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Evaluation on predictive analysis of rain disaster using Adaptive Neural Turing Networks

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ABSTRACT

The Research is mainly focused on the evaluation parameters of the Machine learning algorithm Adaptive Neural Turing networks which have been developed for prediction of Rainfall based Disasters. Based on the Previous Research its observed that the Neural Turing networks have been performing the prediction of the rainfall-based disasters for the consecutive years of 10,15 and 20 with 93.8% accuracy. Here the Research is analyzed with various parameters and Comparing it with the other researches which is implemented with other machine learning algorithms

Keywords— Rainfall disaster, Machine learning, Neural Turing Networks, Evaluation parameters

1. INTRODUCTION

Over the past decade, flood prevention awareness have rising and resulting a drive to boost flood forecasting technique [1]. flooding forecasting technique, flood water level prediction plays important role and plenty of models are proposed [2]. Artificial neural network (ANN) model is more preferable because the aptitude of simulating nonlinear system compared to traditional physical modelling. Furthermore, ANN also has the benefits of using recorded data directly with none simplification and requirement to make an assumption of equation like multivariate analysis [3]. Yiming et. al [4] in their research showed that ANN may be a reliable approach on flood disaster prediction problem and therefore the method may be extended to danger forecasting. Egawa et. al [5] had successfully developed water flow forecasting system using ANN that has been used at Tadami-Agano geographic area for three years. The developed system was ready to forecast water flow in any season. ANN is additionally ready to model the daily rainfall-runoff relationship by coupling a linear model there to. The ends up in terms of model performances indices demonstrated that ANN based model is satisfactory [6]. Even though storm arrive Huangpu Park observation station in China is just too complicated to predict, the result shows that ANN model performs better than the other artificial prediction. additionally, the system could show the storm information with the technology of Geographical Information System [7]. Chang et. al [8] integrated Back Propagation. Neural Network (BPN) with Self Organizing Map (SOM) in flood forecasting. By

establishing of those models, hydrologic data intervals may be forecasted no matter any problems concerning trend, peaks or break. Hence, it's proven that ANN model is best suit for hydrological modelling. This paper proposes BPN modelling and flood water level prediction using EKF.

With huge technological innovations within the domains of sensing systems, communication networks, cloud computing, machine learning and data analytics, it's readily possible to develop an integrated flood disaster management system which can alert the flood affecting regions effectively. Thus latest technologies have life-saving potential within the flood disaster situations. Internet of Things (IoT) is one such technology for a smart nation. With easily available smart phones and Internet facilities to both urban and rural people in India within the recent years, this media are often utilized for communication with the citizens. the Internet of Things (IoT) could be a huge network of physical objects or devices along with virtual entities which are generally powered by small batteries and sometimes hook up with each other through the web. As more number of those devices gets connected to every other, there lies a large opportunity for development and implementation of such integrated flood disaster management system. it's all become possible thanks to ubiquitous connectivity, new sensor technologies, and real-time data processing and analysis. In predictive analytics, artificial neural networks (ANNs) provide better results than other methods. flooding disaster management system, it's of utmost importance that data analysis be finished prediction of floods. Many artificial neural network algorithms are being studied and deployed for prediction purposes

2. LITERATURE REVIEW

Recent researches high prediction depicts the employment of wireless sensor networks and advanced artificial neural networks. [2] Seal et al. have utilized a wireless sensor network (WSN) to gather data and used a rectilinear regression model with multiple variables for real-time and accurate flood prediction results. Increase in water level indicates flood if it exceeds the flood line. [3] Furquim et al. have also utilized WSN and various types of machine learning classification techniques for flash flood broadcasting. they need made a comparison of the performance of those techniques with

different data representations. The multilayer perceptron technique has shown better ends up in their work.

Though the system shows good accuracy with lower power consumption, the price of motes within the work is extremely high. [5] Ancona et al. have discussed an IoT approach for flood monitoring using highly dense grid of rainfall sensors and river gauges to live water level. It also discusses about the integration of sensors' infrastructure with various IoT cloud platforms. It also speaks of development of ultra-low power sensors or devices for the aim. [6] Gangopadhyay et al. have implemented wireless IoT framework using Arduino Uno and an array of sensors connected thereto.

