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ASSESSMENT OF EXPORTED MANGO QUANTITY BY SOFT COMPUTING MODEL

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Assessment plays a major role in the field of prediction. If the Assessment can not be selected properly, the prediction information becomes incorrect and this scope of work of futuristic planning becomes lost. Therefore it is needed to select an appropriate technique for the purpose of forecasting. A lot of soft computing model is being used in various application systems for the purpose of forecasting. The performance of fuzzy logic, in the field of soft computing, is being examined for the purpose of Assessment on the basis of average error. Here an effort is being used to select the proper soft computing technique to predict the futuristic information of quantity of fresh mango to be exported in near future.

Keyword: Fuzzy Logic, Artificial Neural Network, Perceptron Network.

1. Introduction

Assessment plays a major role in the area of prediction. If the Assessment technique is not selected properly, the prediction information becomes incorrect and this scope of work of planning becomes lost. Therefore it is needed to select appropriate technique for the purpose of forecasting. A lot of soft computing model is being used in various application systems for the purpose of forecasting. The performance of fuzzy logic, in the field of soft computing, is being examined for the purpose of Assessment. Here an effort is being used to select the proper soft computing technique to predict the futuristic information of exportable quantity of fresh mango in near future.

2. Methodology

2.1 Fuzzy Logic

In fuzzy logic unlike standard conditional logic, the truth of any statement is a matter of degree. The notion central to fuzzy systems is that the truth values (in fuzzy logic) or membership values (in fuzzy sets) are indicated by a value on the range [0.0, 1.0], with 0.0 representing absolute False and 1.0 representing absolute Truth.

2.2 Artificial Neural Network

The feed forward back propagation neural network (FFBPNN) does not have feedback connections, but errors are back propagated during training. Errors in the output determine measures of hidden layer output errors, which are used as a basis for adjustment of connection weights between the input and hidden layers. Adjusting the two sets of weights between the pairs of layers and recalculating the outputs is an iterative process that is carried on until the errors fall below a tolerance level. Learning rate parameters scale the adjustments to weights. A momentum parameter can be used in scaling the adjustments from a previous iteration and adding to the adjustments in the current iteration.

2.3 Perceptron Network

A perceptron is a connected network that simulates an associative memory. The most basic perceptron is composed of an input layer and output layer of nodes, each of which are fully connected to the other. Assigned to each connection is a weight which can be adjusted so that, given a set of inputs to the network, the associated connections will produce a desired output. The adjusting of weights to produce a particular output is called the "training" of the network which is the mechanism that allows the network to learn. Perceptron network are among the earliest and most basic models of artificial neural networks, yet they are at work in many of today's complex neural net applications.

3. Proposed Work

For prediction of futuristic forecasted data, certain statistical models like regression analysis using least square technique based on exponential, curvilinear (parabolic) equations and the tables of Orthogonal Polynomial will be used to estimate data based on the neural network. For the fuzzification of data we will use, bell shape function, L shape function, sigma function and Z shape function. Depending on the minimum value of average error the corresponding membership function will be input the value to Neural

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network and Perceptron network and then calculate the minimum error and predict the value.

4. IMPLEMENTATION

The available exported mango pulp information for previous years have been collected and using these, the prediction of exported mango for futuristic years has to be ascertained using least square techniques, fuzzy logic based neural network, Perceptron Network The selection technique is made based on minimum average error.

4.1 Statistical Model using Least Square Technique

Based on the linear equation, the estimated values and relative error have been calculated. The average error is 22.22%. Now an effort is being made to improve the performance using fuzzy logic

Step-1

The available data are fuzzified based on the gaussin functions, triangular functions, trapezoidal functions. Based on error analysis, the model with minimum average error has been selected. Since the triangular function gives minimum error, the triangular function is used as membr ship function and the corresponding fuzzy set are furnished in Table 1 as follows:

Table 1

		220-310	*310-400*	*400-490*	*490-580*	*580-670*	*Fuzzy Set*
Serial No.	*Actual Data*	*A1*	*A2*	*A3*	*A4*	*A5*	
1	228	1	0.3	0	0	0	A1
2	255	1	0.6	0	0	0	A1
3	223	1	0.3	0	0	0	A1
4	248	1	0.6	0	0	0	A1
5	429	0	0.6	1	0.3	0	A3
6	455	0	0.6	1	0.3	0	A3
7	347	0.6	1	0.3	0	0	A2
8	372	0.6	1	0.3	0	0	A2
9	445	0	0.6	1	0.3	0	A3
10	381	0.3	1	0.6	0	0	A2
11	606	0	0	0	0.6	1	A5

Step-2

All the fuzzy logical relationships are obtained as follows:

$$A1 \dashrightarrow A1,\ A1 \dashrightarrow A3,\ A3 \dashrightarrow A3,\ A3 \dashrightarrow A2,$$

$$A2 \dashrightarrow A2,\ A2 \dashrightarrow A3,\ A2 \dashrightarrow A5$$

It is to note that the repeated relationships are counted for only once.

