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Senet Cnn Based Tomato Leaf Disease Detection

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Abstract: ***Plants play important roles in the environment. Various plants are fulfilling many demands and basic requirements of the society. Saving such entities in the society is the uttermost necessity in today's world to deal with plant degradations. Many diseases in plants are common and thus they face degradation. While mainly dealing with common plant such as tomato and potato plants, it is observed that they very often face bacterial and other diseases. A proper precaution can be made to save plant from such diseases. Thus the early prediction of such different diseases can be made, which can be a massive savings to the farmer as well as for the country economy. This paper has adapted a moderate different approach of convolutional neural network called SENet. In this approach, a hybrid process is discussed which uses the advantage of SENet and CNN layer concept for better classification. CNN is performed by using the number of layer and kernel selections. Classification of data is performed using the traditional CNN approach. In this scenario, the quick process occurrence is performed using suppression of less used information. It tries to add weight to each and every feature map in the layer. This approach is used to check, identify and detect the defects in leaf of tomato. The prime motive of the presented approach is; to obtain simple easiest method for the detection of disease in tomato leaf with use of minimal computing resources. Thus an improved, efficient algorithm can be made use in real time implementation of leaf disease prediction with high accuracy and efficiency parameters.***

Keywords— Artificial Neural Networks, Convolution Neural Network (CNN), Image Processing, Leaf disease detection, SENet, Support Vector Machine

I. INTRODUCTION

India is a rural nation; wherein about 70% of the occupants rely upon farming. Ranchers have wide scope of adequate variation to select suitable harvests for their farm. Production of different varieties of crops is very specialized in good quality and proper product. It may be improved very well by the guide to innovative help. The administration of perpetual yields needs close observing distinctly for the administration of diseases that can influence fundamental crop production. The picture processing has been utilized for the various farming applications like: Anticipate plant infection from picture of plants, Predict bug's assaults from image of diseased plants. The disease is characterized as any weakness of typical physical capacity of plants, creating trademark of side effects in the event of plant. A side effect is a phenomenon caused to something and is viewed as proof of its reality. Illness is brought about by a pathogen which is any infection causing specialists.

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In a large portion of the cases, irritations or infections can be observed on the various parts of plants like: leaves, branches or stems [1]. In this manner recognizable proof of plants, helps in finding the nuisance or illnesses, manifestations of the infection assault, assumes a key job in effective development of yields. Consequently to conduct high throughput tests, plant scholars need productive PC programming to naturally remove and investigate huge substance. Here, picture handling assumes significant Role [2].India is considered as one of the large producer of the tomatoes and has the one of the biggest market for the tomatoes in Asia. However, this could not be the important aspect in removing and focusing on tomato leaf diseases. Image processing over the plant disease and predicting the proper disease over the plant image dataset is an important requirement. The fundamental interest for the adapted approach is to check, detect and classify the leaf disease in crop of tomato. Diseases which are commonly found in the plant of tomato are: Anthracnose, Bacterial blight and Cerospora leaf spot, Tomato mosaic with many others are suggested in this paper. The adapted approach in this paper mainly contains the three important steps: acquisition of data, pre-processing of data and classification of data. Images of leaf were acquired using a digital camera or a flatbed scanner, both methods had problems, and we had fully explored the use of a scanner. For this work a total of 50 diseased tomato leaf images were obtained from the internet and 45 leaf images were acquired through photography and the leaves were scanned. In the next step, the images were pre-processed to gray scale conversion and features were extracted through the histogram of oriented gradients. The last step is the classification of the input images with the use of SENet convolutional neural network (CNN). The organization of paper is given as: The various researches done in the respective fields are given in Section II. The adapted approach and the sequence of steps involved in getting the desired results are stated in Section III. Section IV concerns about the output of experimental results and it also analysis the adapted approach of this paper. The conclusion and future scope of the paper is included in the Section V.

II. LITERATURE REVIEW

To proceed in the accurate and precise manner, it becomes very essential to identify and acknowledge the various research works accepted in the past, related to this field. The disease detection of various plant leaves and crops have been an important and vital research interests in the classification field where the processing of image and classification techniques, both have been extensively used. Image processing over the plant disease and predicting the proper disease over the plant image dataset is an important requirement.

Some highly talked and implemented approaches of the related field are discussed in this paper. Some diseases that are very common in plant of tomato look like the ones shown in Fig. 1 and some disease that are common in tomato are shown in Fig. 2

Blossom-End Rot

Anthracnose

Fig. 1: Tomato plant diseases

Early Blight (Alternaria)

Septoria Leaf Spot

Fig. 2: Tomato leaf diseases

It is a difficult work to personally keep a track of big farms and fields. Thus, it becomes essential to reduce the manual work for keeping plant records. Hence this is a popular research area attracting many researchers. Several works related to plant diseases are observed in literature. The different algorithm proposed by the authors for the leaf characteristics and their diseases.

