



EFFECTIVE PREDICT PLANT GROWTH AND YIELD IN GREENHOUSE ENVIRONMENTS USING DL, ML

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Abstract — In this paper, a new deep recurrent neural network (RNN), using the Long Short-Term Memory (LSTM) neuron model, in the prediction formulations. Both the former yield, growth and stem diameter values, as well as the microclimate conditions, are used by the RNN architecture to model the targeted growth parameters. A comparative study is presented, using ML methods, such as support vector regression and random forest regression, utilising the mean square error criterion, in order to evaluate the performance achieved by the different methods. Very promising results, based on data that have been obtained from two greenhouses, in Belgium and the UK, in the framework of the EU Interreg SMARTGREEN project (2017-2021), are presented.

INTRODUCTION

Data mining is the process of identifying the hidden patterns from large and complex data. It may provide crucial role in decision making for complex agricultural problems. Data visualisation is also equally important to understand the general trends of the effect of

various factors influencing the crop yield. The present study examines the application of data visualisation techniques to find correlations between the climatic factors and rice crop yield. The study also applies data mining techniques to extract the knowledge from the historical agriculture data set to predict rice crop yield for Kharif season of Tropical Wet and Dry climatic zone of India. The experimental results provided include sensitivity, specificity, accuracy, F1 score, Mathew's correlation coefficient, mean absolute error, root mean squared error, relative absolute error and root relative squared error. General trends in the data visualisation show that decrease in precipitation in the selected climatic zone increases the rice crop yield and increase in minimum, average or maximum temperature for the season increases the rice crop yield. For the current data set experimental results show that J48 and LAD Tree achieved the highest accuracy, sensitivity and specificity. Classification performed by LWL classifier displayed the lowest accuracy, sensitivity and specificity results.



LITERATURE SURVEY

(Kanai et al., 2008). The stem diameter is an important parameter describing the growth of crop plants under abiotic stress during vegetative growth stage. Therefore, it is important to generate stem diameter growth models able to predict the response of SDV to environmental changes and plant growth under different conditions. Many studies emphasize the need to critically review and improve SDV models for assessment of environmental impact on crop growth

(Jones et al., 1999), (Heuvelink, 1996) are considered as the main applicable dynamic growth models. Those models are dependent on physiological processes, and they represent biomass partitioning, crop growth, and yield as a function of several climate and physiological parameters.

(Abreu et al., 2000) to predict tomato yield in terms of the weight of harvested fruits. The model was developed by examining the relationship between environmental parameters in a heated greenhouses in the Southern part of France. A linear relationship between flowering rate and fruit growth was the basic assumption used in this model. However, the model performance was poor when tested in unheated plastic greenhouses in Portugal.

Another tomato yield model was proposed by Adams (Adams, 2002), based on a form of graphical simulation tool. The main objective of the model was to represent weekly fluctuations of greenhouse tomato yield in terms of fruit size and harvest rate. Hourly climate data were used to estimate the rate of growth of leaf truss and the flower production. Yield seasonal fluctuations were generally influenced by periodic variations of solar radiation and air temperature.

(Vandegehuchet et al., 2014). It has been documented that SDV is sensitive to water and nutrient conditions and is closely related to the responses of crop plants to the changes of environmental conditions

PROPOSED METHOD

Effective plant growth and yield prediction is an essential task for greenhouse growers and for agriculture in general. Developing models which can effectively model growth and yield can help growers improve the environmental control for better production, match supply and market demand and lower costs. Recent developments in Machine Learning (ML) and, in particular, Deep Learning (DL) can provide powerful new analytical tools. The proposed study utilises ML and DL techniques to predict yield and plant growth variation across two different scenarios, tomato yield forecasting and *Ficusbenjamina*



stem growth, in controlled greenhouse environments.

As there is no staff available in unmanned restaurants, it is difficult for the restaurant management to estimate how the concept and the food is experienced by the customers. Existing rating systems, such as Google and TripAdvisor, only partially solve this problem, as they only cover a part of the customer's opinions. These rating systems are only used by a subset of the customers who rate the restaurant on independent rating platforms on their own initiative. This applies mainly to customers who experience their visit as very positive or negative.

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PROPOSED SYSTEM

We deploy a new deep recurrent neural network (RNN), using the Long Short-Term Memory (LSTM) neuron model, in the prediction formulations. Both the former yield, growth and stem diameter values, as well as the microclimate conditions, are used by the RNN architecture to model the targeted growth parameters. A comparative study is presented, using ML methods, such as support vector regression and random forest regression, utilising the mean square error criterion, in order to evaluate the performance achieved by the different methods. Very promising results, based on data that have been obtained from two greenhouses, in Belgium and the UK, in the framework of the EU Interreg SMARTGREEN project (2017-2021), are presented.



In order to solve the above problem, all customers must be motivated to give a rating. This paper introduces an approach for a restaurant rating system that asks every customer for a rating after their visit to increase the number of ratings as much as possible. This system can be used unmanned restaurants; the scoring system is based on facial expression detection using pretrained convolutional neural network (CNN) models. It allows the customer to rate the food by taking or capturing a picture of his face that reflects the corresponding feelings. Compared to text-based rating system, there is much less information and no individual experience reports collected. However, this simple fast and playful rating system should give a wider range of opinions about the experiences of the customers with the restaurant concept.

SAMPLE RESULTS



CONCLUSION

In this paper, A comparative study is presented, using ML methods, such as support vector regression and random forest regression, utilising the mean square error criterion, in order to evaluate the performance achieved by the different methods. Very promising results, based on data that have been obtained from two greenhouses, in Belgium and the UK, in the



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