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Crop Selection Algorithm- Technique for Price Prediction

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Abstract- As is known agriculture is intricate zone where consistently new data is aggregated at expanding rate. Vast segment of this learning is as composed records, substantial part coming about because of studies led on data and data gained in agriculture from clients. Today there is an extraordinary propensity to make this data accessible in electronic organization, changing over data into learning, which is no simple assignment. With the expansion in expenses in agricultural ventures and expanding need to control these costs, suitable examination of agrarian data has turned into the subject of awesome significance.

Index Terms- Crop Selection Algorithm (CSA), Monsoon, Forecasting, Climate, Crop planning, Data mining, Prediction, Water harvesting.

INTRODUCTION

Farming data frameworks contain monstrous measures of data including data about products, clients, and market. With the utilization of data mining techniques, valuable examples of data can be found in this data, which will be utilized for further research and report assessment. Important question is the means by which to characterize substantial measure of data. Programmed characterization is done on the premise of similitude present in the data. This kind of characterization is just valuable if the conclusion procured is adequate for the agronomist or the end client. The choice of crop to plant is based on multi parameters like water availability, predicted price, climate conditions, soil type, fertilizer availability etc. Climate parameters can be controlled using shade net. Fertilizer availability can be controlled using stocking. Soil type can be managed using pit soils. But the major uncertainty is water availability and the predicted price. Once we these price fluctuation, we see that it has a pattern and the monsoon rain follows a 7 year repletion cycle in most parts of INDIA. So this motivated us to view the crop suggestion as data mining problem and design a predictor model applying data mining algorithms to solve it.

Related work

In [1], authors applied ARIMA model to predict the demand for vegetables in market. They used past demand and built a ARMIA model to predict the demand. However their model worked only for certain vegetables.

In [2], authors developed a decision tree model to predict the fluctuation is pork price in china market. They took 10 year of data and based on it developed a model to predict if price will fall, rise or stable. The model was used an early warning system to alert for pig price risk.

In [3], authors combined PSO (Particle Swarm Optimization) with SVM (support vector machine) to forecast agricultural water consumption. If the water consumption can be modeled, it will become easy to select crops for planting. But crop selection must not be done based on water consumption forecast alone, it must also involve expected price turning profitably for farmers.

In [4], authors propose multi-dimensional model for analyzing land physical properties. They captured multiple attributes of soil and represented in OLAP data cube. The result OLAP data model was used to query for land properties.

In [5] , authors analyzed the data of rural labor, arable land area and the gross output value of agriculture about 30 cities of China based on the decision tree, and adopted clustering analysis method to discretize continuous data during the process of data mining in order to subjectivity comparing to the traditional classification methods. Finally, they generating the decision tree for agriculture, in terms of spatial classification rules and analyzing the rules.

In [6], authors applied data mining model to analyze the droughts. Based on the concept of the new drought index called Vegetation Drought Response Index (VegDRI) using data-mining technology, an Integrated Surface Drought Index (ISDI) was proposed in this work. ISDI improved the original model, adding remote sensed temperature information into the input factors. This index attempt to describe drought from a more comprehensive perspective, the integrated information including: traditional meteorological data, satellite-derived earth surface water and heat environments, vegetation conditions, and inherent properties of the earth's surface. The Cross-validation results indicated that ISDI construction models for three phases of growth season have very high regression accuracy. The practical application of ISDI in mid-eastern China during the reported dry year 2009 also demonstrated that it can provide accurate and detailed drought condition both at regional and local scale. This investigation showed that ISDI has good application potential for drought monitoring across China.

In [7], authors applied decision tree to analyze the impact of climate factors on soya bean yield. Decision tree model was built to predict the soya bean yield from relative humidity, temperature, and rain fall and evaporation data. But the result is very qualitative and our work tries to propose a quantitative model.

PROPOSED WORK

A Crop Selection Algorithm is proposed in this research work.

Crop Selection Algorithm (CSA)

The architecture of the proposed Crop Selection Algorithm (CSA) is given below.

The solution has following stages:

1. Lake Level Prediction
2. Crop Filtering
3. Market Price Prediction
4. Crop ordering

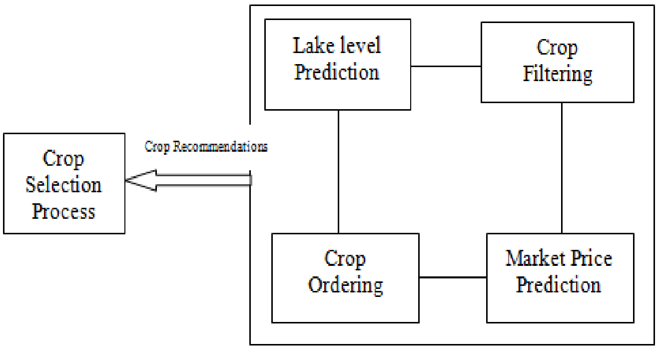

Fig.1: Procedure of Crop selection algorithm

Lake Level prediction module will predict the lake level in future times based on the previous lake level. Crop filtering will invoke select the crops suitable based on the field conditions, climate conditions and lake level. Market price prediction will predict the future price of the selected crops and the crops are ordered in descending order of prices and recommended to the farmers.