The authors of the paper [3] have characterized the grape organic product by its strip sicknesses, utilizing shading, and surface highlights investigation. The surface highlights are determined from the Spatial Gray level Dependence Matrices and the arrangement is finished utilizing squared separation method.

The authors of the paper [4] described a finding procedure that is generally visual and requires exact judgment and furthermore logical strategies. Picture of sick leaf is caught. As the consequence of division color, HSV highlights are separated. Artificial neural network (ANN) is then prepared to recognize the sound and infected examples. ANN arrangement execution is 80% better in precision.

The paper [5] discusses an approach that utilizes the method called as Gabor wavelet transformation. It extracts the feature that assists to detect the disease of leaves in tomato. To train and detect the disease of leaf, obtained features were put in to the SVM classifier. In the pre-processing step, the images were resized and background noises were removed. This method recognizes the patterns of the affected leaf.

The authors of the paper [6] worked in the discovery and characterization of cotton leaf disease, utilizing picture preparing and machine learning procedures. This paper states that for foundation expulsion shading, space change from RGB to HSV is helpful. It discovered that Thresholding system gives a great outcome contrasted with other foundation evacuation methods. It found that SVM gives great outcomes, regarding precision, for grouping of ailments. There are five noteworthy strides in this proposed work, out of which three stages have been executed: Image Acquisition, Image pre-preparing, and Image division.

The paper [7] discusses, a picture preparation based methodology is proposed and utilized for leaf and stem sickness recognition on five infections, which impact on the plants; like: Early sear, Cottony gentle, pale mellow, late singe, and little whiteness. The proposed methodology is based on picture processing. In the initial step of the proposed methodology, the current pictures are fragmented utilizing the K-Means strategy and in the last step, the divided pictures are processed by a prepared neural system.

The concept of the paper [8] is to detect the diseased area of the leaf of cotton, using the technique of image acquisition. It follows the two steps for detection of infected category. In the primary stage, Image segmentation based on Edge detection is applied, and in the final stage, the Homogeneous Pixel Counting Technique is implemented to inspect the image and categories the diseases.

III. PROPOSED METHODOLOGY

The important aspect of the presented work is to provide detection of the diseased leaf of tomato plant India is considered as one of the largest producer of the tomatoes and has the one of the biggest market for the tomatoes in Asia. However, this could not be the important aspect in removing and focusing on tomato leaf diseases. In this approach, a hybrid process is discussed which uses the advantage of SENet and CNN layer concept for better classification. CNN is performed by using the number of layer and kernel selections. Classification of data is performed using the traditional CNN approach. In this scenario, the quick process occurrence is performed using suppression of less used information. It tries to add weight to each and every feature map in the layer. Thus, the SE approach along with CNN is going to work as proposed solution for quick process with high accuracy. The Confusion matrix is computed and it returns the result parameter of comparison analysis.

Fig. 3 shows the Flowchart of the proposed methodology and the sequence of steps involve in processing the leaf image and disease prediction includes:

- The tools and libraries on the basis of selection of the input file were initialized in MATLAB.
- Dataset document was extracted from the web resource and stored over the local disk. The tomato plant diseases were stored in to a dataset. Here the local repository of images dataset was stored to further trained and test for the disease.
- MATLAB library and components for the data processing were initialized, where the image processing library functions and graphical libraries were involved.
- An input file is selected from the available data which is processed for the disease prediction.
- The image has been pre-processed with gray scale conversation and further binarization is done over it.
- Features are measured using Feature extraction as- Histogram of oriented gradients (HOG) and Selection of proper segmentation.
- Color and intensity data are filtered using the filter kernel and further the block is normalized.

- The selected algorithm is performed and the disease prediction using the given approach is performed.
- The computational parameter such as accuracy is computed and other efficiency parameter is discussed.
- Exit;

Thus, the steps discussed about the proposed work and methodology followed at the level of execution.

