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IMPLEMENTATION PAPER TO DETECT AND CLASSIFICATION OF FUNGAL DISEASE IN GRAPES LEAVES USING THE GENETIC ALGORITHM

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ABSTRACT

As we know very well that India's 75% lives in the villages and mostly dependent on the agriculture and horticulture. Mostly farmers are uneducated. They cannot detect the disease of plants and agriculture by human eye. To detect the disease they takes help the experts. It is very costly procedure. To reduce the cost and for the better results we are using the computerized techniques, which will be very helpful for the farmers. In this research work we are using the genetic algorithm to image segmentation, which will detect the disease of leaf image and also using deep neural classifier for the classification. The result of this technique is 97.7% accurate. It is the low cost technique and easily use by the farmers. It works on the MATLAB, because genetic Algorithm is the tools of MATLAB.

Keyword Deep Neural Network, Genetic Algorithm, Image Segmentation, Horticulture, Experts.

I.INTRODUCTION

India is developing country, about 80% population lives in the villages and it's depending upon the agriculture and horticulture in direct or indirect way. Over the 210 million acres land is used for the agriculture. Most of the people in the villages are un-educated; they are unable to understand the concept of science. They grow the crops and plants with the help of experts or based on the experience, but diseases are normal for any crop or plant. Sometimes the diseases are so dangerous that destroys all crop or plant. To treat that disease, we have a great knowledge about it. If the disease finds in the early stage than it may be treat easily. There are so many diseases are present due to the weather, global warming, harmful ground water, wasted water by the factories, air pollution, un-timed rain or harmed flies give the birth of diseases mainly. Plants are the most important thing for the living on the earth for human, animals and birds because it takes the Co2 (Carbon Dioxide) and provides the oxygen, which is the living resource for the living beings. There is the creation of more than 1.7 million living species on the earth.Plants provide plenty of medicines and food bases are the gift of plants to living being. So, plants are most important components for the living being on the earth to protect at each stage.

Plants give the human fruits, vegetables and the food. But if the plant is infected with the disease, it will produce diseased product. Which thing will eat by the living being that is dangerous for their health. So, to protect from that types of diseases the farmer uses the pesticides. The pesticides are more harmful for the living being.

Causes of the pesticides many species of birds have been invisible from the earth. The human and animals have infected with the dangerous diseases due to their food and nature of living. But here is the point how to escape the plants and crops from diseases. There are the numbers of diseases in the plants, to treat the disease; we should to detect that disease. There are many agriculture universities have been established to help the farmers, there are many experts are available by the government and universities, but some diseases are away from the approach of experts too. Like whitefly is the disease. This has destroyed the large amount of cotton crop in India. This is the main opportunity for the farmers and the expert to detect and destroy that disease as early as possible. In this field soft computing approach is using but no more success has found by any person. The birth of the mostly disease of plants after the green revolution, its time is by the experts in 1966. Now the mostly farmers uses the concepts of conventional farming because it is easy than the organic farming. Difference between the organic and conventional farming is written ahead.

1.1 Organic Farming

Organic Farming means the farmers don't use the pesticides. To protect the plants or crops, natural methods are used. There are the number of natural process may be used to protect the disease form the plants and crops. Like the place of the fertilizers, overflow of the animals and poultry feed may be use. There are many things which are used in the organic farming. These are not harmful for living being. But here is the demerit of organic farming; the farmer cannot produce the quantity as compare to conventional farming. Use the technique of conventional farming the farmer may produce the much better quality of the product. So the mostly farmers use conventional farming. But they hide the demerits of conventional farming.

These are those things that are used in the organic farming. Organic has no addiction with the soil of your farmer; if they regularly use the conventional farming than the next time those or extra strong pesticides will use to take effective results.

1.2 Conventional Farming The use of conventional farming is starting with the green revaluation. The starting time of that is called from year 1966. Now days this technique is mostly used in India. But this is very costly and addiction type. With the use of conventional farming can be produce a great quality and quantity of the product. But the effect of the pesticides and fertilizers enters in the food. There are some advantages and disadvantages of advantages of conventional farming.

1.3 Type of Disease in Leaf

Here, we are seeing the comparison between organic and conventional farming. With the help of this literature the farmer may produce the healthy product. So, here is main and important work is to escape the plants, vegetables and crops from the diseases. To detect the disease farmers may have need of experts, which wastes so much time and money. Here soft computing approach may be used to detect the disease. There are so many algorithms are used in the world like KNN, SVM, Digital Image Processing, Genetic Algorithm, K mean Clustering etc. But there are so many diseases in the agriculture and horticulture. Mainly two causes have found which destroys the plants and agriculture. These are:

1. Disease caused by Bacteria in crops/plants
2. Disease caused by Fungi in crops/plants

Now the question arises what is the bacteria and Fungal, which distroys the plants and agriculture. Which are the crops/plants, those are distroyed by the Bacteria and Fungal.

