DETECTION OF PLANT DISEASE USING RESNET FRAMEWORK IN COMPARISON WITH SUPPORT VECTOR MACHINE TO IMPROVE CLASSIFICATION ACCURACY

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Article History: Received: 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

Abstract

Aim: The proposed research aims to improve the classification accuracy of the plant disease detection using ResNet over Novel Support Vector Machine.
Materials and Methods: The detection of plant disease is performed using ResNet (N=10) and Novel Support Vector Machine (N=10) Novel Algorithms. The sample size for each sample is considered as 10 which is performed with a G power calculator.
Results: The ResNet 95% algorithm exhibited better results with classification accuracy compared to that of Novel Support Vector Machine 77% accuracy. The significant accuracy value of p=0.001 ($p<0.05$) is attained through SPSS Statistical Analysis.
Conclusion: The classification of plant disease using ResNet with accuracy efficiency of 95% is better than the Novel Support Vector Machine with accuracy efficiency of 77%.

Keywords: Plant Disease, ResNet, Novel Support Vector Machine, Classification, Machine Learning, Neural Network, Food Chain, Plant Bacteria.

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1. Introduction

Agriculture is one of a country's most vital and valuable industries. It is essential to the entire food chain of a country. When it comes to plant bacteria, disease is a normal occurrence. It has a greater impact on them. The current strategy is to locate them with the naked eye, which will almost certainly fail due to human error. Even though technology is the hot trend that goes around the world, the food chain would be the necessity that each and every nation should produce in order to survive. Thus, cultivating plant bacteria and growing the food chain would be one of the main economical factors as well. On the side of the difficulties faced while producing food, it would be plant diseases. Plant disease reduces the growth of the food chain to even 10% if not detected early. Detection of the disease through naked eye is such a hideous task (Office and Agriculture Editorial Office Agriculture Editorial Office 2020). Automation can aid in the early detection of plant diseases by classifying them according to their symptoms. Resnet is a type of neural network created to deal with the problem of exploding gradients. It's a Neural Network that maximizes value by reducing the number of layers (Hussain et al. 2022). Novel Support Vector Machine is the ML model that utilizes the hyperspace to categorize the different options using hyper lines. The regression can also be performed using the same by using continuous values (Qi, Silvestrov, and Nazir 2017). Though the application of plant disease detection outcomes to various other applications its main application would be a higher efficacy rate of crop yielding that turns into a nation's economic growth (Matthews 2001).

There are various existing similar researches found in the two publications IEEE and google scholars about 22 and 19 respectively. (Clark et al. 2022) used genomics to identify the p.effusa by determining its mitochondrial position using the RPA analysis. They used TaqMan quantitative (PCR) polymerase chain reaction to verify the p.effusa presence and used comparative analysis to detect its individuality. Taqman pcrf has the 100 dna and about 900 rna threshold values (Leelaruji and Teerakawanich 2020). A Convolution Neural Network with image processing can predict sun events 1 to 2 minutes ahead of time. It forecasts the events by taking a picture of the sky and processing it with image processing software. It then determines the position of the sun as well as all cloud movements. It has a 27.50 percent error rate and uses Convolution Neural Networks to anticipate occurrences. (Jia 2022) used residual phase and mel frequency coefficient to extract the properties of low-level sound waves. Algorithms are used to get the primary audio and low level audio properties. The accuracy was determined to be 92.06 percent with a loss value of 0.98.

Our institution is keen on working on latest research trends and has extensive knowledge and research experience which resulted in quality publications (Rinesh et al. 2022; Sundararaman et al. 2022; Mohanavel et al. 2022; Ram et al. 2022; Dinesh Kumar et al. 2022; Vijayalakshmi et al. 2022; Sudhan et al. 2022; Kumar et al. 2022; Sathish et al. 2022; Mahesh et al. 2022; Yaashikaa et al. 2022). Though there are exceptional alternatives that already exist, the study hole located in them is the low accuracy at the same time as detecting the positive plant bacteria. So this test take a look at is focussed on enhancing the accuracy throughout the detection of the plant sicknesses the usage of the ResNet. The intention of ailment detection on time results in the prevention of plant bacteria harm ensuing in the boom of the farmer and financial system of the country. This version attempts to provide the optimized effects as possible. The farmer and agriculture is the spine of any financial system (Yahaya 2020).

2. Materials and Methods

The study was conducted at the Data Analytics Lab, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai. The research is divided into two groups. ResNet is the first group, and Recurrent Neural Network is the second group. With an alpha of 0.05 and beta of 0.2, a confidence interval of 95%, and an 80 percent pretest power, a sample of 20 distinct values is employed (K. and R. 2018). The performance of two algorithms, Recurrent Neural Networks and ResNet, is compared in this paper. The sample values for both techniques are shown in Table 3

Two methods are used to process the test data: ResNet and Recurrent Neural Network of Machine Learning algorithms. The corresponding Analysis values for plant illnesses detected using input photo data are shown in Tables 2 and 3.