The four stages use the following three models

1. ARIMA
2. Multi Perceptron
3. Neural Model

And all the results of the model are combined by using Multi linear regression to predict the crop selection.

a. Lake level prediction

Lake level prediction is a crucial step in our solution. Traditional solutions for lake level prediction are based on using single model but we differ in our solution by employing a multi model. ARIMA and Multi Perceptron are trained to predict the future level and these results are aggregated by using multi layer regression to get the model to predict the lake level.

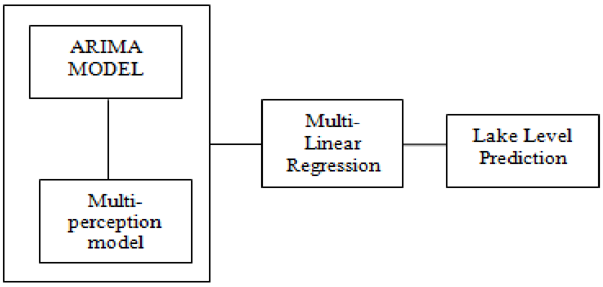

Fig.2: Procedure of Lake level prediction

Say for a future time T, the ARIMA model predicted value is P1 and the multi Perceptron model predicted value is P2; the final lake level prediction i.e. Y is modeled as

$Y = R + b1*P1 + b2*P2$

where, R is the initial level of lake, and b1 & b2 are co-efficient for each model to calculate according to multi-linear regression technique.

b. Crop Filtering

Crop filtering is realized as a decision tree approach. Crops are classified to three levels LOW, MEDIUM, HIGH based on the Lake Level, climate, and soil type. Lake level is transferred to scale of 0 to 100.

Climate is the average temperature during the cropping period and the soil type is sandy, clay. Based on the values of the dependent parameter lake level, climate and soil type the output parameter crop type is determined using a decision tree as shown in table I.

Table I: Values of the output parameter crop type based on dependent parameters like lake level, climate and soil type

Lake Level	Climate	Soil type	Crop Type
<30	>35	sandy	LOW
<30	>35	clay	LOW
<30	27 to 35	sandy	LOW
<30	27 to 35	clay	MEDIUM
30 to 60	>35	sandy	MEDIUM
30 to 60	>35	clay	HIGH
30 to 60	27 to 35	sandy	MEDIUM
30 to 60	27 to 35	clay	HIGH
>60	>35	sandy	MEDIUM
>60	>35	clay	HIGH
>60	27 to 35	sandy	MEDIUM
>60	27 to 35	clay	HIGH

c. Market Price Prediction

Market price prediction is a critical step to determine the profitability. To do the market price prediction we use a multi model. We use ARIMA and Neural network and combine the result using multi linear regression to predict the market price of the crop. Historical prices are crop is collected and used to train the ARIMA and Neural network.

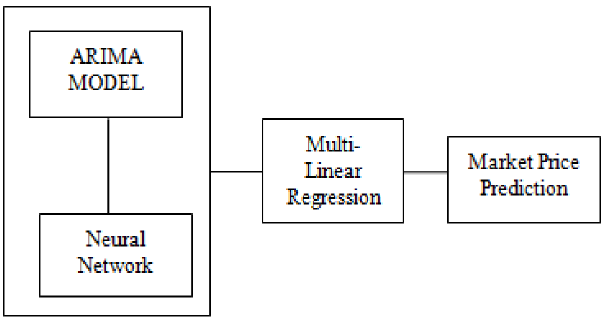

Fig.3: Procedure of Market Price prediction

For each crops in the category provided by crop filtering, market price prediction is applied to predict the market price.

d. Crop Ordering

The selected crops for which the market price prediction is done is then sorted in descending order and recommended to farmers. Farmers can choose the crop from it based on their expertise and profit requirements.

RESULTS

We have collected lake levels in Coimbatore which is located in southern part of India. Choice of Coimbatore is apt since rainfall varies a lot and most of agriculture is dependent on lakes located near to fields. Also price in market is quite volatile. To measure the accuracy of the solution we measured the average profit due to top N recommendations and compared our solution with vegetable price prediction with neural network proposed in [8].

