

Flash Flood Forecasting using Different Artificial Intelligence Method

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ABSTRACT - Flash flood forecasting is a sudden occurrence of flood in the absence of rainfall due to river discharge, dam breaking, ice and snow melts. Due to sudden occurrence of flood it may cause several damages. To avoid the damages and to prevent people from damages several artificial intelligence techniques are used. From those techniques some of the techniques are combined and used to improve the efficiency and performance of the flood forecasting system. With the help of support vector regression volume of rainfall and moisture of the soil is calculated. Finally it may display alert message.

Keywords: Artificial Neural Network, Adaptive Neuro Fuzzy Inference System, Support Vector Regression, Soil moisture sensor.

1.INTRODUCTION

Flood is a natural disaster it may cause several damages. And has the potential to wipe away an entire city, coastline and cause damage to life and property. When flood occur in an area that people live, the water carries along all objects like houses, cars, bridges, furniture and people also. Floods occur at irregular intervals and vary in size, duration and area. Water naturally flows from high areas to low lying areas. This means low lying areas may flood quickly before it begins to get to higher ground. Flood also cause landslides based on the earth movements, have the potential to break up earth material.

Flood may occur due to some events like rains, river overflow, dam breaking, ice and snow melts. There are three types of flood, they are flash flood, rapid on-set flood, and slow on-set flood. Flash flood happens inside a brief timeframe (2-6 hours, and at time inside minutes) and is a rule because of heavy rain, dam breakage or snow dissolve. In some time extreme rainfall from moving storms can cause flash flood. It is most damaging and can be deadly, there is normally no notice, no readiness and the effect can be extremely quick. Flood have impacts on the economy, condition and individuals. To avoid several damages flood forecasting techniques are used.

They are Artificial Neural Network, Adaptive Neuro Fuzzy Inference system, Support Vector Regression. It provide immediate warning and safety measures. A flood warning is the point at which an official declaration is given (through TV, Radio, Text message or Phone, Email or different means) of an approaching flood or a flood that has already occurred. A flood warning teaches individuals to move to higher ground or play it safe and avoid suffocating or to limit harm to property.

2.PROPOSED SYSTEM

Several artificial intelligence methods are used for flood forecasting. From those methods three main techniques are used. They are Artificial Neural Network, Adaptive Neuro Fuzzy Inference System, and Support Vector Regression. All these methods are used to find the sudden happening of flood, and increases the system performance and efficiency.

A. Artificial Neural Network

Artificial neural network is a kind of parallel computer structure, inside which various preparing units are connected together with the goal that computer's memory is appropriated and data is passed in a parallel way. An expensive number of ANN models and calculations have been created up until now, multi-layer feedforward systems, self-sorting out component maps, Hopfield systems, counter propagation systems, radial bias function networks and intermittent ANNs. Of these systems, the most normally utilized are feedforward systems and radial bias function networks. Multi-layer feedforward systems have been found to perform best when utilized as a part of hydrological applications. An attempt is made to choose between different methods and define which is superior, is probably going to be false in many cases the decision is application oriented. To train the data in ANN the data patterns are fed into input layer sequentially. The ANN is a data driven technique.

The outcoming yield forecasts $y_j(t)$ are compared with real yield forecast $d_j(t)$. The

mean square error at any time t, E(t) is calculated for entire data set using below equation.

$$MSE(t) = \frac{1}{2} \sum_{j=1}^n (y_j(t) - d_j(t))^2$$

B. ADAPTIVE NEURO FUZZY INFERENCE SYSTEM

Another data driven technique is fuzzy inference system (FIS). Fuzzy inference system uses fuzzy logic. Both the ANN and FIS are combined to form a powerful intelligent system. In FIS it uses fuzzy logic then it gives better results than ANN. To improve the performance and efficiency both ANN and FIS are combined. In ANFIS it has many layers to refine the clustering events.