The dataset is compared to RGB images of all sick and uninfected plants to detect plant diseases. The information was gathered via kaggle (emmarex 2018) of machine learning. The databases contain information on the numerous diseases that impact plants. There are approximately 38 diseases listed, each having a scientific name. There are around 1800 images in each of the categories. Training, testing, and validation are the three categories in which the data is organized. The dataset is preprocessed by labeling each disease using a labeling technique. Img. To detect the disease, each photo is manually tagged and a boundary box of affected leaves is drawn. The dataset is then divided into 9:1 train and test groups.

ResNet

The ResNet is a type of neural network that was created to solve the problem of vanishing gradients. Many alternatives, such as adding a value to the middle layer to make it less for the descent, were tried before the ResNet, but none of them seemed to work. The ResNet concept is also known as the Identity shortcut connection. Despite the neural network's many layers, the Resnet handles them by ignoring some of the levels that would diminish the vanishing gradient and steering connections to the final layer. As a result, the gradient value is optimized and the overfitting problem is avoided. As the name implies, ResNet gains performance by exploiting shortcut connections.

PseudoCode for ResNet Algorithm

//Input
I: CSV file containing required all the attributes.
1.Perform the convolution, normalization as stage1
2.Use the activation function to activate the model.
3.Try the max pooling to get max data in short.
4.Perform the stage 2 convolutions using identity blocks.
5.Skip the irrelevant layers.
7. Use Adam optimizer and compile the model.
//Output
The output is the predicted disease.

Support Vector Machine

The Novel Recurrent Neural Network is an Artificial Neural Network that deals with a succession of data. Unlike other neural networks, the RNN is focused on the data sequence, which means it gets its value from and is dependent on prior inputs. Memory is also an important concept in the Novel Recurrent Neural Network. The RNN keeps track of the series or previous inputs. Unfolding in time is a concept that carries the weights of a Novel Recurrent Neural Network's weights in order for it to perform. The process of determining the gradient along with it is known as back propagation in time. The neural network as a whole can be deconstructed into simple forward steps.

PseudoCode for Support Vector Machine

//Input
I: CSV file containing required all the attributes.
1.Featurescale and Normalize the data.
2.Select proper kernel and respective parameters
3.Add regularization if required.
4.Generate the Correlation Matrix.
5. Train the model
6.Retrieve the Contraction Coefficients.
7.Create the estimator using the Coefficients
//Output
The output is the predicted disease.
Since Deep Neural Network is used, algorithms run smoothly on the GPU. Unlike CPU the GPU performs tasks concurrently. So Google collaboration is used as the software which will provide a wide Range of GPUs. The Gpu we used is the Nvidia Tesla K80. The configurations of the system we used are Intel i5, 5th Gen CPU@2.8GHZ, 8 GB RAM, and 64-bit OS.

Statistical Analysis

IBM's SPSS statistics programme (version 26) is used for statistical analysis. The independent variables are illness features, while the dependent variable is disease prediction. A total sample size of 20 is used in SPSS, with ten samples taken from each method. The Recurrent Neural Network group id is 2 and the ResNet group id is 1. An independent T-Test using SPSS is performed on a proposed research study (K. and R. 2018). The independent T-Test using SPSS is done for a proposed research study.

3. Results

To assess the detection accuracy of Plant diseases, the dataset is put into the ResNet and Novel Support Vector Machine(SVM) algorithms. Figure 1 shows how the accuracy of two algorithms is compared using a simple bar graph.
It was determined that the ResNet approach outperformed the Recurrent Neural Network machine learning algorithm in this experiment. ResNet has been found to be a useful method for detecting plant diseases. When the model is huge and has many layers, like in the case of the enormous Neural Network experiment we conducted, the ResNet uses a short connected technique for real-time model pull-off. On the other hand, while the Recurrent Neural Network may produce results, if the model is huge, the value may fall due to gradient descent, resulting in low accuracy. As a result, the accuracy of the Recurrent Neural Network is lower than the ResNet network.
The statistics for the t-test are shown in Table 1. Accuracy values for ResNet and Novel Support Vector Machine. Tables 2 and 3 illustrate an independent sample test for provided samples (Mean Accuracy=95& 85) and given samples (Mean Accuracy=95& 85), respectively. An independent sample T-test with a 95% confidence interval and a significance level of 0.05 is performed on the dataset. A significant value (p=0.001) was obtained using Levene's test for equality of variances (p=0.001).

4. Discussion

The ResNet was shown to be more accurate than the Recurrent Neural Network in this investigation, as evidenced by the Independent sample T-test. The average accuracy of plant disease diagnosis is

95%, while the accuracy of a Recurrent Neural Network and Support Vector Machine is 77%. The significant accuracy value of $p=0.001$ ($p<0.05$) is obtained between the two algorithms.

