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Review Article

AN EMPIRICAL STUDY ON MACHINE LEARNING ALGORITHM FOR PLANT DISEASE PREDICTION

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Abstract
In this study, a neuroevolution algorithm has been developed for predicting various diseases in plants. The machine learning algorithms support different classification techniques that can be demonstrated for the performance improvement in plant disease prediction. Prediction of the disease depends on the weather factors which have a relationship with climate change data, the soil of that area. Here we have illustrated an approach of implementing the neuroevolution model based on ANN for predicting various plant diseases. Multiple causes and the type of illness that can affect different plants during the different seasons are predicted. Therefore the result of the proposed model assists in decision making in advance in precaution taking in a disease that may affect the plant. The results are utilized for making an advanced decision for disease avoidance in plants as well as various farm activities throughout multiple-stage it also uses the same model that can be utilized for predicting various agricultural data such as yield prediction and weather prediction.

Key words: Neuroevolution, Prediction, Artificial Neural Network.

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INTRODUCTION

Agriculture is a regional business that is hard to differentiate the disease that affects the plant at the time of harvesting. This paper focuses on the objective of discriminating against the plant that is diseased by inspecting its morphology using a machine learning algorithm. Food production can be devastated by diseases or pests, resulting in reduced food production. There are lots of modern technologies that have been developed, therefore minimizing the burden of the post-harvesting process. A lot of techniques are in use to detect diseases such as polymerase chain reaction, thermography, chromatography, etc. same. At the same time, the significant factors that lead to a decrease in food production are toxic pathogens, poor disease control. Therefore, in this paper, we focus on the prediction of disease in a plant using a machine learning algorithm.[1] The vital techniques that can Automatically detect the conditions in various plants well advance in the early stage help in crop protection. Therefore, we are implementing the procedures for the early detection of diseases in multiple plants. Hyperspectral data are analyzed and recorded from both healthy leaves and inoculates leaves with the pathogens, beticola, betae causing leaf spot, beet rust, and powdery mildew are considered. Early identification of healthy and immunized plants among specific diseases is achieved by the various algorithm.

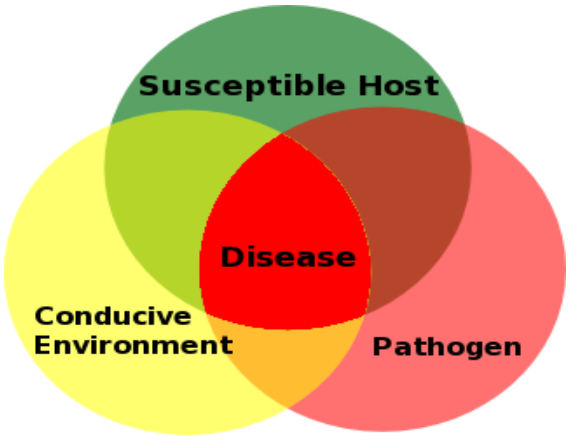

Fig 1 : Factors for plant disease occur

LITERATURE REVIEW

Prediction of leaf moisture using a generalized regression neural network

Younes Chtioui et al. [1] proposes a GRNN (Generalized Regression Neural Network) technique for predicting leaf moisture. Leaf moisture is one of the critical factors that lead to plant disease. Therefore, in this paper, the author analysis the climatological factors that can influence leaf moisture and disease in the plant. Soil Moisture, etc., and obtained the results of absolute prediction error value as 0.1414 and 0.1300 for testing and training set subsequently. Also, the prediction error value as 0.0491 and 0.0894 for the test and training successively, it has also been demonstrated that GRNN technique is more precise comparing MLR.

Predictive evaluation of pest in a wheat plant using a novel regression technique.
Jessica Rutkoski et al. [2] proposed a novel technique for predictive evaluation of pest in the wheat plant. The evaluative technique includes various regression analyses such as Reproducing Kernel Hilbert Spaces Regression, Ridge Regression, Bayesian LASSO, Multiple Linear Regression, and Random Forest Regression, and accordingly, the generated genomic marker model and Quantitative Trait Loci model has obtained the highest precision value as a result.

Prediction of Deoxynivalenol occurring on wheat using Multiple Linear Regression [3]
D. C. Hooker, et al. [3] have predicted the occurrence of Deoxynvalenol using MLR (Multiple Linear Regression) techniques, therefore, to identify the three periods and conditions of Deoxynivalenol occurrence. In this work, they have collected relevant data from around four hundred various farms located in Ontario in Southern Canada from 1996 to 2000. They have collected data such as daily precipitation value, temperature values in degrees, and moisture value for every one hour as weather factors that are used for the experiment, The result demonstrates that growth of wheat, level of rainfall, the value of temperature are all having influences in the occurrence of deoxynivalenol. Also, it is proved that moisture level in the atmosphere doesn't play any role in plant disease break-out, and it is concluded that the precision value was obtained about 89% with a threshold value for two-micron grams.

MATERIALS AND METHODS

Neuroevolution algorithm

Neuroevolution algorithm is one of the Artificial Neural Networks techniques that was evolved using natural organic systems. Neuroevolution strategies are beneficial and appropriate in problem-solving and in the development of evolutionary robotics. Neuroevolution can be seen both as a way to explore how knowledge changed in nature for designing artificial neural systems to achieve needed tasks. Neuroevolution has unusual strategies that lead to inconsistent spaces and fortification learning. These areas are incorporated with few specific uses that are reinforcement in education; the most apparent application is versatile, nonlinear control of physical gadgets.