Name of the Crop/Plant	Bacterial Disease
Beans, Rice	Blight
Cotton	Black Arm
Tomato	Canker
Potato	Ring Rot, Brown Rot

Figure 1.4; Diseases caused by Bacteria in Plants

After the knowing of bacteria and its attacking crops and plants, now we will disscuss on these diseases. Those are the reason to distroy our production.

Techniques to detect the image

1. Traditional techniques
2. Modern techniques

1. Traditional techniques

These are those techniques, which are used by farmers on their experience or the expert eyes. There is no artificial intelligence is used. The main disadvantage of this technique is not easy for the large farms. If the experts detect the large farms, than it is so costly for the farmers. With the experience they cannot detect with great accuracy.

2. Modern techniques

Modern techniques are those which are used nowadays. The artificial intelligence and soft computing approach are used. Now we discuss here about the algorithms have used in the field of agriculture, horticulture, crops, vegetables to detect the diseases. These are like as:

1. SVM
2. KNN
3. K means clustering
4. Genetic Algorithm

These algorithms may detect the disease easily. If detection of the disease in the early stage than it may be controlled and treated at early stage. Than it cannot damage the crop/plant or vegetable. The quality and quantity and the growth of the production will be better. So here is necessary to detect the disease at the born time by the artificial intelligence. Because if the experts will come to detect that disease that will take a large amount of money and extra time will be consume. So to solve this problem, in this research work we are trying to detect the fungal disease using the soft computing. In this research work we are using the Genetic Algorithm to detect and classify the fungal disease in the grapes. Fungal mostly destroys the grapes crop. Genetic Algorithm is the soft computing approach. It can easily detect the disease from the image.

1.3 Genetic Algorithm

Genetic algorithms (GAs) were invented by John Holland in the 1960. It was developed by Holland and his students and colleagues at the University of Michigan in the 1960. Interestingly with development procedures and transformative programming, Holland's unique objective was not to outline calculations to tackle particular issues, yet rather to formally think about the phenomenon of adaptation as it happens in nature and to create courses in which the components of regular adjustment may be transported in into computer frameworks. Genetic Algorithm is a strategy for moving from one populace of "chromosomes"(strings, zeros and ones) to a new population by utilizing a sort of "natural selection" together with the operators - crossover, mutation, and inversion. Crossover exchanges of two subparts of two chromosomes It is an algorithm, which is used to processing the image. The solutions of the problems in the GA on the natural bases. It is the tool of MATLAB. So the availability is very easy to use. It follows the rules of soft computing approach. It works on the LAB. In the real world, mostly images are in the RGB format. It converts image from RGB to LAB format, than it detect the disease using the variables of A & B. Basically any type of change in DNA that may or may not be inheritable. The change ion DNA is most dangerous thing than change into ^{m}RNA or protean, because thousands of protean make one ^{m}RNA and hundreds of ^{m}RNAs make one DNA. So DNA is the final stage of the mutations. If one protean is harmful than it is an initial stage that may be solve easily, ^{m}RNA may be changed, but not easily. If any DNA takes any problem that may be not be change, it is so much dangerous. So the genetic algorithm basically changes on the gene or DNA level that is called Genetic Algorithm.

1.4. General Algorithm for Detection of Plant Disease

General algorithm is that algorithm which is used in every technique of artificial intelligence. Using this algorithm the image is study from the device or memory in the RGB format and converts the image into digital Image, so the need of resources like the computer memory and computational power may reduce. There are the 4 steps to detect the disease using the image segmentation. These steps are:

IMAGE EQUATION
IMAGE PROCESSING
FEATURE EXTRACTION
DETECTION OF DISEASE

II. LITERATURE REVIEW

A literature review goes beyond the search for information and includes the identification and articulation of relationships between the literature and our field of research. While the form of the literature review may vary with different types of studies, the basic purposes remain constant.

