used for numerical analysis
    import tensorflow #open source used for both ML and DL for computation
    from tensorflow.keras.models import Sequential #it is a plain stack of layers
    from tensorflow.keras import layers #A layer consists of a tensor-in tensor-out computation function
    #Dense layer is the regular deeply connected neural network layer
    from tensorflow.keras.layers import Dense,Flatten
    #Faltten-used fot flattening the input or change the dimension
    from tensorflow.keras.layers import Conv2D,MaxPooling2D #Convolutional layer
    #MaxPooling2D-for downsampling the image
    from keras.preprocessing.image import ImageDataGenerator
```

```
    Using TensorFlow backend.
```

Creating the model

```
# Initializing the CNN
classifier = Sequential()

# First convolution layer and poolingo
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
# Second convolution layer and pooling
classifier.add(Conv2D(32, (3, 3), activation='relu'))
# input_shape is going to be the pooled feature maps from the previous convolution layer
classifier.add(MaxPooling2D(pool_size=(2, 2)))
classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))

# Flattening the layers
classifier.add(Flatten())

# Adding a fully connected layer
classifier.add(Dense(units=128, activation='relu'))
classifier.add(Dense(units=4, activation='softmax')) # softmax for more than 2
```

Fitting the model

```
[ ] classifier.fit_generator(
            generator=x_train,steps_per_epoch = len(x_train),
            epochs=40, validation_data=x_test,validation_steps = len(x_test))# No of images in test set
```

```
40/40 [==============================] - 9s 239ms/step - loss: 0.7445 - accuracy: 0.7266 - val_loss: 0.6234 - val_accuracy: 0.7172
Epoch 13/40
40/40 [==============================] - 9s 239ms/step - loss: 0.5752 - accuracy: 0.7508 - val_loss: 0.5389 - val_accuracy: 0.7980
Epoch 14/40
40/40 [==============================] - 10s 242ms/step - loss: 0.6582 - accuracy: 0.7428 - val_loss: 0.4447 - val_accuracy: 0.8283
Epoch 15/40
40/40 [==============================] - 9s 240ms/step - loss: 0.5318 - accuracy: 0.7766 - val_loss: 0.4859 - val_accuracy: 0.8131
Epoch 16/40
40/40 [==============================] - 9s 240ms/step - loss: 0.4472 - accuracy: 0.8269 - val_loss: 0.6708 - val_accuracy: 0.7273
Epoch 17/40
40/40 [==============================] - 10s 246ms/step - loss: 0.5900 - accuracy: 0.7400 - val_loss: 0.6847 - val_accuracy: 0.7525
Epoch 18/40
40/40 [==============================] - 10s 249ms/step - loss: 0.5226 - accuracy: 0.8148 - val_loss: 0.8422 - val_accuracy: 0.7222
Epoch 19/40
40/40 [==============================] - 11s 277ms/step - loss: 0.5587 - accuracy: 0.8253 - val_loss: 0.4669 - val_accuracy: 0.8081
Epoch 20/40
```

Saving our model

```
[ ] # Save the model
    classifier.save('disaster_f.h5')
```

```
[ ] model_json = classifier.to_json()
    with open("model-bw.json", "w") as json_file:
        json_file.write(model_json)
```

```
[ ]
```

Predicting our results

```
from tensorflow.keras.models import load_model
from keras.preprocessing import image
#model = load_model("disaster_f.h5") #loading the model for testing
```

c_check_earthquake.py:

```
def check_earthquakes_location(lat_out=float,lon_out=float):

    try:

        TARGET_REQ_URL = "https://www.emsc-csem.org/service/rss/rss.php?typ=emsc"

        REQ_TARGET = requests.get(TARGET_REQ_URL).text
        SOUP_TARGET = BeautifulSoup(REQ_TARGET,"html.parser")

        FIND_ALL_IT = SOUP_TARGET.find_all("item")

        checking_value = 0

        print("\n")
        time.sleep(1.2)
        print("CONNECTED PORTAL I")


        for x_loop in FIND_ALL_IT:

            TITLE_OUT = x_loop.find("title")
            LAT_OUT = x_loop.find("geo:lat")
            LON_OUT = x_loop.find("geo:long")
```

C_earthquake_g.py:

```
def get_earthquake(count_search=int):

    SOURCE_URL ='https://ds.iris.edu/seismon/eventlist/index.phtml'

    try:

