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Assignment No 2 AI techniques for Natural Disasters

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1- Natural disaster It is a natural event such as flood, earthquake or hurricane that cause damage or loss of life. It effects both living and non-living.

2- Natural Disaster prediction Natural disasters are inevitable in our world. Natural disasters are of different types so it is difficult to predict each and everyone. Meteorologists can track a hurricane with precision, but seismologists cannot predict exactly when and where an earthquake will occur. Prediction of disasters require extensive research and funding. To predict a natural disaster we have to collect extensive past data, record live data and generate patterns on previous data. By comparing past and live

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data scientist predicts the future events to some extent. Trends are recalculated and used to predict earthquakes, tsunamis and volcanic eruptions. We can also predict natural disasters by constant surveillance.

Using offshore cameras in hurricane prone areas ensures that strong winds and waves can be recognized, that will help in tsunami predictions.

Monitoring ocean currents, weather predictions can be predicted in advance, warning nearby areas in advance under the risk of hurricanes and tornados.

But these short term warnings are only effective when relief programs are planned and effectively carried out. But this method is very costly and inefficient. For cost effectiveness and timely information of natural disaster, predicting it in advance is the only solution. However it is not always reliable, because disasters unexpected and do not always follows trends.

But it will save much time and resource than constant surveillance. 3-

Al techniques for earthquake predictions Natural disasters like earthquakes are caused due to the propagating seismic waves underneath the surface of earth. Seismometers are installed on different geographical positions to record vertical motion of surface waves.

Ground motion types are divergence, convergence which results in transforming plate boundaries. Major earthquakes are caused by divergence, convergence and transformation of plate boundaries commonly known as faults. The origin where earthquake takes place is origin point. Total sum of waves are calculated and time series data is collected for further processing.

There are four different aspects of this time series data with respect to geophysical analysis can be considered for experimentation. 1.

Analyze the earthquake data recording indifferent time points independent of common source gather or common receivergather recordings.

2. Analyze the earthquake data set in fixed or variable length time intervals to predict different hidden patterns
 3. Gathering layers data, like layer between Euro-Asian and Indian plate etc, in time points to better analyze and study the seismic patterns of layer with respect to time
 4. Gather and analyze the earth lithosphere layer data with respect to time intervals. Such identified characteristics of earthquake can be easily scaled down using some activation function.

Figure 1: Illustration of criteria for fitness function
 3. 1 - Feed Forward Neural Network
 It is used with sigmoid function. FFN is used on Seismic Electric signals, predicted magnitude and pre-determined future seismic events.

Prediction of structural responses for a structure has 80.55% accuracy.
 Prediction has 71% efficiency.

It is able to predict both long and short term shocks. Outputs of different layers are not feedback.
 3. 2 - Particle Swarm Optimization
 PSO is used for building prior knowledge system. It is used for selection of input values for the BPN (Back Propagation Neural Network) based network. It can determine earthquake local earthquake location.

Works on the principles of Swarms of particles searching for optimal solution in the defined search space. Converge to the solution more efficiently than general BPN.
 3. 3 - Genetic Algorithm
 Rock mass stability is estimated for planning purpose.

Structural formation has been studied using GA. Lower the data uncertainty. Used for building settlement forecast after main shocks. Used in combination with support vector machines for earthquake data set. GA can work with improper or incomplete seismic data. It is found highly efficient in prediction for future earthquakes. Commonly used in research with different alterations. 3.

4 - Clustering Spatial clustering is used versus temporal clustering for earthquake data sets. Spatial clustering has been identified in data set while building earthquake forecast model using differential probability. Set of clusters is developed from huge set of unsupervised data. This makes the overall scenario to be divided into many sub-scenarios. Used in MSc algorithm with different aspect. Until recently, Artificial Intelligence based techniques were widely used for earthquake time series prediction. , the results of traditional approaches of probability estimation should be enhanced by using the particle swarm optimization and genetic algorithms based approaches. PSO and GA are capable to find actual fault intensity in any particular region.

This work is an attempt to cover different strategies related to AI for earthquake prediction and cross check their reliability. . 4- AI techniques for Water Storms Prediction Water storms occur due to intense unsustainable winds in oceans. Hurricanes, cyclones and typhoons are all water storms but their name is different due to the geographical location of storm. There are different artificial intelligence techniques to predict storms. Some are given below. 4.

1 - Nonlinear AI ensemble prediction A new nonlinear artificial intelligence ensemble prediction (NAIEP) model has been developed for predicting typhoon intensity based on multiple neural networks with the same expected output and using an evolutionary genetic algorithm (GA). Ensemble numerical prediction (ENP) model, whether created with different physical process parameterization schemes or with different initial conditions from a Monte Carlo approach, formally consists of many different ensemble members. By optimizing the network structure and the connection weight of ANNs, genetic evolution is able to create a number of different neural network individuals. Ensemble prediction of NWP is motivated by the fact that NWP forecasts are sensitive both to small uncertainties in the initial conditions and model errors, so it is hard to further improve the accuracy of single model deterministic predictions. To construct an NAIEP model, a number of individual neural networks are first created and then integrated to build an ensemble prediction model. A GA is used to construct the members of the ensemble, and a three-layer back-propagation (BP) network is used as the basic model for the neural networks, the major computational steps are summarized below:

1. Randomly generate the connection weights and thresholds from input layer to hidden layer and from hidden layer to output layer, and set the global convergence error, ϵ , of the model.

