Prediction using Sugar production data : Neural and Fuzzy time series

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Abstract*:*. This study covers inquisitive approach to develop an Artificial Neural Network (ANN) model to foresee sugarcane production. The various input data set comprises the agro-climatic and socio-economic factors influencing sugarcane production whereas the output is real sugarcane output. Different forecasting techniques have been deployed on the concept of fuzzy time series data, whereas precision has been a doubtful factor in this scenario. In this paper, On the basis of fuzzy time series (FTS) models performance analysis has been drawn. Data from Food Corporation of India have been gathered for performing the comparative study. The relativity of various FTS models have been suspiciously investigated on the production data on different agro products.

Keywords: *ANN , DSS, Fuzzy Time Series, Fuzzy Set, Forecasting, high order model, Production Linguistic Value.*

I. INTRODUCTION

Contemporary advances in the area of Artificial Intelligence have permitted the deployment of successful, newer time series is assembly of time ordered observation. Artificial neural network(ANN) has the benefit over previous linear models in previous ones representation of both non-linear and linear association and to remember these associations straight forwardly from the data being equated . Previous linear models are only constrained to the mould of linear association among data. Therefore the meaning of forecasting sugar cane production through the correct forecasting techniques remains applicable. The non-linear environment of the data needs a assumed model like Neural Network that is assumed to have achieved substantial victory in assuming similar time series activities. This concept is reviewing various techniques and shows its relevancy in the field of agriculture production . The desire of enact the forecasting model of fuzzy time series is to predict tasks of modelling the augury of crop yield i.e. based on various factors. The data gathered were classified into following parts :

- Training set: It aims for building the model.
- Verification set: It aims for verifying the network.
- Test set: It aims for the prediction,from where it is assumed.

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II. ARTIFICIAL NEURAL NETWORKS

Artificial neural networks (ANNs) is a genealogy of computational learning algorithms formidable by biological neural networks which helps in estimating or probablistic functions which lies on a greater number of inputs . Artificial neural networks(ANN) are basically described as network of interrelated "neurons" which can calculate domains from inputs, which are efficient of machine learning in addition with pattern recognition. Consider an example, a network for handwriting recognition can be seen as a group of input neurons ,initialized by the pixels of input image. Further it is weighted and then transformed by a function ,the initialization of the neurons are passed on another neurons. This procedure is revised till an output neuron is initialized. This explains which character was read.

In feedforward neural network ,the data is unilateral in forward direction. There is no deadlock in this network.In Radial Basic function network,consists of two steps of process .According to first step, the 'hidden' layer consists of mapping of input onto RBF. In Kohonen self organizing network ,self organizing map has been invented which is capable of doing unsupervised learning.In recurrent neural network , data can flow in both direction. In Hopfield network,it needs stationary inputs.

Calculative steps by fuzzy time series:

Step 1. To include the time series data,define the universe of discourse.
Step 2. The universes of discourse is differentiated into 7 equal intervals U1, U2,...., U7
Step 3. Define fuzzy sets A1, A2, ..., A7 with some linguistic values over universe of discourse U .
Step 4. In respect to the fuzzy input for various techniques the time series data
Step 5. For various techniques ,the logical relations have been collected.
Step 6. Simulation of fuzzy forecast of the sugar production have been dispatched by the four different models: Chen[2](Model-1) ,Huang[3](Model-2),S.R. Singh[6] (Model-3) and Chen higher order[1] (Model-4) .
Step 7. Defuzzification is the opposite of Fuzzification.

Activities to Forecast Neural Network:

1. Give the input requirements (Z1, Z2, Z3 …., Zn) affecting crop production.
2. Calculate the production data of different years.
3. Arrange the data so that all values lies in the range of 0 to 1.
4. Formulate the Artificial Neural Network (ANN)
5. Assign the training algorithm for ANN.
6. Design the transfer function for various layers.
7. Choose number of span for ANN.
8. Train the ANN in combination with the production data of past‘ n’ years .
9. Use the test procedure for the years t + 1, t + 2, t+ 3 ……. t+p .

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10.The output of ANN is received.

11. Perform the comparative study.

III. **Fuzzy Time Series**

Time series *analysis* consists of techniques for simulating time series data in reason to extricate conceptual statistics and different properties of the data. Time series forecasting is basically to assume future values on the basis of past gathered data. Whereas regression analysis is to check theories , the present values of one or more nuclear time series influence the present value of different time series, this category of analysis of time series is not known to be "time series analysis".

Natural temporal ordering is another property of Fuzzy time series. According to this type of property,there is no proper sequence of observations.It is different from spatial data analysis in which the observations is related to geographical locations . A stochastic model explains that the observations which are close together according to time will be more near than observations which are farther apart. In close to this, time series techniques uses the realistic single-way ordering of time such that values for a given time will be represented as elaborating in a way from previous values.

IV COMPARITIVE STUDY OF FORECASTING RESULTS

In this, we compare the outcomes of various forecasting techniques on previous data of sugar production. A co-ordination of mean square errors (MSE) with different techniques is demonstrated in table ,in which the mean square error (MSE) is explained below:

MSE=∑ (Actual Production –Forecasted Production)^2/n

Where i=1 to n,

	S.R.Singh[5]	Chen Higher order[1]	Chen [2]	Huarng[3]
MSE	1534.12	63.45	562.78	329.05

Table 1 Relation of MSE

V CONCLUSION

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The provocation of the approach of fuzzy time series in miscellaneous crop production forecast is to support the enlargement of DSS in agricultural production system, a real life problem comes in the group having unpredictability in black and white parameters. The past outcomes disclose that the agricultural production system is a multiplex process and tough to model by the statistical formulations, in concern with even all the excellence practices of cropping are inherited; the unpredictability comes in the crop production because of few uncontrolled parameters. As a result, great data utilization is attained in way of: (1) a raised number of forecast regulations (2) some pattern combinations to be complemented with further time series data. Alternative approach was to make a comparative study between various techniques of fuzzy time series method. It is comprehend that it gives better outcomes than methods of fuzzy time series . Relative experiments drawn so far shows that the suggested model outperforms its corelation. There is not enough proof to finalize whether this is an interesting forecasting method . Since this method of forecasting is inherently is based on the rule, its experimental usefulness greatly depends on its potential to elaborate matching forecast concepts, and stability of those, under unknown conditions. As seen in neural network clarification is done by ANN, so neural network is contemplated as a goal in relation to the techniques of fuzzy time series

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