        MAIN_URL_REQ = requests.get(SOURCE_URL).text
        MAIN_SOUP_URL = BeautifulSoup(MAIN_URL_REQ,"html.parser")
        PARAMS_ALL_GET = MAIN_SOUP_URL.find_all("table",class_="tablesorter")

        i_count_stop = 0

        for X_DETAIL in PARAMS_ALL_GET:

            DETAIL_TR_ALL = X_DETAIL.find_all("tr")

            for x_d in DETAIL_TR_ALL:

                LIST_DETAIL_ALL = x_d.text.replace("\n",",").split(",")
                i_count_stop += 1

                if 1 < i_count_stop < count_search:
```

c_alternative_earthquake.py:

```
def get_alternative_earthquake():

    TARGET_REQ_URL = "https://www.emsc-csem.org/service/rss/rss.php?typ=emsc"

    REQ_TARGET = requests.get(TARGET_REQ_URL).text
    SOUP_TARGET = BeautifulSoup(REQ_TARGET,"html.parser")

    FIND_ALL_IT = SOUP_TARGET.find_all("item")

    try:

        for x_loop in FIND_ALL_IT:

            TITLE_OUT = x_loop.find("title")
            LAT_OUT = x_loop.find("geo:lat")
            LON_OUT = x_loop.find("geo:long")
            DEP_OUT = x_loop.find("emsc:depth")
            MAG_OUT = x_loop.find("emsc:magnitude")
            TIME_OUT = x_loop.find("emsc:time")
            ST_OUT = x_loop.find("status")

            time.sleep(0.8)
            print("\n")
```

C_flood.py:

```
def get_flood(count_search=int):

    try:

        GDACS_TARGET = requests.get("https://www.gdacs.org/default.aspx").text
        SOUP_GDACS = BeautifulSoup(GDACS_TARGET,"html.parser")
        ALL_F_DISASTER = SOUP_GDACS.find_all("div",id="mainListFl")

        CONTROL_VALUE_LIST = []

        i_count_stop = 0


        for x_att in ALL_F_DISASTER:

            ALERT_DETAIL_LINK = x_att.find_all("a")

            for x_detail_link in ALERT_DETAIL_LINK:

                LINK_AFTER_SITE = str(x_detail_link.get("href"))

                SUB_TARGET = requests.get(LINK_AFTER_SITE).text
                SOUP_GDACS_FUNCTION = BeautifulSoup(SUB_TARGET,"html.parser")
```

c_help.py:

```
def how_to_use():

    try:

        MY_TEXT = "ISC INITIATIVE"

        MY_FONT = ImageFont.truetype("verdanab.ttf", 11)
        MY_SIZE = MY_FONT.getsize(MY_TEXT)

        MY_IMG = Image.new("1",MY_SIZE,"black")
        DRAW_FUNC = ImageDraw.Draw(MY_IMG)
        DRAW_FUNC.text((0, 0), MY_TEXT, "white", font=MY_FONT)

        PIX_RES = np.array(MY_IMG, dtype=np.uint8)
        CHAR_RES = np.array([' ','#'], dtype="U1")[PIX_RES]

        STR_RES = CHAR_RES.view('U' + str(CHAR_RES.shape[1])).flatten()
        print("\n".join(STR_RES))

    except:

        pass
```

c_import.py

```
"""
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We are an initiative that conducts studies in the field of Space Science, publishes projects and reports, offers analytical perspectives and data ana
We believe that science changes the future.
initiative.isc@protonmail.com
initiative.isc@tutanota.com
"""

from __future__ import print_function

try:

    from PIL import Image, ImageDraw, ImageFont
    from optparse import OptionParser
    import requests
    from bs4 import BeautifulSoup
    import sys
    import time
    import numpy as np
    import warnings

    warnings.filterwarnings(action="ignore",message="CHECK PYTHON VERSION")
    warnings.filterwarnings(action="ignore",message="ALREADY IMPORTED",category=UserWarning)
```

C_local_alert:

```
def get_local_based(search_parameters=str,count_search=int):

    TARGET_URL = f"https://severeweather.wmo.int/{search_parameters}/"

    try:

        TAR_REQ = requests.get(TARGET_URL).text
        BS_REQ = BeautifulSoup(TAR_REQ,"html.parser")

        Area_ALL = BS_REQ.find_all("area")

        i_count_stop = 0

        for x_loop_area in Area_ALL:

            HREF_ALL_AREA_PATH = x_loop_area.get("href")
            REP_DOT_RAIN = HREF_ALL_AREA_PATH.replace("./","")
            ALL_PATH_RAIN = TARGET_URL + REP_DOT_RAIN

            NEW_TAR_REQ = requests.get(ALL_PATH_RAIN).text
            BS_NEW_TAR = BeautifulSoup(NEW_TAR_REQ,"html.parser")
            AREA_NEW_ALL = BS_NEW_TAR.find_all("area")
```

C_nasaoent.