Data set

The types of Diseases that can be caused in plants, **Black Spot** are the diseases that are appeared in shrubs such as a rose plant. It creates a black stain, which leads to yellowing around the leaf. It usually occurs during the moist and humid conditions, and it occurs in wind-borne or rain splashed leaf tissues. An alternative type of disease is **Botrytis Blight** leads to dead or dying tissues that develop a brown or spotted in the plant. It has silver spores on the dead or dying tissue that make the plant rust. It always affects all the plant parts rather than the roots. These rust spores can travel through the air and spread fungal diseases on other plants also. **If a plant is having lots of fungi stains, then it is called as powdery mildew**. These types of diseases affect the plants by removes essential nutrients, the leaves of the affected plant will become yellow, and they are drop off prematurely. Leaves having affected by the three diseases such as Blackspot, botrytis blight, and powdery mildew and standard leaf are collected for the experiment.

EXPERIMENT AND RESULT DISCUSSION

Experimental Setup

In the process of optimization of the neural network, backpropagation plays a major role, and it can be replaced by a genetic algorithm, which can choose better pair, therefore, to optimize by itself. In this technique, each network tries to carry out its deliberate task, which is provided with its fitness score. The next generation obtained with better systems that are mutated and adjusted with the biases. Out of various machine learning algorithms, the neuroevolution algorithm has been successful in recent years, and it is exploring this by better performance. It is quite complicated compared with the relevant hyper-parameters number. So there was no reason to choose one over the other based on complexity [19]. It is previously pointed out that pure linear models cannot be the better choice of algorithms for this application. But regularization can help to remove issues regarding co-linearity, Introducing higher-order features helps with the non-linearity.

In neuroevolution, any mutation techniques can be applied, such as add or subtract values from mutated weights.

Step 1: Input data values are taken
Step 2: Specific Features considered are computed (Location, Season)
Step 3: neural network (neuroevolution) constructed
Step 4: mutation technique applied for the neural network.
Step 5: Random values nearest to 1 are multiplied to the biases
Step 6: replace previous biases value with the new value.
Step 7: Negate some values for biases.
Step 8: substitute some weight values with other weight values.
Step 9: Train the Model
Step 10: Evaluate the Performance using test set.

Results:
Earlier research studies successfully used many data mining algorithms to discriminate between healthy and diseased leaves. In this paper, we have implemented neuroevolution algorithm to predict three various diseases such as black spot, Botrytis blight, and powdery mildew and we have achieved better results, the results are depicted in the below table 1.

Table 1: Accuracy, Specificity, sensitivity for various disease.

Classification [%]			
Leaf disease	Accuracy	Specificity (healthy leaves)	Sensitivity (diseased leaves)
Black Spot	72 %	81 %	70 %
Botrytis Blight	80%	83%	64%
Powdery mildew	84 %	67 %	84%

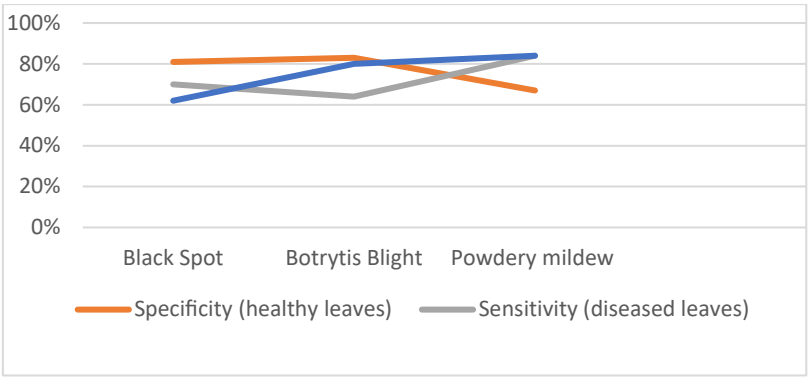

Fig 2: Accuracy, Specificity, Sensitivity for various plant diseases

CONCLUSION

In this study, a neuroevolution technique is proposed for predicting diseases that can be caused in plants, considering various features such as location, temperature, season, and humidity level [18]. Weighing the monthly seasonal scales that can be obtained throughout the period. Though, as the disease prediction model needs daily time steps of weather data, a disaggregation method has been used for the generation of such regular time series. To evaluate the disease that can be caused at different stages of the various season in respect season, plant disease has been simulated. The monthly and seasonal data obtained are analyzed with infections caused are demonstrated significant efficiency prediction of plant disease.

Moreover, improvement of ability in predicting wheat productivity has been observed before the specific season. Therefore, the weather data has seen of having incorporation with updates of successive months, uncertainty in yielding prediction reduces, The weather condition experienced by the crop more used to observe the predicted nature. In this experiment, the last five year data are used for making the proposed model. The results show improvement will be a better use for making decisions in choosing a suitable period for wheat cultivation in coastal regions like Odisha, India. This study can also be further extended to analyze various other major crops like rice, corn, sugarcane etc., of the same region, therefore, to identify better crop cultivation for the expected weather conditions, which may also help in making a decision on selecting crop for the next subsequent seasons.

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