C. SUPPORT VECTOR REGRESSION

Another method for flood forecasting is support vector regression. Support vector regression is a kernel-based method with a built-in regularization mechanism, similar to that of support vector machine classifiers. SVR is mainly used for classification and regression. SVR helps to cluster the events to specify whether flood is going to happen or not. It groups similar events and classify the new event with the help of a line.

D. SOIL MOISTURE SENSOR

Soil moisture sensor is used to find the moisture of the soil during flood. With the help of

soil moisture sensor it is easily detected whether there is a chance for the happening of landslides during flood. Using MATLAB software arduino board is connected to integrate the soil moisture sensor. Due to this integration we can easily identify landslides along with flood forecasting. Soil moisture sensor is used to identify the moisture of the soil during normal days and also in happening of flood. Due to this we can safe guard people life from danger.

E. WORK FLOW DIAGRAM

Matlab and arduino board is connected through data cable. Matlab 2013a software is used, which performs the calculation of rainfall and identifies the happenings of flood. Also calculates the volume of rainfall with the help of Adaptive Neuro Fuzzy Inference System(ANFIS). First the input datas are given to the ANFIS it groups the similar events and cluster the events. Then the events are combined for making decisions. Then the events are trained and updated. These process are done in Matlab simulation. This is one part of the architecture. Then the second part of the architecture is soil moisture sensor with arduino board. The soil moisture sensor identifies the moisture of the soil to find the occurrence of landslides ,soil erosion, ect. The soil moisture sensor is connected to the arduino board then the arduino board is connected to the PC with the help of data cable. Inside the PC the arduino board and the matlab is integrated. Then the GSM alerts message for landslides.

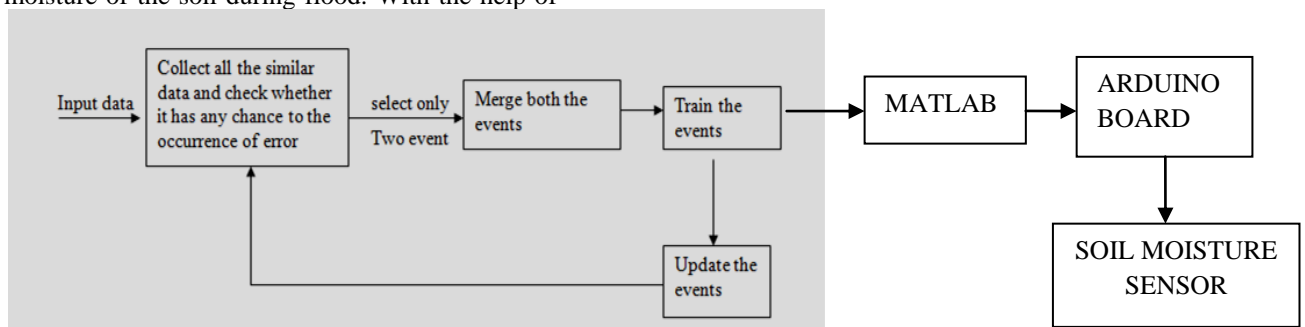


Figure 2.1 Workflow Architecture

3.RESULT AND CONCLUSION

Open the matlab software then select the main files.After opening the main files the folder have to be changed

