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Flood Prediction and warning system using SVM and ELM models.

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Abstract*: Seeing the rising amount of flood calamities worldwide flood management system are recently in limelight and are receiving the much needed attention. However the technologies used in determining and predicting the occurrence of a flood is somewhat inaccurate. Taking into consideration the number of lives at stake this project is aimed at introducing newer and possibly, more effective methods and techniques than its previously used flood prediction models. The proposed system seeks to implement machine learning by gathering the previously existing data along with a periodic live feed update so as to predict the chances of flood occurrence and so as to implement the necessary counteractive measures that can be deployed so as to evade such a mishap. The area taken into consideration for testing this new system is based on Chennai; capital of Tamil Nadu which spans over an area of 426 km^2.The study illustrates how a hybrid model is generated by taking all the data and using the Support Vector Machine (SVM) model and Extreme Learning Machine (ELM) model on it. The experimental results show that the integrated algorithm performs much better than other benchmarks.

Moreover, testing the algorithm with live data makes it even more efficient and precise compared to other algorithms and proposed systems helping us to counteract real time fiascos. The main application of this system is to enable the user to warn and evacuate a mass population in case of a mishap.

***Keywords* :SVM, ELM, Image, Classification, flood forecasting, machine learning**

I. INTRODUCTION

THE Floods have an impact on both individuals and communities, and have social, economic, and environmental consequences. The consequences of floods, both negative and positive, vary greatly depending on the location and extent of flooding, and the vulnerability and value of the natural and constructed environments they affect.

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The proposed system seeks to minimize the loss impacted by floods by ensuring a definite and accurate prediction. The proposed model makes use of SVM and ELM modules on live feed as well as previous years datasets so as to effectively predict he occurrence of a flood thereby helping us save as many lives as possible. Hence so as to counter the aforesaid situation we are deploying a model so as to predict the occurrence of a flood thereby deploying the much needed counteractive measures.

In recent limelight machine learning has been a very niche market which has started booming because of technologies like data analysis and prediction tools. Thereby we are feeding our proposed model with previous years data set so as to train it and are further feeding it with a periodic live feed so as to enhance its precision. Lastly the two models used in the proposed system(SVM and ELM) are state of the art and latest in nature which in itself makes the project all the more effective and practical in nature.

II. EXISTING SYSTEM

1. The existing system is basically subdivided into two major methodologies, hence at present, two principle methodologies are utilized in flood estimating. At present, two principle methodologies are utilized in flood estimating.
2. The first approach depends on physical displaying, which builds up the connection among precipitation and overflow. Be that as it may, it is difficult to build up a completely physically based determining model because of the unpredictable idea of floods and the shifted reactions to them.
3. Moreover the connection established between precipitation and overflow run off is highly non-linear and non-coherent with the actual readings and the observed readings.
4. The second basically establishes a statistical model between the hydrographic input and output.
5. In either case, an algorithm can be applied after which the data is plotted on a graph and results are drawn and predicted thereafter.

III. DRAWBACK

1. The traditional flood predicting systems and their precision to determine the occurrence of a flood raised controversial questions due to its efficiency.

2. The traditional system takes a lot of time to predict the flood in comparison to the proposed system, due to this the "flood warning lead time" is not enough.

3. There are not flood countering measures that are taken care of at grass root levels, even if people are informed of a flood, it usually takes place a lot after the authorities are informed about it.

4. There is simply no option to determine the occurrence of a flash flood and even if one takes place, its categorization is not done efficiently due to which data can be misinterpreted.

5. The cost of fabrication and maintenance of the existing system is significantly higher in comparison to the proposed system

IV. PROPOSED SYSTEM

1. The proposed methodology is individually contrasted and the Support vector-machine (SVM) model and extreme learning machine (ELM) model.

2. The live data, once recorded is combined with the data taken previously to form a proper dataset of information, based on parameters such as precipitation, wind speed, land inundation, slope, etc.

3. The exploratory outcomes demonstrate that the coordinated calculation performs much superior to different benchmarks simply owing to the fact that the algorithms used upon the dataset are relatively new and as the work on image classification, they are quick and efficient in nature.

4. The system seeks to be updated with the live data sets so as to increase the efficiency of the algorithm by treating it with live real time datasets.