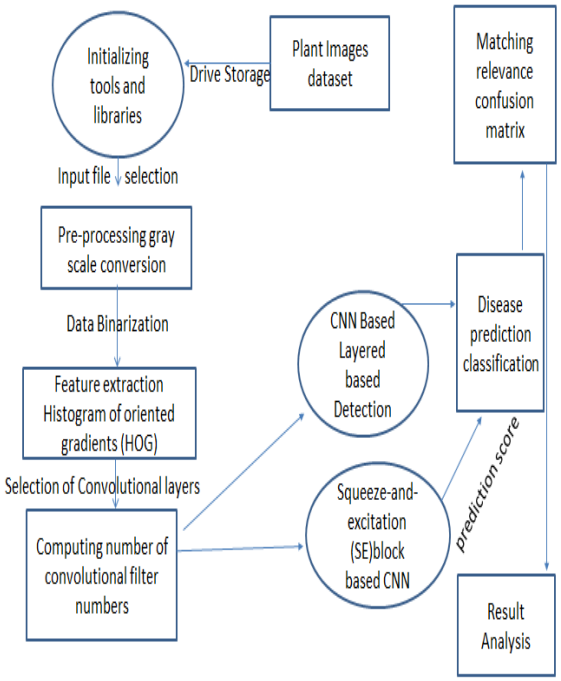

Fig. 3: Flowchart of proposed methodology

CNN: A Convolutional Neural Network is deep learning algorithm. It takes image as an input, assign weights and biases to various entity in the image and is capable to differentiate one entity from the other. When compared to other algorithms, the pre-processing needed in a Convolutional Network is much lower. [9]

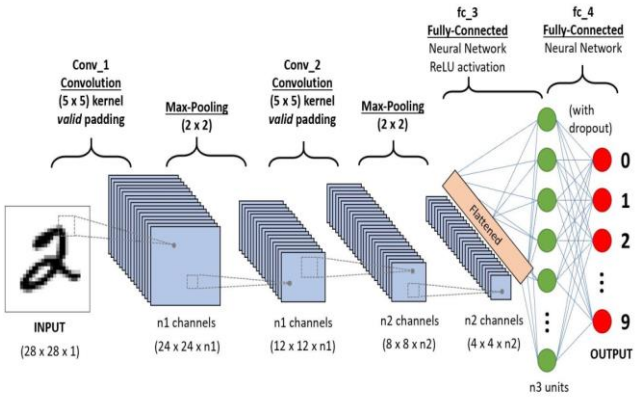

Fig. 4: Shows a CNN sequence

SENet: Squeeze-and-Excitation Networks introduce a basic structural concept for CNNs. It increases the interconnections of channels. It reduces the computational cost at almost zero. Fig. 5 shows the functioning of SENet. It shows the the number of channels and function given as input convolutional block. Each channel is squeezed to a single numeric value using average pooling.

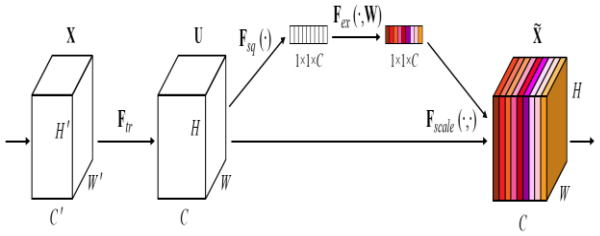

Fig. 5: Squeeze-and-Excitation Block

SENet adds a parameter to each channel in a convolutional block so that the network can adjust the weighting of each feature map.

$$F_{tr}: X \rightarrow U,\ X \in R^{H' \times W' \times C'},\ U \in R^{H \times W \times C} \quad (1)$$

- Where, F_{tr} is the convolutional operator for transformation of X *to* U. This F_{tr} can be the residual block or Inception block.[10]

Here, kernel is used as weighting function which is used in non-parametric estimation techniques. Kernels are used in kernel density estimation to estimate random variables' density functions, or in kernel regression to estimate the conditional expectation of a random variable. The histogram of oriented gradients (HOG) is a feature descriptor used in computer vision and image processing for the purpose of object detection

IV. EXPERIMENTAL RESULTS

We limit our experiment to target classification of diseased leaves of Tomatoes. The pre-processing of training image is done, using median filter, and increasing the contrast. The Fig 6 shows Framework for the detection of the images. The Fig. 7 describes the original image with the three different clusters obtained by using K-means clustering.

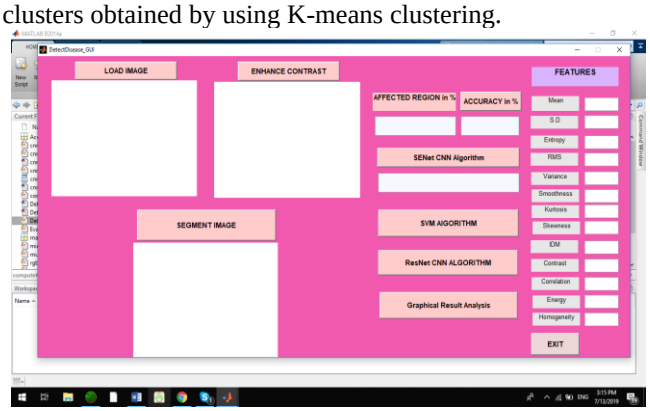

Fig. 6: Shows Framework for the detection of the images.