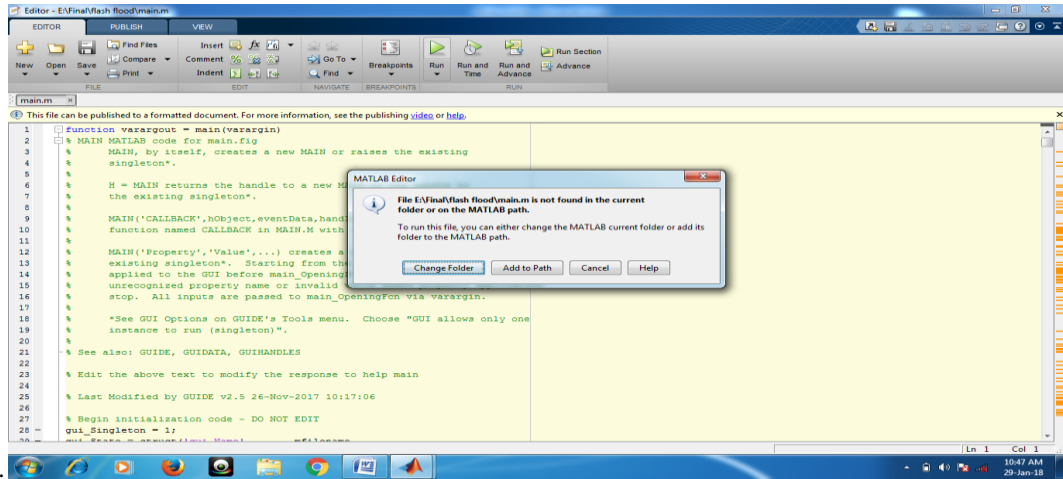


Figure 3.1 Changing the folder

Select the image by browsing on the system. Then the input image is selected, convert it to grey image.

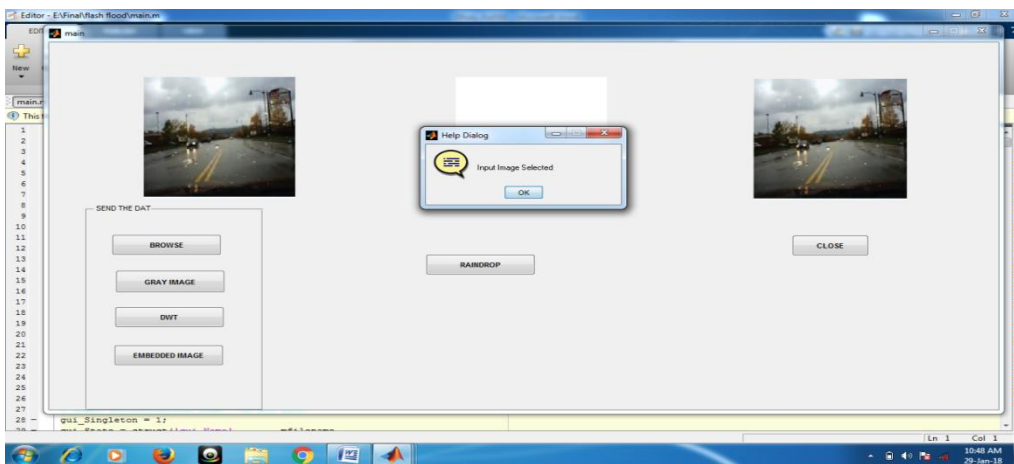


Figure 3.2 Selecting the input

Calculating the amount of rainfall using ANFIS. The input value is given and it produce the expected result.

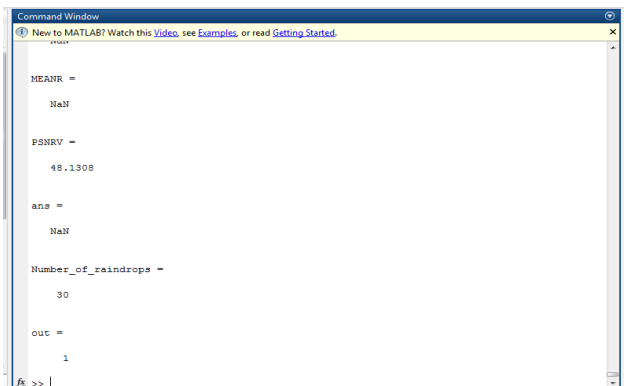


Figure 3.3 Volume of Rainfall

Displaying the amount of rainfall in graphical manner.