5. This will in turn help the system to counteract and take effective measures for example, in case of flash floods the warning system will always perform more efficiently each time..

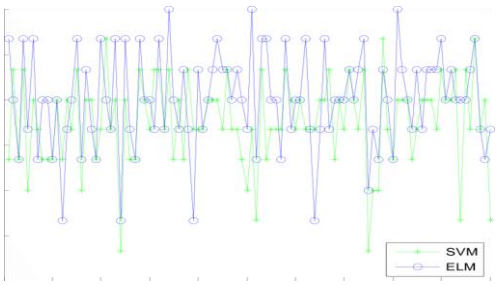
V. IMPLEMENTATION

The implementation of the system revolves around the basic idea of creating a hybrid module by implementing SVM and ELM modules in a combined effort on a hybrid dataset which is taken from a periodic live feed as well as the accumulation of readings of previous years dataset based upon different parameters.

The Support Vector Machine model is a general approach to functional problems, i.e. to problems of finding the function y=f(x) given by its measurements.

Hence firstly we collect the data and implement the Support Vector Machine module on it.

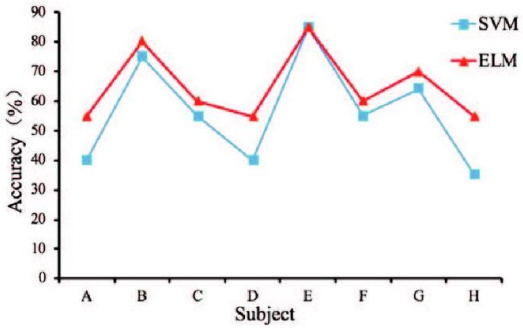
Then we apply the Extreme Learning Module on it and create another data extracted module, then we combine both the readings obtained to create a hybrid module and the collected readings can be assumed something close to figure(1) .



Figure(1).

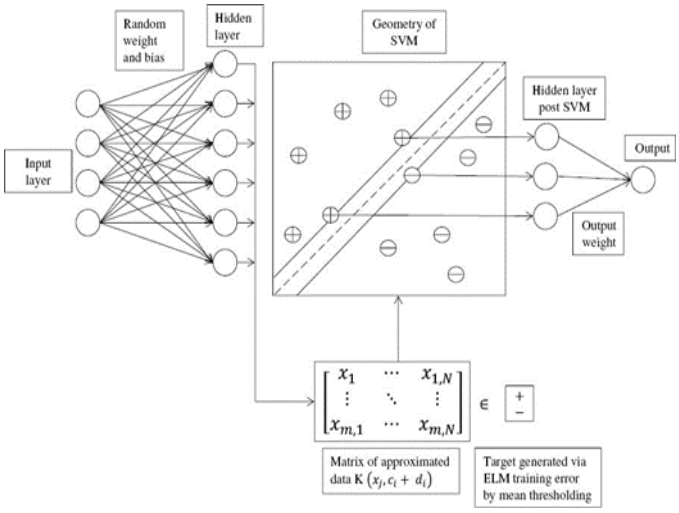
The basic code for applying the SVM and ELM can be written either in Python (Tensor floJw) or in MATLAB.

The difference and comparJison between the two modules (SVM and ELM) can be simply comprehended graphically from another figure (2), given below.



Figure(2).

Hence the basic aim of using these two modules that are so closely related to each other is to prune the results of ELM by the use of SVM. Hence technically these two algorithms complement each other to provide a result that is far more precise from what we obtain if we would have used just one of the modules. The need for using both the modules side nby side can be understood from figure(3) given below.

