Date	**20-october-2022**
Team ID	**PNT2022TMID4511**
Project Name	Natural Disasters Intensity Analysis and Classification using Artificial Intelligence
Maximum Marks	2 Marks

Literature Survey

Natural Disasters Intensity Analysis and Classification using Artificial Intelligence

1. **Islam A.R.M.T., Talukdar S., Mahato S., Kundu S., Eibek K.U., Pham Q.B., Kuriqi A., Linh N.T.T. Flood susceptibility modelling using advanced ensemble machine learning models. *Geosci. Front.* 2021.**

Floods are one of nature's most destructive disasters because of the immense damage to land, buildings, and human fatalities. It is difficult to forecast the areas that are vulnerable to flash flooding due to the dynamic and complex nature of the flash floods. Therefore, earlier identification of flash flood susceptible sites can be performed using advanced machine learning models for managing flood disasters. In this study, we applied and assessed two new hybrid ensemble models, namely Dagging and Random Subspace (RS) coupled with Artificial Neural Network (ANN), Random Forest (RF), and Support Vector Machine (SVM)

2. **Yang S., Hu J., Zhang H., Liu G. Simultaneous Earthquake Detection on Multiple Stations via a Convolutional Neural Network. *Seism. Res. Lett.* 2021.**

This study considers earthquake detection as the problem of image classification and convolutional neural networks (CNNs), as some of the widely used deep-learning tools in image processing, can be well used to solve this problem. In contrast to existing studies training the network using seismic data from individual stations, in this study, we train a CNN model jointly using records of multiple stations. Because the CNN automatically synthesizes information among multiple stations, the detector can more reliably detect seismic events and is less affected by spurious signals. The CNN is trained using aftershock data of the 2013 MwMw 6.6 Lushan earthquake. We have applied it on two very different datasets of Gofar transform fault, East Pacific Rise and Changning shale gas field in southern Sichuan basin, China.

3. **Meadows M., Wilson M. A Comparison of Machine Learning Approaches to**

Improve Free Topography Data for Flood Modelling. ***Remote Sens.*** **2021.**

To predict (and thereby reduce) these biases, we apply a fully-convolutional neural network (FCN), a form of artificial neural network originally developed for image segmentation which is capable of learning from multi-variate spatial patterns at different scales. We assess its potential by training such a model on a wide variety of remote-sensed input data (primarily multi-spectral imagery), using high-resolution, LiDAR-derived Digital Terrain Models published by the New Zealand government as the reference topography data. In parallel, two more widely used machine learning models are also trained, in order to provide benchmarks against which the novel FCN may be assessed. We find that the FCN outperforms the other models (reducing root mean square error in the testing dataset by

71%), likely due to its ability to learn from spatial patterns at multiple scales, rather than only a pixel-by-pixel basis.

4. **Mignan A., Broccardo M. Neural network applications in earthquake prediction (1994–2019): Meta-analytic and statistical insights on their limitations. *Seism. Res. Lett.* 2020.**

Earthquake prediction, the Grail of Seismology, is, in this context of continuous exciting discoveries, an obvious choice for deep learning exploration. We reviewed the literature of artificial neural network (ANN) applications for earthquake prediction (77 articles, 1994–2019 period) and found two emerging trends: an increasing interest in this domain over time and a complexification of ANN models toward deep learning. Despite the relatively positive results claimed in those studies, we verified that far simpler (and traditional) models seem to offer similar predictive powers, if not better ones. Those include an exponential law for magnitude prediction and a power law (approximated by a logistic regression or one artificial neuron) for aftershock prediction in space.