We varied N from 2 to 10 and measured the average profit. From the result we see that average profit is higher in our solution when compared to [8].

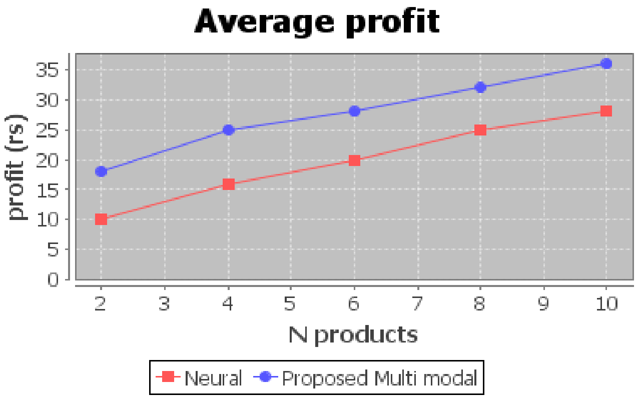

Fig.4: Comparison results of proposed multi model with neural network in terms of profit and number of crop products

We varied the lake level from three ranges <30, 30 to 60, > 60 corresponding to different monsoon levels and for N=5, measured the average profit. From the results we see that our solution adopted fast and was able to give better profit then solution [8].

The result for low lake level of < 30 is below in fig.5

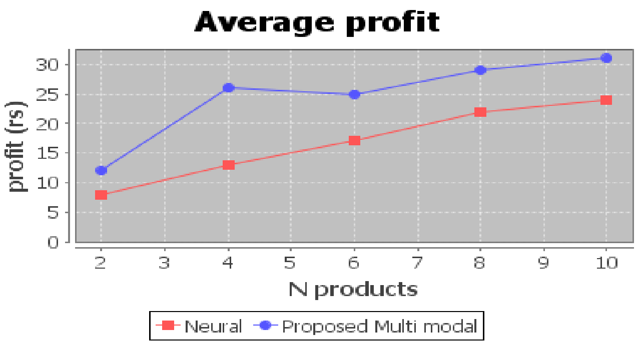

Fig.5: Comparasion results of proposed multi model with neural network for lake level <30

The result for medium lake level of 30 to 60 is below in fig.6

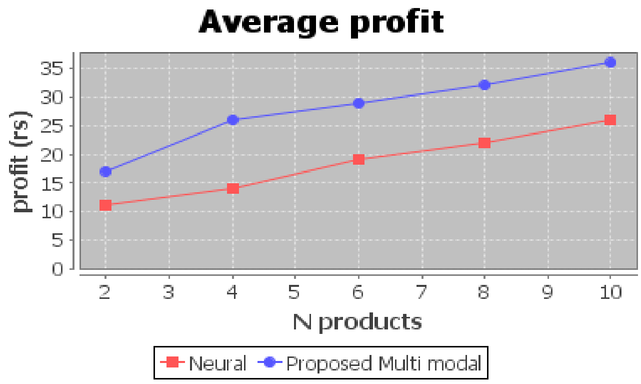

Fig.6: Comparasion results of proposed multi model with neural network for lake level 30-60

The result of high lake level >60 is below in fig.7

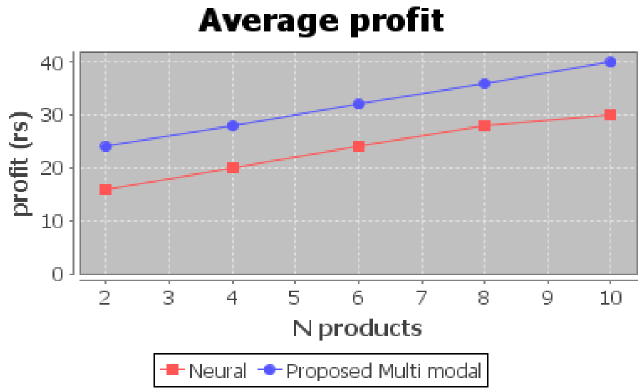

Fig.7: Comparison results of proposed multi model with neural network for lake level >60

The capacity to foresee yields would profit ranchers as they plan the offer of their harvests and biofuel enterprises as they plan their operations. The new model could help both cultivators and industry boost their benefits and productivity. Determining crop yield can be to a great degree valuable for ranchers. In the event that they have a thought of the measure of yield they can expect, they can get their corn before collect, frequently securing a more aggressive cost than if they somehow happened to hold up until after reap. In like manner, industry can profit by yield forecasts by better arranging the coordination's of their business. Yet, tried and true gauges can be hard to discover. Overall the research work proved that multi model is able to give better accuracy compared to single model. Also for future work one can try to use others models like Fuzzy etc. to still improve the accuracy.

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