1. **Nikita Butala et al (2017)** Review on Diagnosis the Plant Disease at Early Stage. This paper describes the image processing technique to detect the disease of agriculture/horticulture. It also describes that this technique desktop based technique which is cost effective too. This research work mainly works on the flowering and non flowering plants. This research work is also color based technique. This project is used minimum hardware and

other resources, which makes the cost effective. It is easy to use and accurate. This technique extracts the feature of image and makes a Matrix (Color Co-Occurrence Matrix) than it transforms the color imaginary, that detects the result of and shows the diseases area of the plant/crop. Image processing-Based approach is proposed and it is useful for the plant disease detection because there is no language barrier in this software technique, English and Hindi language are provided.[21]

2. **Nikita Butala et al (2017)** Desktop Application for the usage of Analysing and Detecting of Disease on Plants. This paper describes about the lost crop in India is 18% with the pest attack in one budget year. The value of the lost crop is around Rs.90000 million. This paper advice to the farmers to avoid the costly pesticides and chemicals and use the natural process for the agriculture. It also describes about the whitefly disease, which is so much harmful for the crop of cotton. MATLAB is used for the software platform. This paper is also working the image to detect the plant disease. Bacterial disease with rose, beans leaf, lemon leaf with Sun burn disease and fungal disease in beans leaf. To detect the diseases Blob Detection Algorithm is used. It works on the image segmentation, but the image should be clear and noise free. So to remove the noise and other meaningless objects image cropping technique is used of the leaf image. The result can be display in English or Hindi, so it easy to understand and the technique may be performs on the flowering and non flowering plants. [24]

3. **Prabhjeet Kaur et al (2017)** Detection and classification of leaf disease using integrated approach of Support Vector Machine and Particle Swarm Optimization on the MATLAB software with GUI (Graphical User Interface) platform. This is also the plant disease detection technique using the image segmentation. This research work uses the particle swarm optimization (PSO) and support vector machine (SVM) for the detection of four diseases Cercospora leaf spot, bacterial blight, anthracnose, and Alternaria alternata. The main purpose of this research is to detect the disease and healthy part of the leaf and calculated the percentage of the affected portion.

4. **S.Jayamoorthy et al (2017)** Identification of Leaf Disease Using Fuzzy C-MEAN and Kernal Fuzzy C-MEAN and Suggesting the Pesticides. In this paper the author introduces a clustering technique called Spatial FCM (SFCM) to detect the disease and also compare with the other clustering techniques like as K-means, Fuzzy C-Means (FCM), Kernel based FCM (KFCM) & Spatial FCM (SFCM). After that the features of disease are extracted and compare with normal leaf image. This paper suggests neural network to use the detection of disease in crops [18].

5. **Rajneet Kaur et al (2017)** A Brief Review on Plant Disease Detection using in Image Processing**.** This research work detection of plant disease using the KNN (K- nearest neighbors) and SVM (Support Vector Machine) algorithms are used. SVM is exceptionally perplexing in computations and it is not the practical testing of each occasion and off base to wrong sources of info. KNN calculation is viable classifier would be utilized to limit the computational cost. The examination would be founded on two parameters Accuracy and Detection time. The examination surveys and abridges a few procedures have been utilized for plant infection recognition. A novel approach for grouping of plant [15].

6. **M. Ravindra Naik et al (2016)** Plant Leaf and Disease Detection by Using HSV Features and SVM Classifier. This research work is performing the technique which is less expensive, less efforts, less time and

more accurate. It uses an algorithm for automatic detection and classification of the plant leaf disease using the image segmentation technique. Image segmentation technique is an important part for plant leaf disease detection using the Genetic Algorithm. The research work has classified these leaves by using the NN classifier and checks the leaf is actually affected with disease. The research has been implemented on the Beans, Lemon, Guava, cotton and mango plant leaves and comparison SVM and NN classifiers and has showed the accuracy of both classifiers [25].

7. **Mr. Jagan Bihari Padhy et al (2016)** Leaf Disease Detection Using K-Means Clustering and Fuzzy Logic Classifier. This paper is also based on the detection of plant disease using the artificial intelligence. Here, the three techniques of artificial intelligence algorithms are used like KNN (k-nearest Neighbour), NN (Neural Network) and SVM (Support Vector Machine). Using these algorithms to detect the disease of plant leaf, some types of plant leaves are used to detect the disease. And image processing technique is used. The steps of disease detection in the image processing technique are image acquisition, image pre-processing, image segmentation, feature extraction and classification. Here is also called in future the entire system is to be implemented in hardware based Plant Motoring System will also be implemented.[27]

8. **Prajakta Mitkal et al (2016)** Leaf Disease Detection and Prevention Using Image Processing using MATLAB. In this research work, it detects the sugarcane's disease and study the various review techniques. They used SVM with MATLAB. According to this paper this technique may be work with JAVA, but using MATLAB, it produces the effective results. This project is user friendly project and easy to use to protect their crops. It supports Multi-Lingual concept. [33]

9. **Dr. D. Devi Aruna et al (2016)** A Survey on Different Disease and Image Processing Techniques in Sugarcane Crops. This research work gives the knowledge about the diseases of sugarcane, that how to detect the diseases. According to the paper there are many diseases in the sugarcane which are so much harmful for the people too. These diseases such as Red Rot, Leaf Spot, Sugarcane Mosaic Virus, Yellow Spot, Brown spot etc. Paper's mainly motive to design such system that automatically estimating hardly of the detected disease [19].