The disease infected cluster is selected from the segmented images to extract the feature. Cluster 1 is selected as it is the affected by disease.

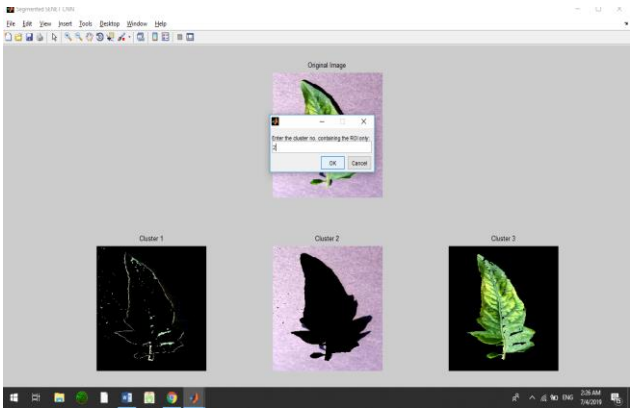

Fig. 7: Shows the Original image with the three different clusters.

After selecting the cluster, the extracted feature is sent to the SENet CNN classifier to classify the disease of tomato leaf with the help of created training dataset. Fig. 8 shows the proper prediction result module along with feature extraction and percentage of affected area. The calculation of percentage of diseased affected region is done. The disease is recognised as Tomato Mosaic and percentage of disease affected area is 73:2498%.

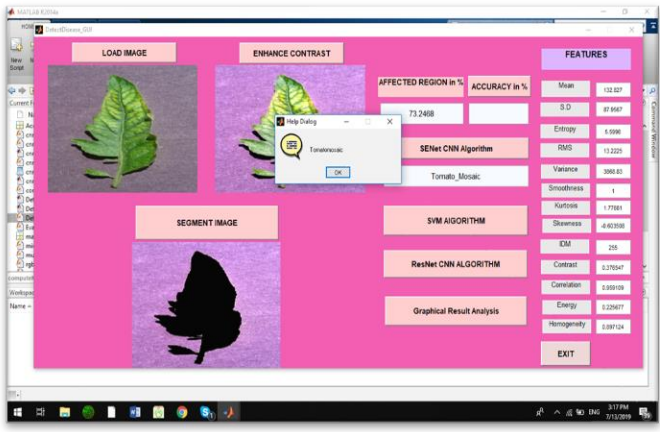

Fig. 8: Shows the proper prediction result module along with feature extraction.

The graphical representation of accuracy% and error % results when compared with two other previous approaches: ResNet CNN and SVM approach are shown in the Fig. 9.

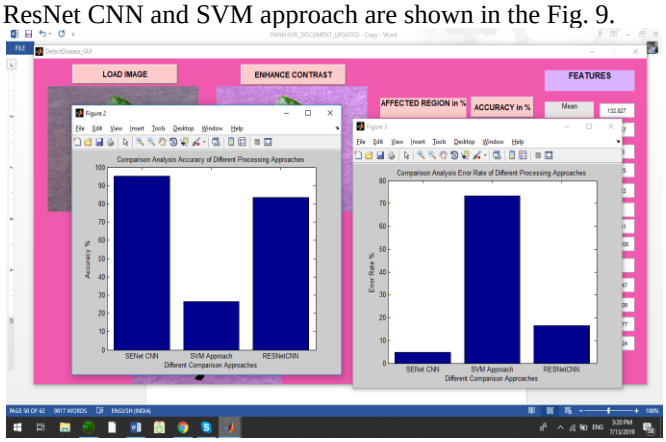

Fig. 9: Shows the graphical representation of results.

The Fig. 10 represents the statistical analysis of accuracy percentage when compared with two other previous approaches: ResNet CNN and SVM approach.

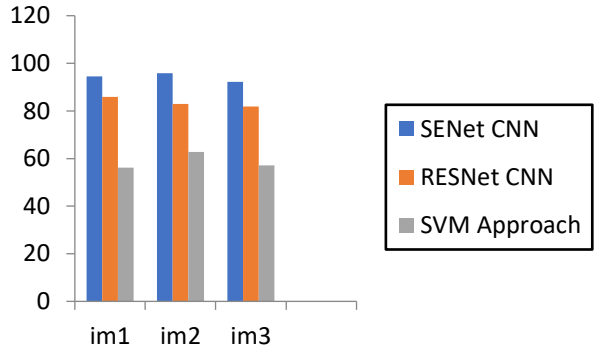

Fig. 10: Comparison Line Graph for technical analysis Accuracy value.