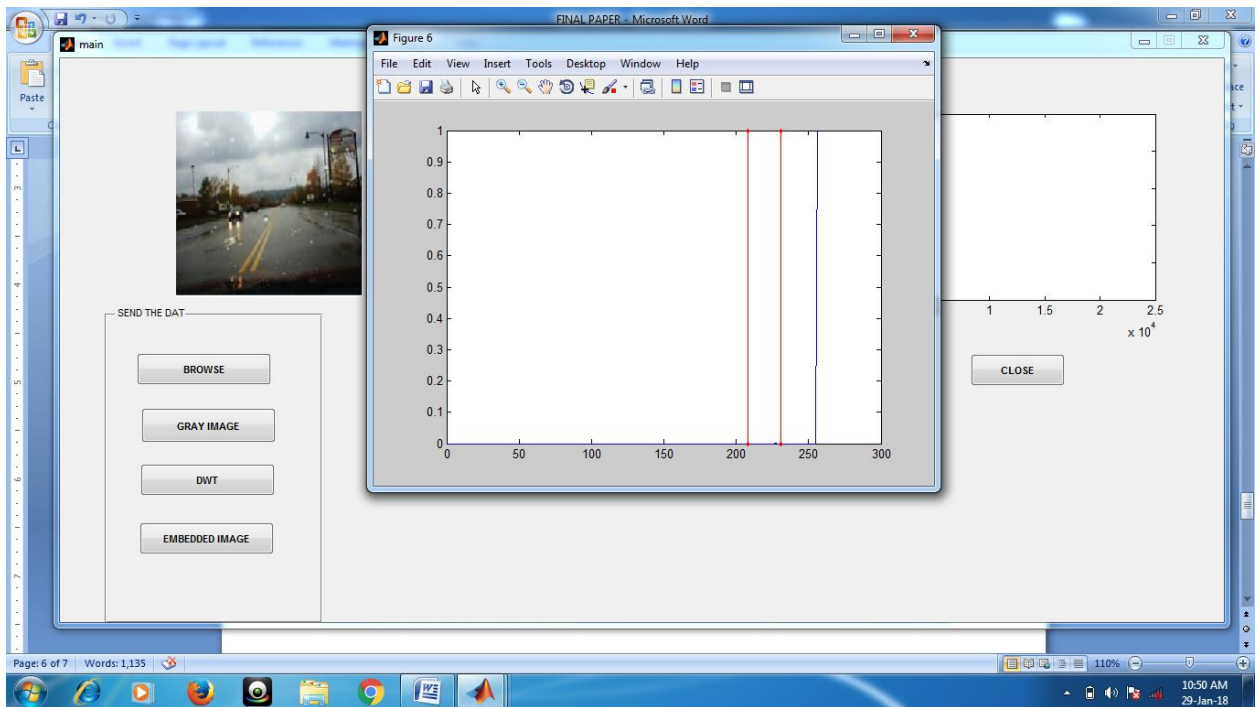


Figure 3.4 Graphical output

For calculating the moisture level of the soil soil moisture sensor is used. The below is the coding for identifying the moisture of the soil.

```
int sensor_pin = A0; // Soil Sensor input at Analog PIN A0
int output_value = 0;

void setup() {
  Serial.begin(9600);
  Serial.println("Reading from the Sensor ...");
  delay(2000);
}

void loop() {
  output_value = analogRead(sensor_pin);
  output_value = map(output_value, 550, 0, 0, 100);
  Serial.print("Moisture : ");
  Serial.print(output_value);
  Serial.println("%");
  delay(5000);
}
```

Figure 3.5 Coding Moisture level

Different levels of the moisture of the soil using arduino board.



Figure 3.6 Different levels of soil moisture

Final output for the soil moisture using sensor.

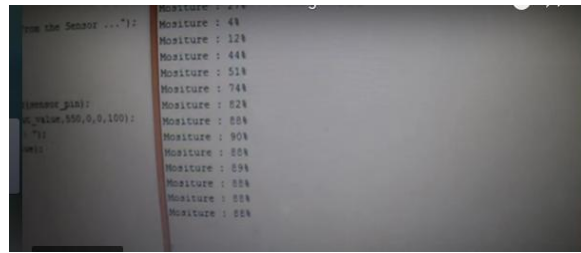


Figure 3.7 Moisture levels using sensor

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