International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-5, January 2020

Assessment of Plant Disease Identification using GLCM and KNN Algorithms

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Abstract*: One of the significant segments of Indian Economy is Cultivation. Occupation to almost 50% of the nation's labor force is delivered by Indian cultivation segment. India is recognized to be the world's biggest manufacturer of pulses, rice, wheat, spices and spice harvests. Agronomist's financial progress is contingent on the excellence of the goods that they yield, which depend on on the plant's progress and the harvest they get. Consequently, in ground of cultivation, recognition of disease in plants shows an involved part. Plants are exceedingly disposed to to infections that disturb the progress of the plant which in chance distresses the natural balance of the agronomist. In order to distinguish a plant disease at right preliminary period, usage of automatic disease detection procedure is beneficial. The indications of plant diseases are noticeable in various portions of a plant such as leaves, etc. Physical recognition of plant disease by means of leaf descriptions is a wearisome job. The k-mean clustering procedure is utilized for the segmentation of input images. The GLCM (gray-level co-occurrence matrices) procedure is utilized which excerpts textural features from the input image and implementation of KNN (k-nearest neighbors) algorithm for image classification and produced classification accuracy from 70 to 75% for different inputs. Hence, it is required to develop machine learning based computational methods which will make the process of disease detection and classification using leaf images automatic. .. To advance concert of standing methods machine learning and deep learning algorithms will be utilized for more accurate classification.

Keywords* : GLCM, K-Means, KNN algorithm, bacterial, fungal, viral, machine learning, deep learning, neural networks, support vector machines, genetic algorithm, convolution neural networks.

I. INTRODUCTION

The cultivation land-living mass is added than just actuality a nurturing sourcing in today's realm. Indian economy is extremely reliant on of cultivated production. Consequently in ground of agriculture, recognition of infection in plants shows an imperative part. To perceive a plant infection in very preliminary phase, usage of instinctive disease recognition procedure is advantageous. The newest group of convolutional neural networks (CNNs) has accomplished exciting outcomes in the arena of image cataloguing. This work alarmed with a different method to the growth of plant disease recognition classic, centred on leaf image classification, by the use of deep convolutional networks. Innovative way of training and the procedure utilized enable a rapid and relaxed system enactment in exercise. The advanced prototypical is able to identify 13 various sorts of plant diseases out of in good physical shape verdures, with the capability to discriminate plant leaves from their backgrounds. Rendering to our information plant disease appreciation has been planned. Entire important stages essential for realizing disease gratitude typical are wholly defined opening from collecting images so as to make a record [1].An innovative attitude to the expansion of plant disease acknowledgment classical, grounded on leaf image categorization from deep convolution neural networks (DCNN). Developments in computer visualization existing an opening to increase and upsurge the exercise of detailed plant fortification and encompass the fair of computer vision solicitations in the ground of exactness cultivation. It is an original attitude in perceiving plant infections expending the DCNN accomplished and acceptable to fit truthfully to the record of a plant's verdures that was assembled individually for various plant maladies. The improvement and an originality of the advanced prototypical lie in its effortlessness strong verdures and related descriptions are in route with added modules, empowering the prototypical to extricate concerning non-healthy leaves and fit ones or from the setting by using deep CNN [2].DCNN has realized excessive achievement in the cataloguing of numerous plant infections. Though, a inadequate number of revisions have clarified the procedure of implication, parting it by way of an unattainable obscure case. Tightfitting the CNN to excerpt the cultured property as an understoode form not only guarantees its consistency but also allows the authentication of the prototypical genuineness and the training dataset by human involvement. In the proposed work neural networks can imprisonment the colors and grains of scratches explicit to particular sicknesses upon finding, which is similar to human supervisory.. The outcomes afford energy for the CNN handlers in the ground of plant discipline to restored recognise the judgement development and lead to auxiliary resourceful use of DCNN for plant disease identification [3]. Modern progressive progresses in Deep Learning have permitted investigators to enormously advance the concert and correctness of object finding and acknowledgement schemes. A deep-learning method to perceive foil illnesses in numerous plants using images of plant leaves. Aim is to detect and improve the further appropriate deep learning procedures to the context. In the propsed work modern approaches are utilized for the determination of exertion and

Manuscript published on January 30, 2020.
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it successfully recognised diverse categories of diseases with the capability to deal with compound situations from a plant's zone [4]. Advanced methods presented to process hyperspectral facts, with a distinct importance on plant disease detection. The hybridization of NN-hyperspectral method has developed as a dominant process for illness recognition and conclusion. Spectral Disease Index (SDI) is the proportions of various supernatural possess of clean sickness bands. Consequently, NN practices for speedy expansion of SDI [5].

