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Decision Support Information System for Crop Advice and Water Management

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Abstract: Decision support information system (DSIS) is a system that analyses raw data and presents the information for the decision makers and assists them in making decisions quickly and accurately. This paper deals with decision support information system for crop advice and water management in Narava Basin, Visakhapatnam district. This proposed system is implemented using artificial neural network based Back-propagation algorithm. The objective of the proposed DSIS is to suggest the type of crop that best yields for a given area and season based on the parameters such as soil type, rock type, rainfall, and humidity.

Keywords: DSIS, Back propagation, Crop advice, Water Management.

I. INTRODUCTION

India is covered with abundant physical resources for agriculture [6]. But, however, the farmers who are new to farming need some advices and assistance in farming, from the experts in order to get better yields. Experts suggest the crops to the farmers based on the experience, domain knowledge and scientific research evaluations. The suggestions provided by the experts assist the farmers in choosing the type of crop. The yield of crop is affected by farming a crop based on the suggestions of the crop advisors with poor domain knowledge and less experience or by own inexperienced decisions of farmers. An automated crop advisory system [3] addresses these issues by providing suggestions automatically based on the physical resources present in a given area.

This paper discusses our decision support information system for crop advice and water management. A Knowledge base and training set are developed for DSIS. All of the people who are connected with the agriculture will be benefited with this web portal to increase the productivity. The main functionalities of the DSIS are information enquiry, analysis of data, information processing to enable decision making.

The DSIS discussed in this paper mainly computes the decision on issues like crop advisory, information about water resources [1],[2] in Narava Basin, Visakhapatnam.

This system is intended to place in web and provides decision and suggestion for the crops such as paddy, millets,and vegetables using neural network based back propagation algorithm [4],[5].

II. METHODOLOGY

The proposed system mainly focuses on crop advice system and provides decision whether the crop is suitable in particular area based on the physical resources such as soil type, rock type, rainfall, humidity, and season. The proposed system is applied on the crops such as paddy, millets, and vegetables, and implemented using a supervised learning algorithm, artificial neural network based Backpropagation [7]. Backpropagation is abbreviated as "Backward Propagation of Errors" common method of training artificial neural networks used in conjunction with an optimization method of gradient descent. It requires a known, desired output for each input value in order to calculate the loss function gradient so it is considered to be a supervised learning method.

The goal and motivation for developing the artificial neural network based backpropagation algorithm is a way to train a multi-layered neural network such that it can learn the appropriate internal representations to allow it to learn any arbitrary mapping of input to output.

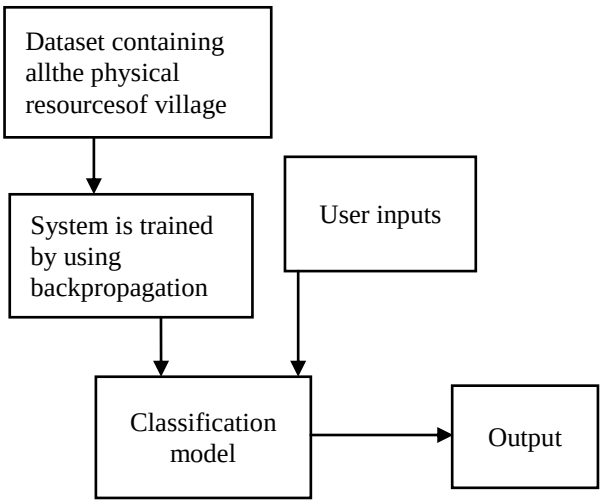

Fig. 1 Flow Diagram of Decision Support Information System for crop Advisory System

Fig. 1 depicts about the flow of crop advisory system. The proposed system is implemented using the artificial neural network based backpropagation algorithm. Initially a training data set is prepared with parameters such as soil type, rock type, rainfall, humidity, season, and type of

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crop and dataset also contains desired output value for the each input value and the system is trained. After completing the number of iterations specified, a classification model with the final weights are generated. When a new user input is given the model is applied on the new inputs and final outputs are generated.

A. Algorithm

Inputs

- Assign network input neurons with 6 parameters, 10 neurons in hidden layer, and 2 output neurons in output layer.
- Initialize all weights with small random numbers, typically between -1 and 1 and neuron bias values.

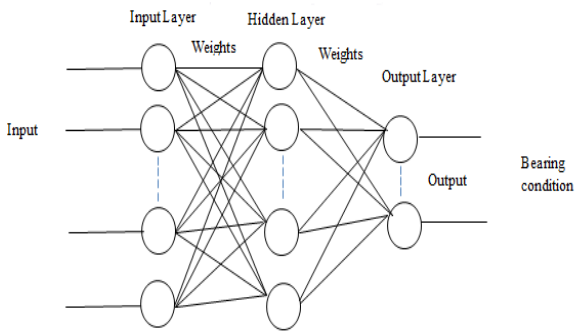

Fig. 2Artificial neural network

Fig. 2 depicts the structure of artificial neural network which contains three layers input layer, hidden layer and output layer. Initially some weights are assigned from input to hidden layer and hidden to output layer. Bearing condition describes the no. of iterations to perform.

