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Deep Learning Model for Early Prediction of Plant Disease

Mrs.Shylaja N S[1], Bhoomika T S[2], Brunda S V[3], Rachana K S[4]
[1, 2, 3, 4]*Dept. of Computer Science and Engg., Government Engineering College, Krishnarajapet, Karnataka, India*

Abstract: ***Recognition of illnesses in the agricultural flora is a essential which needs to be executed in farming. This is approximate on which the financial system greatly depends. Infections finding in flora is sizable work in the agriculture business arena, as consuming ailments in plants is very common. To identify the disease in Leaves, constant statement of a plant life is compulsory. The statement and non-stop monitoring of the flora takes a lot of human effort and it is tedious. And clearly some kind of programmed strategy is required to study the plants. Database based documentation of illnesses in plant life made easy to observe the broken leaf and decreases human hard work and time saving. The projected procedure characteristic health problem in flora and categorize them extra precisely as in contrast current methods.***

I. INTRODUCTION

India is an agricultural united states and the position of any united states of America in the world relies upon on its economic system and the economy of most of the nations depends on agricultural production. In India the farmers have wide variety to select their crop for cultivation to produce most yield depending on environment available.Then also the manufacturing get affected by using ailments of the crop.

The diseases of the crop are caused with the aid of pathogens, deficiency of nutrients, fungi etc. Detecting ailments at early ranges allows to overcome it and deal with it appropriately. This process requires an professional to discover the disease, describe the method of therapy and protection. Identifying the plant sickness is no longer effortless task. It requires journey and understanding of vegetation and their illnesses. Relating the symptoms of plant diseases also requires accuracy.A man or woman can depend on a device which has ride and knowledge, referred to as an Expert System.

The aggregate of growing world smartphone penetration and in computer imaginative and prescient made possible by means of deep getting to know has covered the method for smart phone-assisted disorder analysis. Via a public dataset of 54,000 pix of diseases and wholesome shrub leaves gathered beneath managed environments, we instruct a deep convolutional neural community to discover fourteen yield types and twenty-six illnesses. The skilled mannequin attains an accuracy of 99.35% on a held-out take a look at set, representing the possibility of this method. Overall, the method of working out deep getting to know fashions on increasingly more massive and publicly reachable photograph datasets affords a clear route towards smartphone-assisted crop sickness prognosis in a huge worldwide gauge.

II. EXISTING WORKS

Hyeon Park in paper [1] et al., projected a approach to perceive the strawberry diseases. The agriculturalist needs the pictures of leaves via a mobilephone then upload the photo in the calculation engine system, which will discover if the leaf is healthful or disease. Suppose the leaf is diseased it will categorize the kinds of disease. Convolution and completely connected network is used by the author to identify the disease strawberry.The dataset which are used 4 kinds of disease photographs.

Also, they created the dataset by way of deliberately inflicting diseases to the strawberry plants. In every other Halil Darmus paper[2], expected a profound gaining knowledge of method to become aware orange of ailments in the leaf of tomato floras. 2 one-of-a-kind pre trained profound studying community plannings namely squeeze Net and Alex Net are used. Nvidia Jetson TX1 was once working to educate and authenticate the planning. It is proven that Squeeze Net is a properly planning for the portable profound mastering organization. [3] Amara J., et al., projected a deep learning based approach of CNN. Lent structure is used to be categorize the banana leaf disease. The efficacy of this strategy which is that it works well with numerous intricate circumstances. [4] Guan Wang et al., has took the Plant Community dataset with the apple black rot photos of five harshness tiers were used deep CNN to pick out the difficulty in the disease. The creator referred to that the excellent mannequin is the deepVGG16 model which offers an universal accurateness of 90.4%. Aditya Khamparia [5] et al., planned a hybrid strategy called a Convolutional encoder community to discover yield leaves disease.

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III. PROPOSED SYSTEM

1) *Phase 1:* Region Proposal. Create and extract class unbiased vicinity proposals, example CBB.
2) *Phase 2:* Feature Extractor. Feature extraction from every candidate region, example, by means of a deep CNN.
3) *Phase 3:* Classifier. Categorize points as one of the recognize modules, example, linear SVM classifier model in fig 1.