In the above graph drawn x-axis represents data images which were used for the query processing; the graph is printed using the chart library provided by the Microsoft. The graph representation shows the efficiency of our proposed algorithm work and it outperforms the low forecasting value.

Fig. 11 represents the statistical analysis of Error rate percentage when compared with two other previous approaches: ResNet CNN and SVM approach.

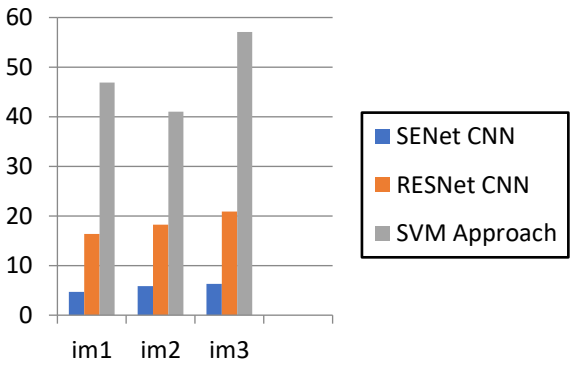

Fig. 11: Comparison Line Graph for technical analysis Error Rate value.

In the above graph drawn x-axis represents data images which were used for the query processing; the graph is printed using the chart library provided by the Microsoft. The graph representation shows the efficiency of our proposed algorithm work and it outperforms the low forecasting value.

V. CONCLUSION AND FUTURE WORK

This paper focuses on to adapt a powerful and handy method that classifies the diseases of tomato leaf. SENet CNN technique is used for this motive. Attributes from the disease affected area are taken out to examine the structure, and colour of tomato leaf disease. Classification of diseases and the evaluation of percentage of diseased affected area are done by Convolutional Neural Network. It is observed that the proposed approach shows best result when compared with other approaches.

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For future work, an integration of more filtering approaches and more efficiency parameters can be used with the proposed approach. An implementation of algorithm by industry experts in mobile application can also be included, which can be useful for the farmers in real time. This approach can be applied with other plant leaf diseases also so that this efficient and powerful method can be used to identify other plant diseases. The proposed approach gives precise detection of the diseased leaf of tomato with an accuracy of 92-96%.

REFERENCES

1. H. Park, J. S. Eun and S. H. Kim, "Image-based sickness diagnosing and predicting of the harvests through the huge adapting part", In Information and Communication Technology Convergence (ICTC), IEEE 2017 International Conference on, pp. 129-131.
2. H. Durmus¸, E. O. Gunes ¨ ¸ and M. Kırcı, "Disease disclosure on the leaves of the tomato plants by utilizing noteworthy learning", In Agro-Geoinformatics, IEEE sixth International Conference on, 2017, pp. 1-5.
3. Kim, D. G., T. F. Burks, J. Qin, and D. M. Bulanon. "Depiction of grapefruit strip illnesses utilizing hiding surface section examination". Overall Journal on Agriculture and Biological Engineering, 2009, 2(3): 41-50.
4. MalvikaRanjan, Manasi Rajiv Weginwar, NehaJoshi, Prof.A.B. "Ingole, revelation and solicitation of leaf sickness utilizing counterfeit neural structure", International Journal of Technical Research and Applications, 2015.
5. Usama Mokhtar , "Tomato leaves diseases detection approach based on support vector machines". In: Computer Engineering Conference (ICENCO), 2015 11th International. IEEE. pp. 246–250.
6. BhumikaS.Prajapati,VipulK.DabhiHarshadkumar, B.Prajapati, "A survey on detection and classification of cotton leaf diseases", International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) – 2016
7. Heeb Al Bashish, Malik Braik, and SuliemanBani-Ahmad, "A framework for detection and classification of plant leaf and stem diseases", IEEE 2010.
8. S. Arivazhagan, R. N. Shebiah, "detection of undesirable zone of plant leaves and depiction of plant leaf illnesses utilizing surface highlights", CIGR Journal, Vol. 15, No.1, March, 2013.
9. Huang, Jiayi, Mengxi Zeng, Weixia Li, and Xiangbao Meng. "Application of data augmentation and migration learning in identification of diseases and pests in tea trees" .American Society of Agricultural and Biological Engineers, (2019).
10. Hu, Jie, Li Shen, and Gang Sun. "Squeeze-and-excitation networks." In Proceedings of the IEEE 2018 conference on computer vision and pattern recognition, pp. 7132-7141, 2018.

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