10. **Mamta Yadav et al (2016)** Hybrid Approach of Neural Network and Genetic Algorithm to Recognize Black Mold Disease in Tomato. This research work belongs to the diseases of tomatoes. Because tomatoes suffer so much due to the many diseases. The reasons of these diseases are Bacteria, fungal and virus. To detect the disease Back Propagation Neural Network (BPN) is used and Genetic algorithm (GA) is applied for extract feature selection. It takes the image in proper size. They worked on 212 images data set of tomatoes. It resized the image into 130X130. And it cropped the image into 120X85 size of image.[34]

11. **Prabhjeet Kaur et al (2016)** A Review on plant leaf disease detection techniques. Here the author describes about the plant diseases like bacteria, fungal and virus etc. which destroys the crops. They have used multiple algorithms like KNN, SVM, Pattern Reorganization method, back propagation etc. They have discussed basics of plant leaf disease detection [16].

12. **Mark C. Bilton, et al (2016)** Perspectives in Plant Ecology, Evolution and Systematic. This research work basic and instinctive guideline hidden Bioclimatic Envelope Model (BEM) expectations for environmental change impacts. Here, they apply a similar specialty standard to entire communities inside a medium/long haul

atmosphere control examine, where environmental procedures are inherently included. The model includes temporal models of ecosystem structure, carbon cycling and water cycling responses to reforestation. These temporal models are scaled up to a whole region allowing future wild view to be described. Accordingly, depending just upon usually gathered organic records and climatic information, the simplicity of use makes CNG s an appealing, intense and generalist method for expanding the prescient precision of plant group reactions to environmental change [14].

13. **Mark C. Bilton et al (2016)** Perspectives in Plant Ecology, Evolution and Systematic. Defining species by simple and intuitive principle underlying Bioclimatic Envelope Model (BEM) word for climate change effects. Here, they apply the same niche principle to entire communities within a medium/long-term climate manipulation study, where ecological processes are inherently included. This research work gives the knowledge to the society that Global Warming and day by day increasing pollution and population is the main reason of plant and human diseases. So to solve these problems, we will try to change our living style. We should use the biological products place of pesticides. CNG vehicles will also help to reduce the pollution and protect from diseases human and plants [12].

14. **Vijai Singh et al,(2016)** Detection of plant leaf diseases using image segmentation and soft computing techniques. In this paper a large scale farms, which are difficult to detect the disease by experts and they are too time consuming. Due to these reasons cost of production is too high. So to reduce these things soft computing technique is used. It is also used on banana, mango, potato, tomato etc crops. Here genetic algorithm is used, which works successfully. But to improve recognition rate some other algorithms are used like as: ANN, Bayer Classifier and hybrid algorithms [9].

15. **Prof. Arati A. Dandavate et al (2015)** E-Agriculture Analysis and Grading Disease of Leaf using Image Processing. This research is basically based on the E- Agriculture. To grow the concept of E-Agriculture internet is the basic need of it. In this paper the developer introduce describe the development of an Android application. Which will capable to identify images of plants leaves. The user may use anytime with the help of mobile and internet [20].

16. **Al-Azhar University – Gaza, al-quds open university (2014)** Developing an expert system for plant disease diagnosis. This research work explains about the expert system to identity the disease, method of treatment and of disease. Present expert systems saved a lot of time and effort in identifying plant disease. It is clear that it is very useful in short of time [2].

17. **P.Saranya, et al (2014)** Image processing method to measure the severity of fungi caused disease in leaf. In this paper using the image processing wants to reduce the cost of pesticides, which is the main reason of pollution and greater cost production. This paper shows the results of image processing are 98.60%. Thus image processing tools to measure plant disease severity is suitable and correct. This eliminates subjectivity of usual methods and person induced errors. It will helps to farmers to make a decision the specific amount for pesticide use which reduces the price and ecological pollution [10].

18. **Jagadeesh D Pujari et al (2014)** Image processing based detection of fungal disease in plants. In this paper fungi disease is described to detect using image processing in the field of agriculture/horticulture. The

implement was successfully run on the vegetable crops, fruit crops and commercial crops. The main goal of this research work was to detect, to identify and accurately the disease. Paper can be produce efficient results at the offline stage, with the help of internet the disease may be detect as early as possible. This work is difficult in the term of high variability and outdoor conditions and general symptoms [1].