II. EXISTING TECHNIQUES

Indian Frugality is extremely needy on efficiency of cultivated fields. So, here is the necessity to deliver exciting consideration to take attention of fields Diseases are the regular feature that can basis severe possessions on plants which eventually decreases yield, superiority and capacity of goods. Physical recognition of plant viruses raises the hominid struggles as it is not informal to squared every distinct plant. Also the physical recognition is not proper technique [6]. Crop viruses are a significant risk to nutrition sanctuary; though their speedy distinctive proof stays difficult in various slices of the world since of the default of the imperative groundwork. Appearance of precise practices in the ground of greenery centred image cataloguing has publicized remarkable outcomes. Exploring Random Forest in categorising vigorous and contaminated leaf from the group generated. The produced databases of unhealthy and in fine fettle leaves are communally experienced under Random Forest to classify the diseased and healthy images. For mining structures of an image utilized Histogram of an Oriented Gradient (HOG) here. Inclusive, expending machine learning to train the huge datasets accessible openly provides us a strong approach to perceive the disease existing in foliage in a massive gauge [7].

Convolutional neural network methods stood established to achieve plant infection recognition and conclusion by expending modest leaves pictures of well and unwell plants from deep knowledge practises. Exercise of the prototypes was achieved with the practice of an open database of 87,848 images, comprising 25 diverse plants in a set of 58 different modules of permutations, counting well plants. Numerous prototypical constructions were proficient, with the greatest enactment attainment of 99.53% accomplishment rate in recognizing the conforming [plant, disease] amalgamation. The suggestively great accomplishment rate sorts the prototypical a rightly advantageous recommended and a method that might be auxiliary lengthened to upkeep an cohesive plant disease identification scheme to drive in actual farming circumstances [8].Crop diseases are a foremost hazard to food safety, but their speedy empathy ruins tough in various portions of the world owing to the absence of the essential groundwork. The grouping of increasing universal smartphone perception and current improvements in computer vision completed likely by deep learning has covered the way for smartphone supported disease identification. Expending an open database of 54,306 inputs of unhealthy and vigorous plant shrubberies composed in well-ordered circumstances, A CNN method to identify 14 crop modules and 26 sicknesses. Finally, the method of working out deep learning prototypes on progressively great and openly accessible image groups offerings a clear track in the direction of smartphone helped crop disease identification on a enormous overall measure [9]. Different measures are utilized to assess satellite and medical domain ouput images attained from fuzzy logic [10].Fuzzy and NN fused images are evaluated by typical assessment parameters and are concluded with precise exploration [11,12].

Plant diseases invented from existing entities are biotic. Fungi, bacteria, and viruses are the foremost sources of various forms of biotic infections. Abiotic, in contrast, are formed by lifeless organic conditions like hail, spring frosts, weather circumstances, boiling of substances, etc. Abiotic infections are non-infectious, non-transmissible, less hazardous, and are typically preventable. The proposed work deliberates the biotic infections and their classification with a few mutual forms is presented in Fig. 1. An assortment of mechanism happens for numerous fungal and bacterial infections, but those under pathological group are not engrossed plentiful in writings. Spots (caused either through fungi or bacteria), mildew, and rust are the top three kinds which are maximum frequently deliberated for recognition and categorization. In adding, shortage of nutrients is discovered for mechanization. Section 4 offerings additional particulars on these perceived details.

III. PROPOSED METHODOLOGY FOR PLANT DISEASE IDENTIFICATION

Machine learning approach for plant disease identification using leaf images have been proposed in Fig2 with five major steps are involved. Implementation these steps in precise order will produce classification and/or recognition as a final outcome.

Steps in the proposed methodology

1. Input images acquisition under various environmental conditions/usage of available datasets-Image acquisition is key to find accuracy contingent seriously on image examples utilized for training
2. Pre-processing-color-space, filtering, smoothing, enhancement and cropping-During pre-processing, misrepresentation elimination progresses images which affluence additional processing. Contingent upon image superiority the functionality of this segment differs
3. Segmentation with K-means algorithm splits image into sections with strong association along with the substances of attention. Structures of an efficiently partitioned image support in a tranquil recognition of vigorous or diseased examples.
4. Feature Extraction using GLCM-Inputs are typically understood as color, texture, and shape structures. Color is usually demarcated as instants and color intensity calculations. Possessions like, distinction, regularity, difference and entropy can be involved to texture. Correspondingly, for shape, plumpness, area, strangeness and concavity features are recognised.

GLCM algorithm

- Count all the number of pixels in the image matrix
- Store the calculated pixels in image matrix
- Check likeness between pixels in the matrix by using histogram procedure.
- Compute dissimilarity factor from the matrix
- The elements to be normalized by dividing the pixels.

Rust Gray mold Downey mildew Root rot Canker Spots Wilt light

(a)Fungal Diseases

(b)Bacterial diseases

(c) Viral diseases

Fig.1. Leaf images: (a) Fungal Diseases, (b) Bacterial diseases and (c) Viral diseases

5. Classification with KNN is a significant section in plant disease recognition organisms. Proposed method reflects structures that detect plant a disease expending an image, thus cataloguing is demarcated as a method of cataloguing plant sprig descriptions founded on recognized infections.