5. **Tonini M., D'Andrea M., Biondi G., Degli Esposti S., Trucchia A., Fiorucci P. A Machine Learning-Based Approach for Wildfire Susceptibility Mapping. The Case Study of the Liguria Region in Italy. *Geosciences.* 2020.**

Wildfire susceptibility maps display the spatial probability of an area to burn in the future, based solely on the intrinsic local proprieties of a site. Current studies in this field often rely on statistical models, often improved by expert knowledge for data retrieving and processing. In the last few years, machine learning algorithms have proven to be successful in this domain, thanks to their capability of learning from data through the modeling of hidden relationships. In the present study, authors introduce an approach based on random forests, allowing elaborating a wildfire susceptibility map for the Liguria region in Italy. This region is highly affected by wildfires due to the dense and heterogeneous vegetation, with more than 70% of its surface covered by forests, and due to the favorable climatic conditions. Susceptibility was assessed by considering the dataset of the mapped fire perimeters, spanning a 21-year period (1997–2017) and different geo-environmental predisposing factors (i.e., land cover, vegetation type, road network, altitude, and derivatives).

6. **Tang C., Zhu Q., Wu W., Huang W., Hong C., Niu X. PLANET: Improved convolutional neural networks with image enhancement for image classification. *Math. Probl. Eng.* 2020.**

A research hotspot and has had a profound impact on computer vision. Deep CNN has been proven to be the most important and effective model for image processing, but due to the lack of training samples and huge number of learning parameters, it is easy to tend to overfit. In this work, we propose a new two-stage CNN image classification network, named "Improved Convolutional Neural Networks with Image Enhancement for Image Classification" and PLANET in abbreviation, which uses a new image data enhancement method called InnerMove to enhance images and augment the number of training samples.

InnerMove is inspired by the "object movement" scene in computer vision and can improve the generalization ability of deep CNN models for image classification tasks.

7. **Direkoglu C. Abnormal Crowd Behavior Detection Using Motion Information Images and Convolutional Neural Networks.** ***IEEE Access*** **2020.**

Particularly, our work focuses on panic and escape behavior detection that may appear because of violent events and natural disasters. First, optical flow vectors are computed to generate a motion information image (MII) for each frame, and then MIIs are used to train a convolutional neural network (CNN) for abnormal crowd event detection. The proposed MII is a new formulation that provides a visual appearance of crowd motion. The proposed MIIs make the discrimination between normal and abnormal behaviors easier. The MII is mainly based on the optical flow magnitude, and angle difference computed between the optical flow vectors in consecutive frames. A CNN is employed to learn normal and abnormal crowd behaviors using MIIs.

8. **Zhai C., Zhang S., Cao Z., Wang X. Learning-based prediction of wildfire spread with real-time rate of spread measurement.** ***Combust. Flame.*** **2020.**

A learning-based wildfire spread model was developed in this study to predict short-term wildfire spread. Real-time rate of spread (RoS) measurement was first conducted by calculating normal movements of fire fronts. Subsequently, machine learning was employed to correlate the local RoS and environmental parameters and predict the RoS in the unburnt area. After that, a narrow-band level-set method was utilized to simulate the evolution of fire front. RoS measurement, machine learning, and level-set method were individually verified with numerically generated fire fronts, and applied in a real scale shrubland fire scenario. Results show that the proposed learning-based method is capable of predicting short-term fire spread without employing an empirical RoS model, which is beneficial for modeling spreading of a real wildfire.

9. **Tan J., Chen S., Wang J. Western North Pacific tropical cyclone track forecasts by a machine learning model.** ***Stoch. Environ. Res. Risk Assess.*** **2020.**

First, we investigated predictors including TC climatology and persistence factors which were extracted from TC best-track dataset and storm's surrounding atmospheric conditions which were extracted from ERA-Interim reanalysis. Then, we built a Gradient Boosting Decision Tree (GBDT) nonlinear model for TC track forecasts, in which 30-year data was used. Finally, using tenfold cross-validation method, the GBDT model was compared with a frequently used technique: climatology and persistence (CLIPER) model. The experimental results show that the GBDT model performs well in three forecast times (24 h, 48 h, and 72 h) with relatively small forecast error of 138, 264, and 363.5 km, respectively. The model obtains excellent TC moving direction aspects. However, the model is still insufficient to produce aspects of storm acceleration and deceleration, with mean moving velocity sensitivities all less than 60%. Nevertheless, the model obtains much more robust and accurate TC tracks relative to CLIPER model, where the forecast skills are 17.5%, 26.3%, and 32.1% at three forecast times, respectively.