19. **Marek schikora et al (2014**) Image-based analysis to study plant infection with human pathogens", this paper is growing awareness protection. It works as the decrypted method (step by step) and graphically method. Graphically method uses the symptoms that contaminated plants, fresh fruits and vegetables are responsible for a significant proportion of food poisoning with pathogenic microorganisms indorses the demand to understand the interactions between plants and human pathogens. The image processing area is not a new area it has been working from the 90 years old when aerial pictures made from the airplanes were used to study about the diseases of plants. This research work is mainly works on to identify the disease in early stage of plants and save the people from bad effects from the pesticides [11].

20. Jayme Garcia Arnal Barbedo et al (2013) Digital image processing techniques for detecting, quantifying and classifying plant diseases This paper is also on the image processing to detect and classify the images using SVM (Support Vector Machine), Neural networks and Fuzzy classifier are used to detect the disease [22].

III. PROBLEM FORMULATION & OBJECTIVES

3.1 Problem Definition

Agriculture is going down day by day. There are many reasons to downfall, like as weather, shortage of ground water, pollution and diseases. To handle these problems, farmers should have so much money.

To treat the diseases costly pesticides and chemicals are used for the crops. The disease is at the large scale than it will be extra use. But if the disease may be found out than the cost of production may be reduce. So here to detect the diseases, we are using the soft computing approach. It will help the farmers to identify the percentage of disease at the lower cost.

Fungal disease is a main disease of grapes. This disease attack so much on the grapes. It changes the color of the leaves, which is the sign of disease. So using the image of that type of leaves we may indentify the percentage of disease and may be treat as the early stage.

With the help of this technique injured leaf will be detect easily and it will improve the production and maintaining of plants.

The classification is first done using the Minimum Distance Criterion with K-Mean Clustering and shows its efficiency with accuracy of 86.54%. The detection accuracy is improved to 93.63% by proposed algorithm. In the second phase classification is done using SVM classifier and shows its efficiency with accuracy of 95.71%. Now the detection accuracy is improved to 97.7% by Deep Neural with proposed algorithm. [9]

Table 1.2 - Comparison of results.

Disease samples	No. of images used for training	No. of images used for testing	Detection accuracy/%		
			MDC with K mean	MDC with proposed algorithm	SVM with proposed algorithm
Banana	15	10	80.00	90.00	90.00
Beans	15	14	92.85	92.85	92.85
Lemon	15	10	90.00	100.00	100
Rose	15	12	83.33	91.66	100
	Overall accuracy		86.54	93.63	95.71

But we will try to increase the accuracy results with using the new techniques. If the result shows the accurate than there will be no problem to detect the disease of any leaf. There will be a revaluation in the field of agriculture and horticulture.

3.2 Objectives

1. Read the image of the Plant to detect the fungal portion.
2. Extracts the ROI (region of interest) of Image using the segmentation to identify the fungal disease of leaf.
3. Extracts the features of ROI which will show that how much percentage of disease exists in the leaf.
4. Apply the classifier and genetic algorithm classified on plant disease and non disease.
5. To increases the accuracy in the new algorithm.
6. Compare the classifier performance results with existing classified results.

IV. RESEARCH METHODOLOGY

In this research work, we are using the soft computing approach in the field of agriculture/ horticulture. It is basically depends on the color of image. Fungal disease changes the color of leaf or fruit. So we take the advantage of this problem. We should have the image of leaf. Than we can check it that it is infected or not. If the color of leaf is green, than we can say it is a health leaf. If the color of leaf changes that is the sign of disease.

Using the color of pixels, we can produce the results of that disease that how much disease exists in this leaf. This is the economical and time saver project. Because like as the traditional way, if the expert team will detect the disease than it will be so costly and time consuming.

4.1 Software and Hardware Requirements

To implement this project platform is needed. Platform means those things are necessary to run application program. To perform this project some software and hardware is needed. Software means computers internal system, which we cannot touch. It is like as the soul of human. Hardware is that which hard devices, which can be touch. Both of them is called the input/output devices. Here we will use the input of image than we have a camera, scanner, phone or any other capture device, which may ne take a high quality image. Than the process is gone to process and takes the output on our screen. We may take output using printer. The requirements are written ahead.

4.1.1 Software

Software is the soul of computer. There are two types of software like as application software and system software. System software is used to run a computer, because we cannot run the computer system. Application software is used run a particular application. It solve the specific problem. But application software cannot run without system software. In this research work we are using the MATLAB.

4.1.2 MATLAB

It is application software. MATLAB has many versions like 2013a or 2017 but we are using 2013a. This software is used by the scientists and engineers in the field of image and signal processing, communications, control systems for industry, smart grid design, robotics as well as computational finance. MATLAB stands for matrix laboratory. MATLAB has a powerful tool to make a picture 2D and 3D. But we are using here only to detect the different colored pixels. This is license based created by Cleve Moler, a professor of Computer Science at the University of New Mexico to help his students in 1970. Octave and segmentation are free version are available on the internet. Genetic Algorithm is the tool of MATLAB, so it may be used easily. Its commercial version was introduced in 1983 by Jack Little. Coding is easy to understand than other languages.