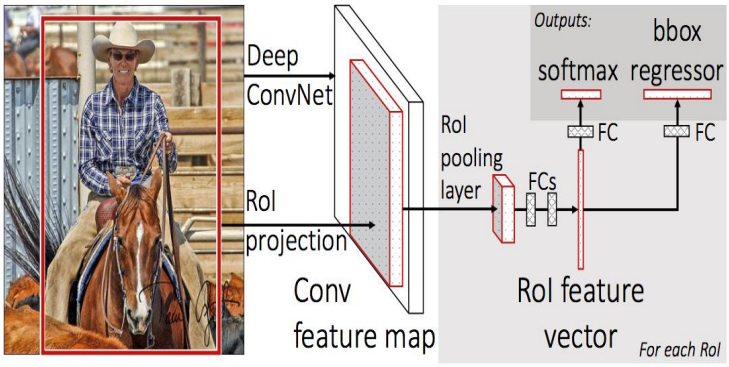


Figure 1

IV. PRE MODELING

The following methodology for pre-modeling
In records preprocessing, In fig 2 the uncooked photograph occupied in the database had long past via pre-processing previously nourished into the CNN model.

1) The photographs are re-constructed the stabilized to launch a dishonorable measurement for every photos or dispose.
2) Every photos are characterized as a 3-D vector of Q,P also P,Q and R denotes the width and height of an image, and R represents a variety of RGB station.
3) The pix are resized to 224 x 224 picture elements to stay well-matched with the transmission replicas