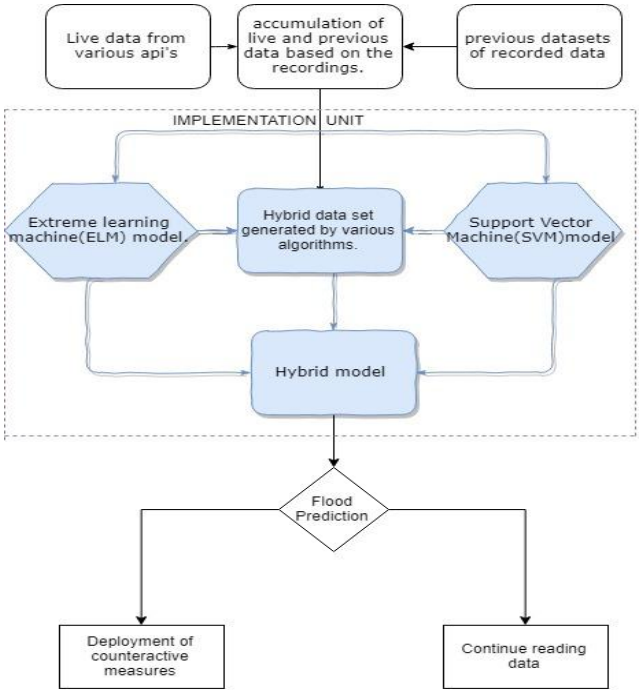


Figure(3).

Hence it can be completely comprehended that even though ELM is a really great selection as a predictive model for solving problems on regression, classification, etc. But one of the main problems with it is the selection of the optimal number of selection nodes. Hence we use SVM which targets $y_i \in \{+1, -1\}$ that are derived using the mean or median of ELM training errors as a threshold for separating the training data, which are projected to SVM dimensions.

VI. IMPLEMENTATION MODULE

The breakdown of IMPLEMENTATION into its respective modules makes it easier for comprehending the use of each module to obtain the desired result hence an architectural breakdown of the implementation can be comprehended from figure(3).



Figure(3).

Hence the implementation architecture module simply explains how the system works the whole idea behind it and the workflow behind the whole idea in a bottom to top approach. Thereby giving a self-explanatory diagram makes the task of explaining the whole procedure all the more easier. The following modules are the basic functional units of the implementational architecture of the proposed system.

A. ***Live Data Feed Module****-This module basically renders live feed from API's rendered by websites like openweathermap.org and rapidapi.com and dzone.com . The data is collected on different parameters and can be stored in multiple file formats such as JSON, XML and HTML.*

B. ***Previous Years Dataset module –*** *This module is basically responsible for holding the data set of previous years in a statistical way so as to optimize the prediction based on the current and past readings. The recording for each year is updated to the dataset so as to improve it and hence at the end of one year the recorded data is added to the dataset. The previous years dataset has been rendered from IMD(India Meteorological Department) for the past 20 years.*

C. ***Support Vector Machine Module -*** *The reason that we chose SVM as classifier is that its performance on small devices with limited resources is implacable. SVM has been used by many researchers in the past and proved its significance over the other classifiers available. Hence the data is classified based on the different parameters such as wind speed, humidity, precipitation, land inundation, etc. Hence the datasets are basically imported in .csv or .data format in python, thereupon enabling us to perform clustering on the given data thereby helping us in classifying it.*

D. ***Extreme Learning Machine Module -*** *ELM has been relatively computation faster than other neural networks. In addition according to ELM has great accuracy and it is almost the same as Support Vector Machine (SVM) for balanced data. The main reason behind performing this kind of classification is so as to eliminate any kind of anomalies in the predictive result. To implement it we will inastall the pip elm package in python and will then load the dataset thereafter for the ELM to act upon.*

E. ***Hybrid Module –*** *The combined efforts of SVM and ELM modules result in a hybrid module that is nothing but a hyperplane with clustered data within which one can easily predict the occurrence of a flood based on different key parameters.*

F. ***Flood Prediction Module –*** *It is a simple module that is assigned the task of determining the occurrence of a flood based on different key factors and parameters which are derived from the current live feed as well as the data set of the previous years.*

VII. CONCLUSION

This project solely aims at saving lives by the use of modern means of technology. Floods being one of the major reasons behind the increasing death toll time and again, the problems being faced by the victims were the motivation behind the creation and inception of this project in the first place. With the hope that this project could actually be implemented practically the project is aimed at preventing such mishaps in the future or at least preparing the mass population in case one occurs.

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AUTHORS PROFILE

M Madhuram , Master in Engineering in computer science and technology. She has been the mentor of the entire project and helped us in making the research paper. Working in SRM she has gained a lot of knowledge on the domain of AI and Machine learning and has done many presentation on this domain and thus helped in making the And also in the gathering of the material and checking the Plagerism and how to keep the domain trendy. Done her qualification in Chennai , has done the engineering from Chennai and has done many projects and presentation during college

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