They utilize Xbee transceivers for communication and upload the info on ThingSpeak and Xively cloud servers. Their experiment shows that ThingSpeak may be a better IoT cloud platform for this purpose. Also a moment alert is sent to the users through Twitter or the android app developed. However the system cannot accurately predict the event of flood in their work as they need not deployed a model for it. Ruslan et. al. have proposed Nonlinear Auto Regressive with Exogenous Input model to mitigate the matter of nonlinear flood prediction problem. The system predicts the occurrence of get Kelang River with a lead-time of 85 hours.

In this work, the research got developed a ultra-low power IoT flood monitoring system using low-power sensors and a dashboard developed by ThingSpeak is employed to depict the real-time data collected by the system. The ANN flood prediction model is implemented on the real-time collected data and also the prediction of flood event is completed. Also an alert system is proposed supported the ThingSpeak messages on registered Twitter accounts.

At present it's optimum to use machine learning methods to determine a particular identification. Their final aim is to get trained algorithms that facilitates the flood and rain fall based disaster predictions in advance. These algorithms can be utilized by meteorological scientists as auxiliary tools to enhance the predictability of Rainfall and flood based disaster alerts. According to the International Agency for analysis on Meteorology there have been concerning 4 % (1,590 thousand) deaths of the total range of deaths every year due to water based disasters whereas in current scenario the death poll due to water based disasters have been increased to 35%.

3. RESEARCH METHODOLOGY

Based on the previous researches all the researches have been taken with the Evaluation parameters of the Machine learning algorithm Neural Turing Machine or networks [26] is a sub-set of computing models. This Turing model can respond to the following interpretations:

- (a) Is there any machine able to determine whether to stop or continue its function through its own memory tapes?
- (b) Is there any machine able to determine that another machine can ever prints symbol on its tape [27].

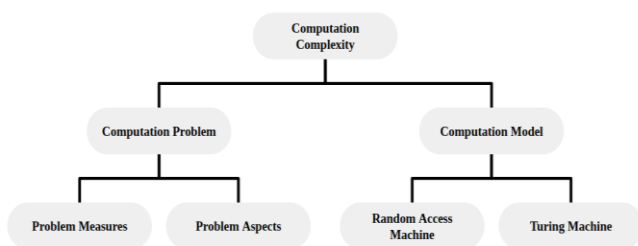


Fig. 1: Computational Complexity and Turing Machines

Based on these approaches we have intended to use Neural Turing machines in the Research to reduce the memory consumption of the data. The research is made to reduce the involvement of Big data and Hadoop concept to integrate large sets of data and to avoid noises that is caused due to data transmission from one software environment to other.

Turing machine takes the first overview that can be considered as signal receptor or data receptor and for fast computing. Hence in the concept of Machine learning approach the idea have been developed for a fast processing easy accessible machine that plays a major role in the Turing process.

Neural computing Research is a base in visualizing human brain on data processing or information systems. This system works completely with the concept of features or parameters that segregates the characteristics of the information received. Memory plays a major role in data processing since we use information processing based on feedback or prediction are processed which is also called as computing systems and this operates in different channels like Order of the computation, Prediction strategy or cost functions and theoretical logics[14]. Alike this Turing machines Recurrent neural networks also plays a major role in development of the system predictive efficiency [3]. On the other words the other way of prediction of an information can also be predicted with Recurrent Neural Networks with maximum effectiveness [22].

The Algorithms considered in the Research are kNN, Support vector Machine, Gradient descent with Adaptive learning, Lenenberg Marquedt and with Neural Turing Machines. The Algorithms have been considered with various different researches and utilized with Prediction based Concepts in most of the Researches.

4. RESULTS AND DISCUSSION

Based on the Analysis with different database its observed that the prediction accuracy has been considered with various evaluation parameters like Receiver Operations Characteristics, Mathews Correlation Coefficient, Mean Square Error and Validation of Epochs. The Research have been considered with different Machine learning algorithms to analyze the evaluations with different Perspectives. Based on these considerations we have used K-Means classifier which is one of the famous algorithms in prediction-based Researches.