Step-3

Let us define on operator '×' of two vectors.

Suppose C and B are two vectors of dimension m and $D = (dij) = C^T \times B$.

Then the element dij of matrix D of row i and j is defined as

$$dij = \min(Ci, Bj)\ (i, j = 1, 2 \ldots\ldots m)$$

where, Ci & Bj are the i^{th} & j^{th} element of C & B respectively.

$$\text{Let } R1 = A1^T \times A1,\ R2 = A1^T \times A3,\ R3 = A3^T \times A3,$$
$$R4 = A3^T \times A2,\ R5 = A2^T \times A2,\ R6 = A2^T \times A3,$$
$$R7 = A2^T \times A5$$

Then $R = URi$ where, R is the 5 × 5 matrix and U is the union operator (1)

Using the formula (1) and through certain calculations the value of R has been calculated. We find the relationship (R) among the set of data and apply this formula $Ai = A_{i-1}.R$[where A_{i-1} is the employment of year (i–1) and A_i is the forecasted employment of year I in terms fuzzy sets and '.' is the maxmin operator].

For the defuzzification we have use our technique

- If the membership of an output has two or more consecutive maximums then selects the difference of value from first set to last set and divide the value by number of consecutive maximum. Then for forecasted value, add the calculated value with the minimum range of first set.
- If the membership of an output has only one maximum, the mid point of the interval corresponding to the maximum is selected as the forecasting value.
- If more than one membership occur but not consecutive, the selected the minimum value difference of the given data of maximum set and take the midpoint of that for the forecasted value.

Step-4

The forecasted output has been furnished in Table 2

Step-5

Then take the output of fuzzy data as the input to BPNN and get the error 3.14%.

It has been observed that the average error based on least square technique using linear equation, 22.22%. The average error using fuzzy logic, neural network and Perceptron network is 4.04, 3.14% and 1.39% respectively. Since the percepton network gives the minimum error, the perceptron network can be used for the mango yield (production) of futuristic years.

Table 2 (Triangular Function)
Actual Data, Input Fuzzy Data, Output Fuzzy Data and Relative Error

Number of Occurrence	*Actual Data*	*Input Fuzzy*	*Output Fuzzy*	*Output*	*Error in %*
1	228	[1.3000]			
2	255	[1.6000]	[10.610.30.3]	265	3.92
3	223	[1.3000]	[10.610.60.6]	265	18.83
4	248	[1.60.00]	[10.610.30.3]	265	6.85
5	429	[0.61.30]	[10.610.60.6]	265	-38.22
6	455	[0.61.30]	[0.6110.60.6]	400	-12.08
7	347	[.61.300]	[0.6110.60.6]	400	15.27
8	372	[.61.300]	[0.6110.60.6]	400	7.52
9	445	[0.61.3.0]	[0.6110.66]	400	-10.11
10	381	[.31.60.0]	[0.6110.60.6]	400	4.98
11	606	[000.6.1]	[0.6110.61]	355	-41.41
			[0.30.30.300]	310	

Table 3 (Perceptron Network)
Actual Data, Forecasted Output Data and Percentage Error based on Perceptron Network

Number of Occurrence	*Actual Data*	*Forecasted Data*	*Percentage Error*
1	228		
2	255	265	3.92
3	223	265	18.83
4	248	265	6.85
5	429	445	3.72
6	455	445	-12.08
7	347	355	2.3
8	372	355	-4.5
9	445	445	0
10	381	355	-6.82
11	606	625	3.13

5. CONCLUSION

The said work has been undertaken on the available data from the year 1991-92 to 2004. A lot of revenue has been earned by the country through export. If the said information is available in advance, necessary planning work can be decided by the Governments and various other agencies in the country. The estimated value of quantity of export mango is 61500, 624000, and 63400 metric tons for the years 2005-06, 2007-08, 2008-09 respectively. The same technique can be used for the prediction of other export fruits also.

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