KNN Algorithm

- Decide parameter K = number of adjoining neighbour's.
- Compute the distance between the inquiry example and all the training examples.
- Sort the distance and regulate adjoining neighbours centred on the K-th minimum distance.
- Collect the sort of bordering neighbours.
- Practice modest popular of the sort of nearest neighbours as the estimate importance of the inquiry occurrence.

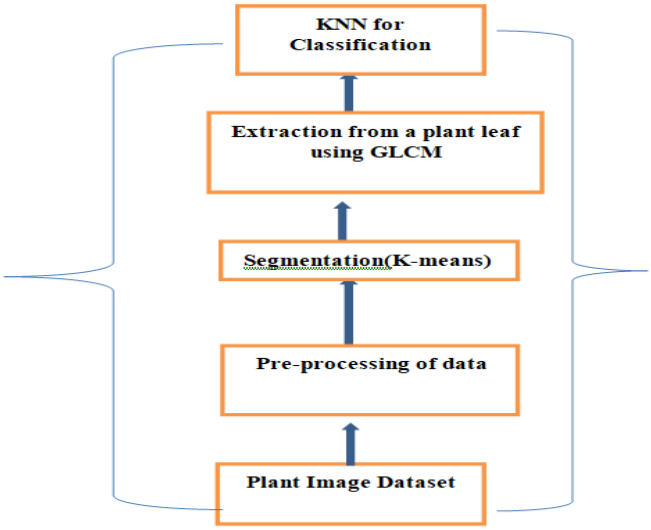


Fig2. Proposed machine learning approach for plant disease identification using leaf images

IV. RESULTS AND DISCUSSIONS

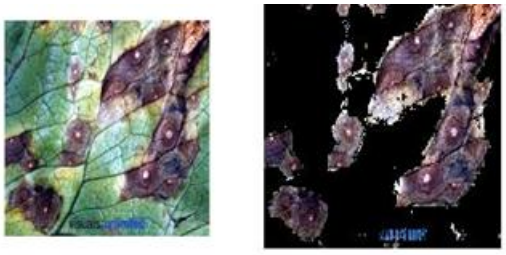
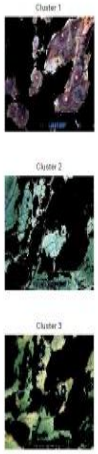


Fig 3. a) Diseased leaf image b) Disease part



c) K-means clusters

Fig 4. a) Diseased leaf image b) Disease part

Fig 5. a) Diseased leaf image b) Disease part

c) K-means clusters

c) K-means clusters

Table 1: Classification results obtained from KNN algorithm

S.No	Input	Method	Accuracy	
1	Fig.3.a	KNN algorithm	72.35%, K=5	73.45%, K=7
2	Fig 4.a	KNN algorithm	72.79%, K=5	71.73%, K=7
3	Fig 5.a	KNN algorithm	74.93%, K=5	75.12%, K=7

As shown in figures 3, 4 and 5, the procedure of k-mean is used which is the textural feature based segmentation method. Table1: illustrates classification results obtained from KNN algorithm. In the k-mean clustering procedure, the centred point is computed from which the Euclidian space is computed and data is clustered conferring to their resemblance. It will enter the number of cluster in which we have ROI (region of interest).After entering the cluster number, we will get cluster having diseased part. The GLCM feature mining and segmentation procedure is been used which will segment the image rendering to their similarity. The finishing disease image is exposed in which disease part is emphasized. KNN algorithm generated classification results on various input images. Deep learning algorithms will be helpful to improve disease identification accuracy.

V. CONCLUSIONS AND FUTURE WORK

Productivity of any system is contingent importantly on the excellence of preparing the data; tortuously it is essentially the amount of exercised pictures and their mined structures. So it can remain thought that a well exercised scheme is extremely effectual. But, totally the present schemes obligate a distinct set of requests important to be pleased for precise enactment. If unique or the additional restriction is not satisfied, before the measured scheme may yield imprecise outcomes which move to incorrect infection recognition. For instance, the difficult of over preparation or over-fitting is normally perceived in the considered schemes that indecorously work influential advanced methods. In such a situation, investigators must contemplate of fusion and adaptive schemes intended with springy set of desires in its place of static one. It is being determined that plant disease detection essential three main steps namely segmentation, feature extraction, and classification. The k-mean clustering is used to segment input images. In the existing technique GLCM procedure is utilized to excerpt the textural features. The KNN classifier in the projected effort to classify data into various classes with 70 to75% on various inputs and need to improve plant disease identification accuracy through more advanced machine learning and deep learning algorithms. Over the former few years, deep learning procedures have allowed prompt advancement in this context, even outstanding human concert. They're greatest usually utilised to analyze pictorial imagery and are regularly employed behind the sections in image classification. So utilization of machine learning and deep learning will improve the classification accuracy on large datasets.

ACKNOWLEDGMENT

This work was partially supported by the Jawaharlal Nehru Technological University Hyderabad Under TEQIP-III Collaborative Research Scheme .

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