Figure 2:. Pre-processing of images

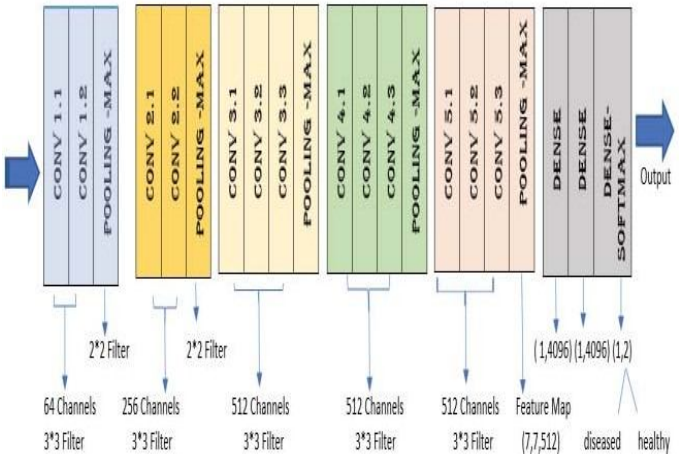


Figure 3: VGG16 Architecture

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4) Modeling

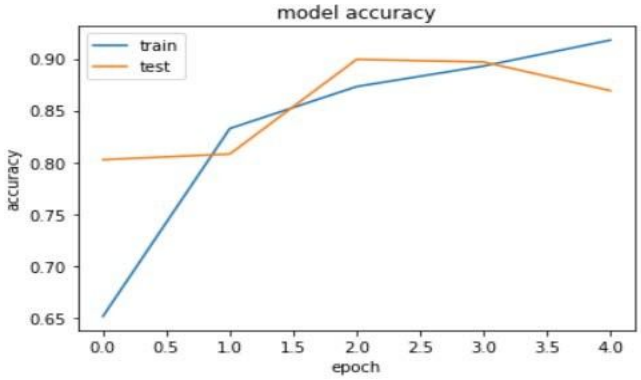


Figure4: training and testing of VGG16

5) Detailed Design

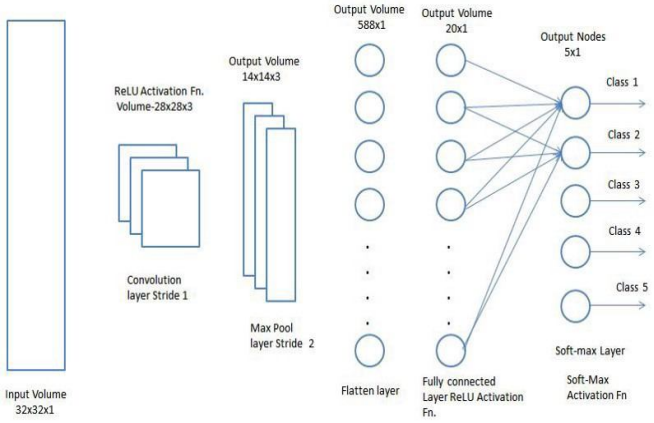


Figure 5: Fully Connected Layer (FC Layer) - Classification

Calculation a Fully-Connected layer is a (usually) low priced method of gaining knowledge of non-linear combos of the elevated factors as denoted with the aid of the output of the convolutional layer. The Fully-Connected layer is gaining understanding of a perchance non-linear characteristic in that space. Example of CNN network:Now that we have modified our input image into a terrific procedure, The compressed outcome was given to the fed-forward CNN and backpropagation applies to all and every repetition of exercise. Concluded a sequence of aeras, the mannequin is capable to differentiate among governing or sure subordinate elements pictures and categorize them. Use of the SoftMax Classification technique.All the parts required to construct a CNN are there. Convolution, ReLU and Pooling. The outcome of max pooling is given into the classifier we mentioned at first we can typically a multi-layer perceptron layer. Generally in CNNs these layers are used larger than as quickly as i.e. Convolution ->ReLU -> Max-Pool -> Convolution ->ReLU -> Max-Pool and so on.

V. IMPLEMENTATION AND RESULTS

The necessary resolved of projected job is to understand and pick out if or not a leaves are unhealthy and healthful and mentioned the kind of diseases to the agriculturalist. Skilled fashions are examined in the authentication set the usage of GPU. There are 15000 education images and 4000 authentication pictures. Every one of them are labeled. The deep gaining knowledge of mannequin was once once capable to categorize with thr accurate value of 96-98 %.Accurate value could be improved when competent with a massive wide variety of photos and by way of accepting pre-trained CNN model**.**

A. CNN

Extraction in this implementation, Convolutional Neural Networks (CNN) based feature extraction method is adopted to obtain the more accurate features. These features are like diameter, length, width, area and perimeter of the leaves. Flavia data set is applied in the given training images for the CNN.

The performance of CNN based approach is far better than the hand-crafted features of the previous approaches. The CNN architecture is shown in the figure 6

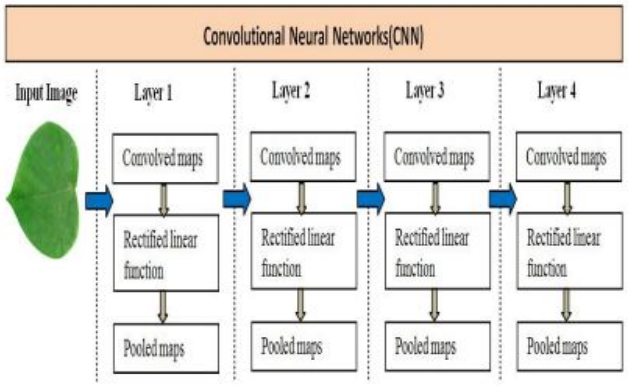


Figure 6: CNN

This CNN algorithm was implemented on falvia dataset used as the training images with 1800 leaves to extract the features from 32 different species. Here we have used 4-layer CNN model. The CNN architecture is shown in figure 6 the network layers are given below. i) Input Layer data set vector (q) is fed to this layer. Its dimensions are 5x1. ii) Radial Basis Layer In this layer, the vector distance (n) is calculated between the vector p and the weight vector ω.
It is implemented as the dot product. ni = || ωi − pi ||·∗pi (1) radial basis (ni) = exp (-ni 2) (2) Where i is the row number of the vector. iii) Some features of Radial Basis Layer ni=1, if pi is identical with ωi In this case, its yield weights in the competitive layer will pass their values to the modest function. iv) Competitive Layer The output vector d = n.*Mi. (3) The competitive function C is calculated from d. C equals to 1 at the major element of d and zero elsewhere.ii. Machine Learning based classification Classification is the final step in the automatic plant recognition process. This classification process can be implemented using the various machine learning algorithms like Artificial Neural Network (ANN), Support Vector Machines (SVM), K-Nearest Neighbour (KNN) and Naive Bayes (NB).