4.1.3 Hardware

Basic hardware is used for implementation; we should have i3 processor, 1 GB RAM, 250 GB or More Hard Disk. The size of MATLAB is 1.44 GB. Than the results also will be store on the hard drive. We should have the images for input that will be collect with the device or from the internet.

4.2 Data Base

Data base may be collect from the real world, means actual leafs are captured from the farms using the camera or any another captured device. And we may be collect this from the internet.

4.3 How it works

It is basically depends on the quality of image. If we have a high quality image, than the great accuracy can be produced. The background of image should be black. Black background helps to detect the color of original pixels. Basically RGB image is converted into the LAB. It is called the image enhancement. Genetic Algorithm is used to preprocess the image. It gives us the satisfactory results. Before this we used K-means clustering, but this algorithm could not produce the actual result. Because this is the basic method, it does not obey the rules of soft computing.

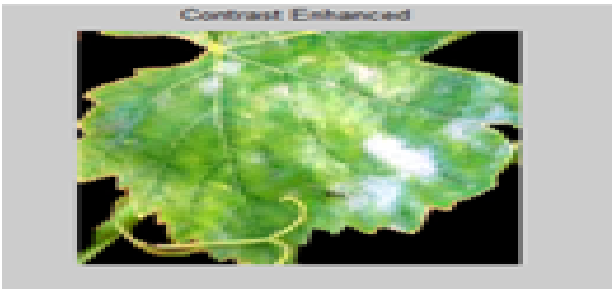

Figure 4.2: Image Enhanced

In this image we are seeing mainly three colors are Green, Yellow-White and black background. Green part of the leaf is the healthy part, black color describes the background of the image and which is the part of yellow-white that is disease in the leaf. Using the Genetic Algorithm the percentage and the accuracy be define. This is useful for the farmer.

4.4 Proposed Algorithm with Genetic Technique

As we know that the Genetic Algorithm is basically used for the modern fields. Genetic Algorithm is used to true or approximately result. Genetic Algorithm is the natural process and used for the large classes important features. GA is the high quality algorithm that generates the high quality solution for optimization and research problems.

Here in this research work the Genetic Algorithm creates the clustering of image. Than it creates the mask of the image and this mask is multiplied with original image, which detects the disease part of the image. Three functions are used in the GA are the reasons of its success. These functions are:

1. Fitness Function
2. Cross Over Function
3. Mutation Function

4.4.1 Fitness Function

Genetic Algorithm obeys the rules of nature. We can define it with example of real life. As we know without a couple the population cannot be increased. The characteristics of couple inherit in the child. Same rule applies here.

Good qualities of parent inherit in the child. Like parents have little height, than, the child will also be little. If mother is tall and father is small than the child will also may tall. Same as in the case of father. If both are tall than the child will be tall.

4.4.2 Cross Over Function

Cross over function is takes the value. It inherits the great value of the contents. For example

Mother	1	2	3	4
Father	5	6	4	5
Cross Over	**5**	**6**	**4**	**5**

Figure 4.4 Chart of Cross Over Function

As we see this chart, father has greater values than mother. The result is showing as input of father's values. If mother's values were greater, it takes those values because this function takes the greater values.

4.4.3 Mutation Function

Same as the cross over function, the mutation function works. It also takes the larger values, which could be either in father or mother.

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4.5 Image Clustering

The next step of the algorithm is image clustering. In this process the algorithm collects the same attributes in same group. This helps to find the disease easily 0because the disease symptoms are categorized in the same group.

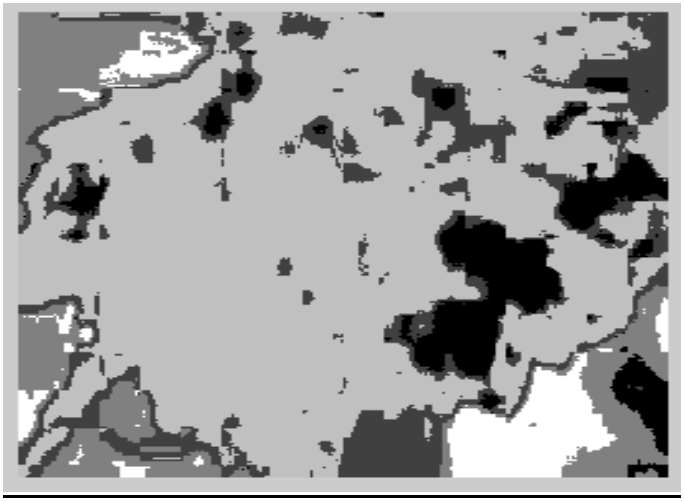

Figure 4.5: Image Clustering using Genetic Algorithm

3.6 Detection of Disease

The last process of the Genetic Algorithm is detection of disease. Here it shows only the part of the disease. Now we can easily understand which part is affected with the disease. There is no need of any expert person.