```
def get_nasa_eonet(count_search=int):

    TEST_SPEC_TARGET_URL = "https://eonet.sci.gsfc.nasa.gov/api/v3/events"

    try:

        READ_URL = requests.get(TEST_SPEC_TARGET_URL)
        READ_JSON = READ_URL.json()

        EVENTS_JSON = READ_JSON["events"]


        for x_range in range(count_search):


            EVENT_TITLE = EVENTS_JSON[x_range]["title"]
            EVENT_DATE = EVENTS_JSON[x_range]["geometry"][0]["date"]
            EVENTS_LAT = EVENTS_JSON[x_range]["geometry"][0]["coordinates"][1]
            EVENTS_LON = EVENTS_JSON[x_range]["geometry"][0]["coordinates"][0]

            time.sleep(0.8)
            print("\n")
            print("TITLE: ",EVENT_TITLE)
```

c_seismic.py:

```
def get_seismic_data(count_search=int):

    TARGET_REQ_URL = f"https://www.seismicportal.eu/mtws/api/search?&format=json&downloadAsFile=false&orderby=tim

    try:

        READ_URL = requests.get(TARGET_REQ_URL)
        READ_JSON = READ_URL.json()

        for x_num in range(len(READ_JSON)):

            NEW_JSON = READ_JSON[x_num]

            time.sleep(0.8)
            print("\n")
            print("REGION: ",NEW_JSON["ev_region"])
            print("LATITUDE: ",NEW_JSON["ev_latitude"])
            print("LONGITUDE: ",NEW_JSON["ev_longitude"])
            print("DEPTH: ",NEW_JSON["ev_depth"])
            print("MAGNITUDE VALUE: ",NEW_JSON["ev_mag_value"])
            print("MAGNITUDE TYPE: ",NEW_JSON["ev_mag_type"])
            print("EVENT TIME: ",NEW_JSON["ev_event_time"])
            print("FULL COUNT: ",NEW_JSON["full_count"])
```

C_valcano_g:

```
def get_volcano(count_search=int):

    try:

        GDACS_TARGET = requests.get("https://www.gdacs.org/default.aspx").text
        SOUP_GDACS = BeautifulSoup(GDACS_TARGET,"html.parser")
        ALL_V_DISASTER = SOUP_GDACS.find_all("div",id="mainListVo")
        CONTROL_VALUE_LIST = []
        i_count_stop = 0


        for x_att in ALL_V_DISASTER:

            ALERT_DETAIL_LINK = x_att.find_all("a")

            for x_detail_link in ALERT_DETAIL_LINK:

                LINK_AFTER_SITE = str(x_detail_link.get("href"))

                SUB_TARGET = requests.get(LINK_AFTER_SITE).text
                SOUP_TARGET = BeautifulSoup(SUB_TARGET,"html.parser")
                SUB_TARGET_DIV = SOUP_TARGET.find_all("div",id="alert_summary_left")
```

C_valcano_alternative:

```
def get_alternative_volcano():

    TARGET_REQ_URL = "https://volcano.si.edu/news/WeeklyVolcanoRSS.xml"

    try:

        REQ_TARGET = requests.get(TARGET_REQ_URL).text
        SOUP_TARGET = BeautifulSoup(REQ_TARGET,"html.parser")

        FIND_ALL_ITE = SOUP_TARGET.find_all("item")


        for x_loop in FIND_ALL_ITE:

            TITLE_OUT = x_loop.find("title")
            DES_OUT = x_loop.find("description")
            COOR_OUT = x_loop.find("georss:point")

            time.sleep(0.8)
            print("\n")
            print("TITLE: ",TITLE_OUT.text)
            print("DESCRIPTION: ",DES_OUT.text.replace("<p>","").replace("</p>",""))
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-43123-1660713197