B. Snapshots

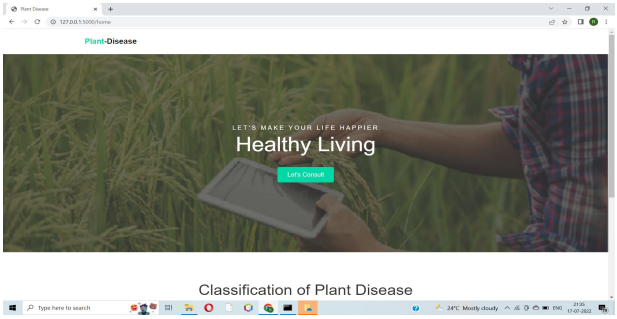


Figure 7: Home page

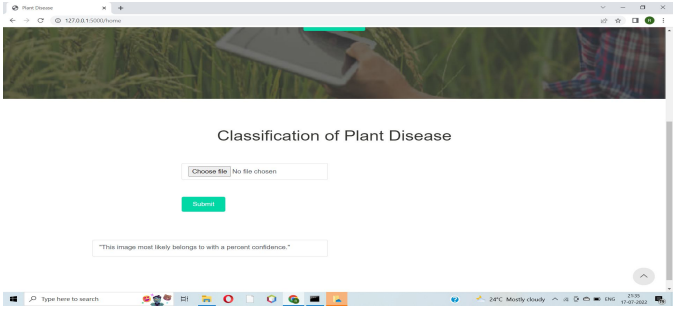


Figure 8: Classification of plant disease

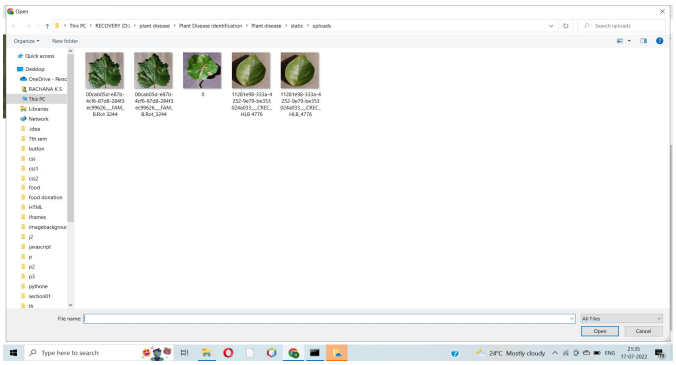


Figure 9: Sample image

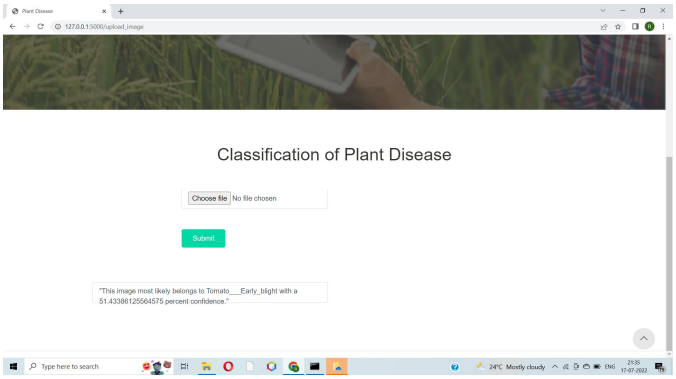


Figure 10: Identify Plant disease

VI. CONCLUSION

CNN and deep learning methods are used for the feature extraction and classification of plant diseased species. The different machine learning algorithms are ANN, SVM, KNN and Naive Bayes (NB). We have considered the Flavia dataset in this method. This data sets used for both and training and testing purpose. It has been achieved an accuracy of 98%. All the performance metrics like precision, recall, F1-score and support are calculated. Also, the achieved training and validation accuracies are nearly equal. Images used in the training purpose are small and gray scale images. As a future work it is possible to implement the color image classification for plant disease recognition.