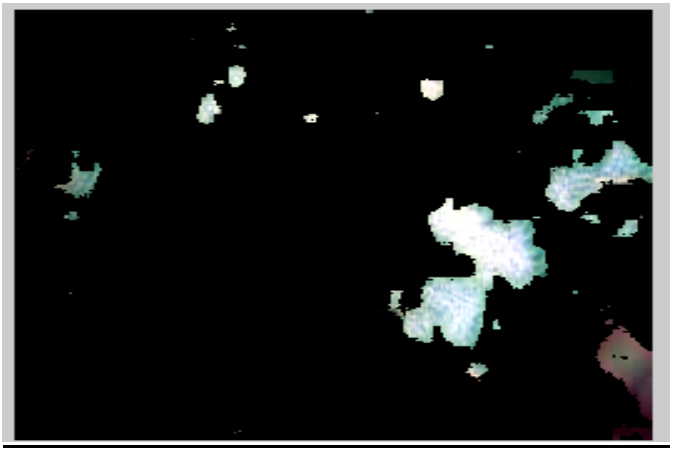

Figure 4.6: Final Image after disease segmentation

4.7 Flow Chart

It is the process which shows the above research graphically. These are those steps, which are used to implement the project. Using the flowchart, we may easily define the project.

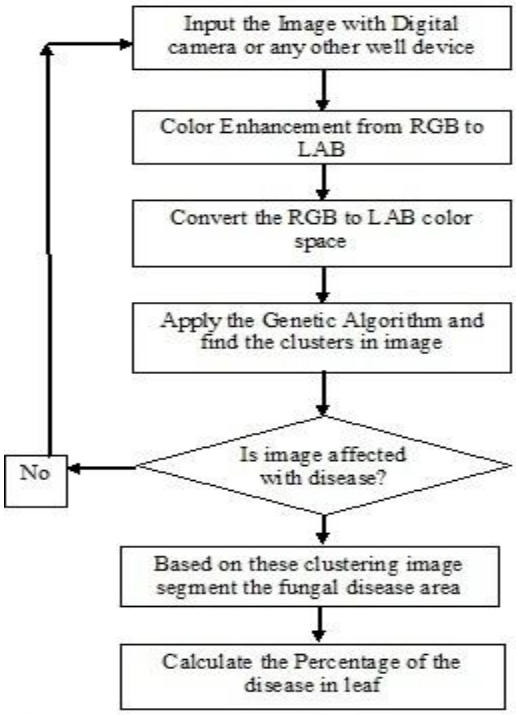

Figure 4.7; Flow Chart to detect the fungal disease

4.8 Explanation Steps of Flow chart

In this flowchart we are seeing 6 steps and 1 decision box. Decision box checks the condition of the problem whether the leaf is affected with disease or not. If yes, it will calculate the percentage and accuracy of the disease; otherwise we could take a new image to solve out.

4.8.1 First Step

First of all, we need an image of plant's leaf to detect the disease. It should be clear with large number of pixels. The accuracy will be greater as per the clarity the picture. If possible, keep the background black or white which makes it easier to detect the disease of the plant's leaf.

4.8.2 Second Step

Second step of the flow chart is to enhance the colors of the image. As the colors of pixels will be dark, the detection will be easy with great accuracy. If we don't use this step than the software will work but it will produce lower accuracy, which is important for the farmer.

4.8.3 Third Step

Here the algorithm RGB converts into LAB. Both are the color properties. RGB stands for Red, Green and Blue. It is the older technique, which is not so much successful. It should not be used in the Genetic Algorithm. In this Algorithm we can use LAB. It works as the natural process image. So it is more useful than the RGB. So we use this technique.

4.8.4 Fourth Step

In the fourth step we used the Genetic Algorithm. It works on the rules of nature. So this algorithm is basically used for more accurate and optimization results. GA is the high quality algorithm that generates the high quality solution for optimization and research problems.GA is the high quality algorithm that generates the high quality solution.

4.8.5 Fifth Step

Here the algorithm is based on the segmentation clustering; the disease part of the life is shown. Healthy part which has the green pixels hides by the algorithm.