The Research have been performed with different analysis of Each algorithms. Also, each algorithm has its own operations and cost functions to predict the data. The Research have also evaluated with Bio inspired algorithm like Cuckoo Search Algorithm, Random Forest Algorithm and Particle Swarm Optimization where the Results are not adaptive for different scenarios. In this Research various Database have been considered and found the results adaptive for the selected algorithms. Since selection of Algorithm is most critical process in Machine learning researches this research not only makes the prediction efficient but also the memory processing faster. Here are the various algorithms have been considered with all the critical evaluation parameters.

Table 1: Evaluation Result of Various Machine Learning Predictive Scoped Algorithms

Performance Metric	KNN K=1	KNN K=5	SVM	GD	LM	NTM
R	0.75	0.62	0.58	0.68	0.88	0.9351
Validation MSE	7.65	6.53	5.85	8.86	2.31	2.25
Train MSE	7.95	8.1	7.65	9.94	7.27	6.54

Test MSE	8.56	9.25	11.25	10.67	4.87	3.82
Epochs	50	30	30	32	6	10
Mathews Correlation Coefficient	0.87	0.75	0.72	0.65	0.85	0.92
Receiver Operations Characteristics	0.62	0.75	0.5	0.35	0.3	0.8
Area Under ROC	0.5	0.45	0.75	0.35	0.5	0.85

Based on the above research its observed that the Neural Turing Machine is providing better results than comparison with the other Machine learning Predictive scoped Algorithms.

In general, the conception of NTM is incredibly robust however restricted by weak coaching algorithms [18]. Due to its memory, it's ready to surmount several continual neural networks. The structural changes concerning the methods mentioned during this article square measure tabulated in Table above, wherever all have external memory and also the neural network is applied because the controller. The comparisons square measure created against one among is the most effective than the recurrent neural networks.

Flood modeling and prediction exploitation with different Machine Learning Algorithms was successfully developed and Evaluated. The flood water level at downstream river around referred to as the flood location area unit with success foretold with minimum of 10.833 hours prior time with sensible prediction results. The effects of physio graphical factors like basin space, length of mainstream and mean slope was neglected during this Evaluation process. Therefore, for future works, NTM may be applied to other hydrological issues like rainfall-runoff prediction and stream flow forecast that area unit unacustomed the researchers around the world.

5. CONCLUSION

The studies within the field of deep learning area unit current and because of neural networks' high potential, attempts are created to enhance form of learning strategies by adding external memory to them. Will reason the NTM strategies. Supported the elements of NTM and there exists a verity of fields within which NTM is presumptively well fitted in several area unit as follows.

- Learning of the relation among completely different tasks with appropriate structure of NTM is price learning.
- Learning a way to run many NTM in parallel to emulate the behavior of somebody's brain that do many jobs at the same time.
- A way to share information among many NTM instances is of crucial importance.
- It's foreseen that through some structural modifications the performance of NTM would improve in future.
- Enhancements in NTM controller or applying completely different learning strategies for it (use another Neural Networks that use Reinforcement Learning and Evolving algorithmic program for coaching the NTM).
- Using another structure for memory and memory tapes and promoting the Neural Turing Machine.
- Implementation of NTM supported High Performance Computing (HPC) and High Transactional Computing (HTC).
- Additionally, to its high capability in performing difficult tasks, it is applied in resolution issues and tasks within the realm of:
 - (a) Machine learning tasks like various groups, classification, association, and prediction.
 - (b) Tasks in distinguished areas like cryptography, data activity, etc.

- (c) Tasks in image process, computer vision, image caption, etc.
- (d) Tasks in voice detection and linguistic communication process, etc.

Thus, the sensible flood disaster prediction system has relevancy in terms of actual preparation and responsibility with real time monitoring and change of environmental parameters and prediction of flood as compared to existing approaches. The integrated approach combines the measurability of IoT and reliability of artificial neural networks to handle information provided by a sensing element network and by effective communication between these two elements, associate degree early prediction of flood is completed.

After the experimentation, it's been established that Neural Turing machine based Algorithm Indicate that the event of flood is predicted one time-step ahead and warns the communities in danger using this advanced approach and in easy to know language with the employment of web. Therefore, by harnessing latest technological disruptions such as IoT and machine learning, big data, prophetic analytic along with social media and quality permits effective emergency & disaster management for sensible nations.

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