2. Perform supervised learning training of the network with learning matrix samples, calculate the error between the real input and expected output of the network, and tune the connection weight coefficients from input layer to hidden layer and from hidden layer to output layer using the learning

algorithm of the error-inverse propagation of the BP network. 3. If the calculated output error of the model is greater than ϵ , return to step 2; otherwise, end the training and compute the prediction value using the connection weights, thresholds of the network, and predictors of the prediction samples. The meteorological ensemble modeling approach of GNN opens up a vast range of possibilities for operational weather prediction.

4. 2 - Back propagation Neural Network Like human neural network in artificial neural network has 3 layers; perceptron, dendrites and axon. In NN, each input is multiplied by its weight of its connection of neuron.

Connection determine which input has to be forward and then it sums up all the inputs. Then it is passed through the hidden layer to calculate its results. After it passes the result to output layer. In back propagation NN, there is only one input layer, one output layer and a hidden layer. It is easy to calculate the results. To compute the prediction of storm or any other disaster information is collected and then it is feed to the neural network. First of all data is normalized then it is feed to input layer. From input layer the data is transferred to hidden layer.

There we do our calculations by applying sigmoid function. From hidden layer calculations are collected and summed up, this sum is input to output layer. NN with back propagation is a self-driving system which collects data then train itself for different conditions and scenarios and produce results. NN with back propagation and other NN's are not more than pattern recognition

techniques. They are just some short term predictive skills not to replace metrologies.

But it can help in understanding metrological problems and can solve many complicated patterns that are difficult to solve by humans and simple programs. 5- Degree of success in natural disaster prediction by AI For some people weather forecasts are just for surety of good day ahead. But for some people it is everything. Their bread and butter depends upon it. By applying artificial intelligence knowledge we have been able to transform life of many people and giving them a new chance.

Companies and governments are collecting data of winds, water and soil from satellites and different devices installed on different portions on earth.

Physical understanding of environment with the combination of artificial intelligence improves prediction skills for multiple types of natural disasters like thunderstorms, tornadoes, hurricanes, volcanic eruptions, earthquakes and many more. Hail forecasting can be forecasted accurately by using machine learning according to research paper. Hail causes billions of dollars damages every year. Many cars, airplanes and buildings are affected in hail storms. By forecasting hail storms cars can be moved to safe places, flights can be delayed and prevention measures can be taken for buildings to protect them from heavy damages.

IBM is commercializing its weather forecasting for that purpose so warning can be issued to people from heavy damage. Big companies like IBM, Panasonic are working on their weather forecasting systems and increasing its accuracy day by day by applying new developed and refined artificial

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intelligence and computational intelligence techniques. Better weather forecasting allows airlines to change their routes and save money and time, improve safety and increase on time arrivals.

Better weather predictions has direct effect on different fields of life. It directly effects the agriculture, 90% of crops are destroyed by weather conditions. It can be controlled by proper weather conditions. If damage is inevitable then we can save our money and time by not planting that kind of crops that are not suitable for that kind of weather condition. Transportation is improved by weather forecasting a lot.

Directing routes of flights in near storm save many lives and money than ever. Road transport is improved by making optimized routes for hilly and severe condition areas. The company using Panasonic's weather forecasting shows significant rise in commercial aircrafts climb profile optimization.

. They claim their system can reduce fuel consumption by up to 10 percent during ascent. By putting in that perspective, US airline carriers spent \$24.

6 billion on fuel last year. Better weather forecasting saves many lives and helps to speed up the rebuilding efforts. Companies like IBM and Panasonic has started to combine their weather forecasting tools with information about utilities' distribution networks and data about local ground cover for severe storms. Machine learning helps them to predict many severe conditions and outages. IBM claims that their prediction is about 70- 80 % accurate and is 72 hours before the disaster. Weather related data source will continue to grow dramatically and the new advances in machine learning are making it possible for government agencies and companies to make better use of all <https://assignbuster.com/assignment-prediction-by-your-name-table-of-contents/>

this data. Weather is always unpredicted and it can never be truly perfected, but AI will allow to make consistent improvement in its accuracy and in its resolution.

More refined and localized weather information will help to make it easier to find distinct patterns and connections in them. Small improvements in weather forecasting has huge impact on the modern day world. These improvements will give many companies and government agencies useful pieces of data by finding new correlations and giving companies and government agencies more chances to take full advantage of them. 6-

Summary Natural disasters are inevitable and unpredicted in nature. Nobody can exactly predict that what will happen next. But by the passage of time human being is able to extract information from past events and made patterns from that information. In past those patterns were not so clear and difficult to compute. Modern day technology helps to collect data and draws results from that data effectively.

Artificial intelligence plays a key role in pattern recognition and analysis of past events to predict future events. Different techniques like Neural network (NN), genetic algorithm (GN), particle swarm optimization (PSO), clustering and many more helps us to find patterns and prediction. These algorithms alone do not generate good results. But by merging two algorithms gives us better results that give us better understanding of occurring and future events. By using artificial intelligence techniques success rate of prediction is about 60-70%. Although it is not so accurate one but it helps to save resources and lives. By using weather prediction crops are not destroying any more than before.

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Air traffic is controlled in a good manner and they are informed before any bad can happen to them. In short, artificial intelligence made a good impact on the life of people by giving them useful piece of information in advance.

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