Output

Final weights of the network

Method

Repeat
for every pattern in the training set
Present the pattern to the network
Propagate the input forward through the network:
foreach layer in the network
for every node in the layer
1. Calculate the weight sum of the inputs to the node.
2. Add the threshold to the sum
3. Calculate the activation for the node
end for
end for
Propagate the errors backward through the network
for every node in the output layer
calculate the error signal
end for
for all hidden layers
for every node in the layer
1. Calculate the node's signal error
2. Update each node's weight in the network
end for
end for

B. Activation Functions

1) tanhFunction

tanh is a sigmoid curve, like the logistic function, except that output lies in the range (-1,+1). Often performs better than the logistic function because of its symmetry. It is applied on input values, weights from input to hidden, hidden bias values.

$$\tanh(x) = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}} \qquad (1)$$

Where x = input to the neuron

2) Softmax Function

In neural network simulations, the softmax function is often implemented at the final layer of a network used for classification. It is used in various probabilistic multiclass classification methods such as artificial neural networks. It is applied on hidden neuron bias values, weights from hidden to output layer and output layer bias values.

$$\text{softmax}(z_j) = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}} \qquad (2)$$

where zj = input to the neuron and
k= number of output neurons

III.RESULTS AND DISCUSSIONS

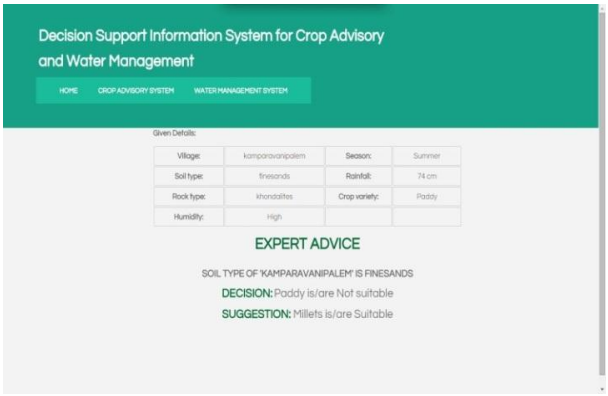

Fig. 3Sample Output of Crop Advisory module

Fig 3 depicts output of the crop advisory module. Crop advisory module takes the inputs village name, type of crop, and season, and provides decision and suggestion. If the given village name is suitable for the given type of crop and season, then the crop advisory module provides decision alone without providing any suggestion. For example, if a user selects the inputs kamparavanipalem, summer and paddy, the advisory module displays all the physical resources available in that village and gives a decision "paddy is not suitable" and suggestion "millets are suitable".

Figure 4 depicts the output for the information of the water management system and the user provide inputs such as village name, season, year. Based on the user inputs, water management module displays information of water resources such as rainfall in that year, amount of surface water, extent of water resources suitable for irrigation, drinking.

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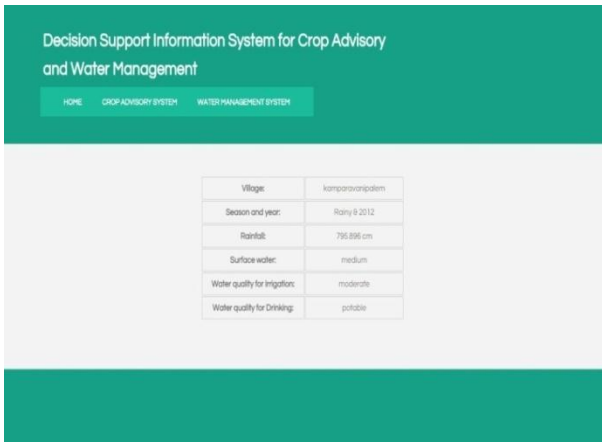

Fig. 4A Sample Output of information system of water management module

Decision support information system for Crop advice and water management uses Neural network based back propagation algorithm with network model 6-10-2 and training data of 250 records for classifying the crop whether it is suitable. Back propagation classifier achieves 89.42% accuracy.

IV. CONCLUSION AND FUTURE WORK

Decision support Information system for crop advice and water management implemented using Back propagation algorithm. A predictive model generated by applying the algorithm on training data. The model is tested for accuracy and is found to be 89.42%.
The proposed system can be enhanced by considering more parameters to get accurate results. This can also be applied to several other crops. Efficiency of the algorithm has to be increased.

V. ACKNOWLEDGMENT

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