4.8.6 Sixth Step

It is the last step of the algorithm, which generates the percentage of leaf's infection and accuracy of the disease. This is the most important step, because any non technical person can see the results of the disease.

Now it's the time to check the fungal disease. The disease exists in leaf than it shows the percentage of disease and accuracy of the algorithm. Otherwise the conditional function tells the leaf is healthy and no fungal disease exists in the leaf.

V. RESULT AND DISCUSSIONS

5.1 Result

In the field of agriculture, this algorithm will play an important role in the large farms mainly, because no more expensive are used. It saves the time and money too. This produces the great accuracy and faithful results. So the farmers do not need call to the experts for their plant disease.

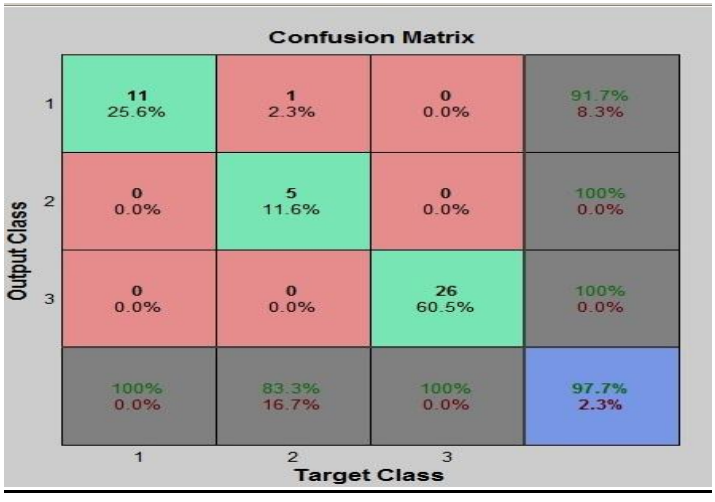

Figure 5.1: Result of disease

In the figure, we are seeing that the Accuracy is 97.7 percent. We can see the disease on the image which part is infected with disease. Here the accuracy of disease depends on the input of the image. How much the image will be clear than the accuracy will be greater.

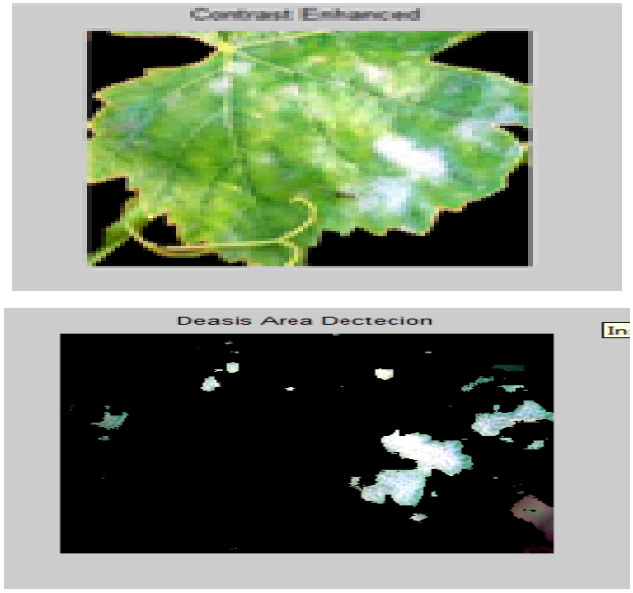

Figure 5.2: Input and Output of Fungal Disease Area of Detection of Image

5.2 Comparison between proposed and existing algorithms

The Genetic Algorithm is used in this research work. The accuracy is 97.7% of segmentation the image. Used techniques have the accuracy is 91.37 % and 86.715%. GA is the soft computing approach. It is used for the segmentation of the image to detect the disease of the plant leaf. The accuracy is shown in the graph with the comparison of three techniques.

VI. CONCLUSION & FUTURE SCOPE

6.1 CONCLUSION

This research work presents the detection of the fungal disease in the grapes. Because fungal is the main disease in the grapes. Now using this project the farmer can be easily find out the fungal disease in plants. This is the economical work and under the budget. Here no need of expert team. It may find in the early stage of the disease with the great accuracy. It shows the results in percentage, using this percentage the farmer can use the pesticides. That how much strong may be used. It will reduce the cost of production, no time consumption and result with great accuracy.

6.2 FUTURE SCOPE

This research work, we have applied only on the leaf of grapes to detect the fungal disease. Fungal is that disease, which changes the color of every plant. So it may be apply on the leaves of banana, mango, potato, tomato etc.

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List of Publications

1. Sukhchain Singh and Er. Rachna Rajput, "**Detection and Classification of Fungal Disease in Plants based on Severity using Genetic Algorithm**", IJSRD - International