This part discusses similar outcomes that have been used by others in the past. (Yahaya 2020) used remote sensing techniques such as the Multilayer Perceptron and the SVM to detect plant diseases. (Clark et al. 2022) employed genomics to identify the p.effusa by employing RPA analysis to determine its mitochondrial location. They employed the TaqMan quantitative polymerase chain reaction (PCR) to confirm the presence of P. effusa and comparative analysis to determine its individuality. The 100 dna and 900 rna threshold values are found in Taqman pcrf. (Mahlein 2016) employed a multiview Machine Learning algorithm, which is a neural network made up of multiview learning capabilities and learning methodologies. By inputting two separate stock attributes, they were able to predict stock prices using a real dataset.

Based on the discussion, it is evident that plant disease prediction is critical and must be executed efficiently in any way possible, as it has a significant impact on people's health and economies, as well as nations' economies. When compared to the Novel Support Vector Machine, the ResNet provides a more precise diagnosis of plant disease. The dataset we utilized is good enough to detect the condition because it includes a wide range of diseases that would cover everything. Following detection, countermeasures can be implemented at an early stage, resulting in the eradication of disease-causing micro microorganisms. As a result, it will benefit everyone. The food chain is the most important component of any economy.

5. Conclusion

It is concluded based on the findings that ResNet is a significantly superior model for identifying with higher accuracy than Support Vector Machine. The ResNet Neural network focuses on the most important layers while disregarding the less effective ones. In our tests, ResNet was shown to be the most accurate algorithm, with a 95 percent accuracy vs 77 percent for Support Vector Machine.

Declarations

Conflicts of Interest

No conflict of interests in this manuscript

Authors Contribution

Data collection, data analysis, algorithm framing, implementation, and manuscript writing were all done by NC. Author NBD was involved in the workflow design, coaching, and paper review.

Acknowledgements

We would like to thank Saveetha School of Engineering for their support. Saveetha Institute of Medical And Technical Sciences (Formerly Saveetha University) for providing him with the necessary facilities and ongoing assistance to complete his studies.

Funding:

We thank the following organizations for providing financial support that enabled us to complete our study.

1. Azacus Pvt. Ltd.
2. Saveetha University
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

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Tables and Figures

Table 1. Accuracy values of ResNet and Support Vector Machine(SVM). (Mean Accuracy=95& 80) respectively

Group_id	ResNet	Group_id	Support Vector Machine
1	95	2	77
1	93	2	83
1	97	2	80
1	94.5	2	78
1	95.5	2	82
1	95	2	79
1	93	2	81
1	94	2	78.5
1	96	2	80
1	97	2	82.5

Table 2. Descriptive Statistics of the mean and standard deviation of two groups with each sample size of 10 using T-Test

Algorithm		N	Mean	Std. Deviation	Std. Error Mean
Accuracy	ResNet	10	95	1.43372	.45338
	Support Vector Machine	10	80.1	2.01108	.63596

Table 3. Independent sample T-test is applied for the dataset fixing confidence as 95% and level of significance as P=0.001($p< 0.05$)

Accuracy	Levene's test for equality of variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1..470	.241	19.077	18	.001	14.90000	.7810	13.25913	16.54087
Equal variances not assumed	-	-	19.077	16.270	.001	14.90000	.7810	13.24653	16.55347

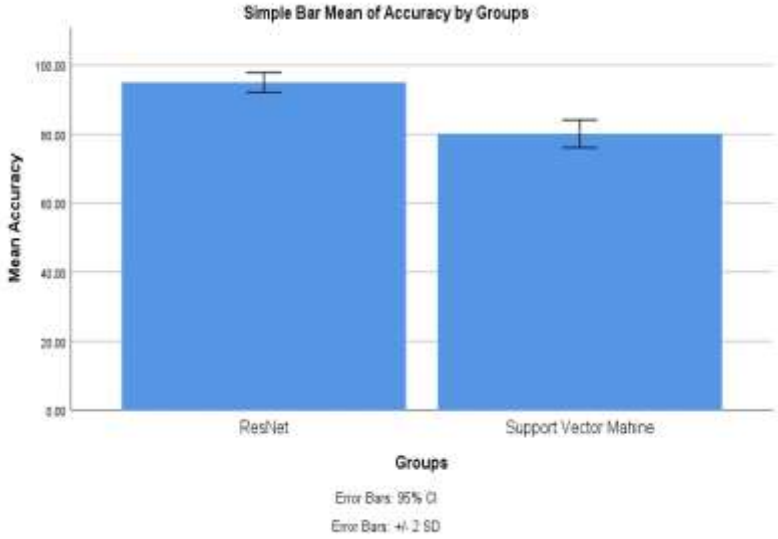

Fig. 1. Comparison of ResNet and Support Vector Machine Analysis in terms of mean accuracy. The mean accuracy of the Support Vector Machine is better than the ResNet. X-Axis: ResNet and Support Vector Machine, Y Axis: Mean Accuracy. Error Bar +/-2 SD with 95% CI.