From the implementation section and outcome, we conclude: This CNN model is now not every day for all one of a kind kinds of plant species. It is simply constrained to only 4 incredible classes. We have developed a mannequin for simply solely of 5 one-of-a-kind plant Classes, specially Pungai, Basil, Kuppaimni, Jamun, Jatropha curcas. Here the directory values are arranged in the order of [0,1,2,3,4] respectively for the overhead referred to instruction's labels. Exactness 96.67%, which a splendid result.

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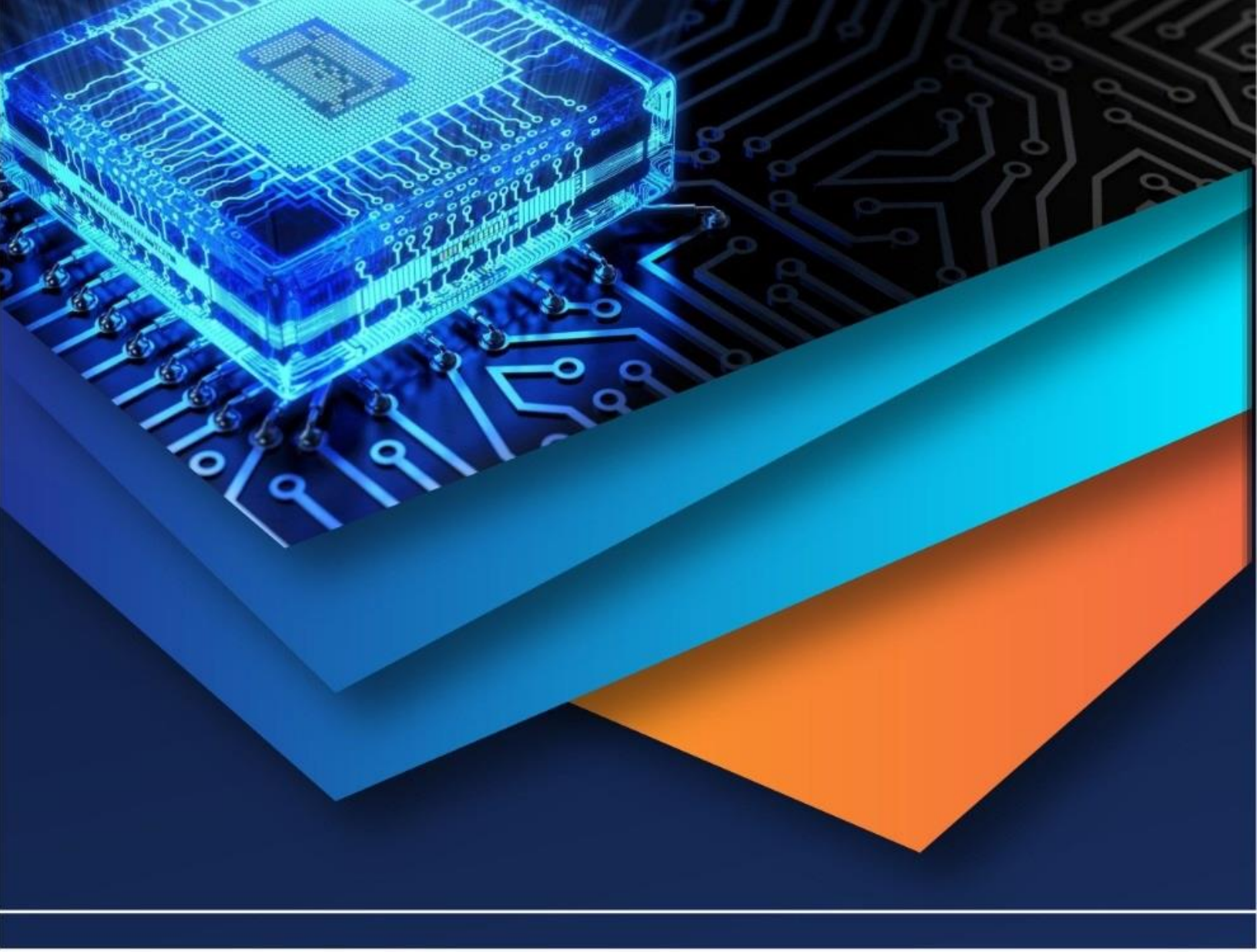
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