

Leaf Disease Classification using Triangular Thresholding Method and Machine Learning

A DISSERTATION

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Abstract

Leaf malady recognition and estimation is one of the most troublesome undertakings in rural picture handling. This investigation plate in subtleties the techniques and methods for distinguishing and estimating the seriousness of growths caused sickness on plant leaves utilizing the triangular thresholding strategy. Four speculated pictures product gathered from various plant species and analyses were led on each to identify and gauge the degree of harm brought about by the organisms cause sickness on the leaf. Investigation was made and the outcomes end up being about 97% exact.

Keyword: Division, Thresholding, Picture Securing, leaf Sickness, AI

INTRODUCTION

In ongoing year's agriculture has ended up being impressively more critical than it used to be a couple of years back where plants were simply used to support individuals similarly as animals. This is a result of how plants are by and by used to create power and various wellsprings of essentialness to upgrade the living conditions of mankind. Regardless, there are such countless infections that impact plants that can make remarkable harm various economies and social requests. It can even provoke remarkable regular setbacks. Consequently, it is more brilliant to break down diseases definitely and propitious to avoid such loses. Plant afflictions can be perceived through a couple of techniques including manual and PC based systems. Most plant illnesses appear as spots on the leaves, which are continuously unquestionable to human eye. On the other hand, there are a couple of ailments that don't appear on the leaves and others appear in the later stages when they have made uncommon harm the plants. In such cases, it is recommended that robotized structures would be the principle choice to perceive the condition helpful using a type of complex figurings and logical gadgets, in a perfect world utilizing unbelievable amplifying focal point and various machines. In some various events, the signs must be recognized through the electromagnetic techniques, which convey more pictures that are not unquestionable to the human eye. Another technique for achieving this is through system known as Remote Sensing Technique (RST) that takes a gander at and ends using multi and hyperactive absurd picture gets. All of the methods that use the RST approach generally fall on cutting edge picture getting ready instruments to achieve their optimal results. Most of the afflictions that impact plants are achieved by developments

which appear as spots on plant leaves. These spots make it difficult for such plants to set up their sustenance by techniques for photosynthesis since they impact the green hues in the leaf, in this way to a tremendous degree impacts the improvement and the yield of such plants. In conditions where the life forms illness ends up genuine, the spots spread the surface area of the leaf. The diseases in plants don't simply decrease the yield yet can in like manner rot the variety of such plants and its withdrawal from improvement. Plant diseases especially leaf afflictions are normally controlled using bug showers, fungicides and pesticides. Regardless, extravagant usage of these engineered substances for the treatment of plant illnesses can achieve hurting their produce similarly as making various harms individuals and animals. The danger of perilous development on yields as a result of the use of pesticides on plants that have been affected by various sorts of afflictions has been recognized as an imperative supporter of ground water tainting and contamination. Again, an overabundance of usage of pesticides by farmers increase cost of age which can incite progressively vital disaster. In this way, there is the need to confine their usage on account of the above reasons. One significant strategy for achieving this is by surveying the reality of the affected locale of the plant earnestness focusing on the tainted district, with the fitting sum and centralization of pesticides. The usage of independent eye discernment and manual strategies are usually used to pick disease reality in the age practice nonetheless, that may bring about a couple of errors and off course results. Various systems, for instance, Grid counting can be used to improve the careful measurement regardless, this strategy is difficult to use and besides exhausts a lot of time. The utilization of picture taking care of methodology in coordinating assessment in the agric section has caused in various ways to deal with upgrade the improvement of the country part. There are such tremendous quantities of techniques used by specific examiners to perceive quantify and mastermind leaf contaminations on plants. A segment of these techniques consolidates the Bounding Box, Moment Analysis, Color Analysis, Support Vector Machine and Neural Networks. All things considered, none of these procedures have gotten by the various experts has been noteworthy. This paper attempts to recognize quantify and assess the earnestness of developments caused ailment on leaves using the Triangular Thresholding system. What

makes this technique exceptional is how it is direct, easy to use and gives exact results.

2. LITERATURE SURVEY

2.1 Image Processing

Rao (2014), is portrayed as the route toward improving and redesigning the unrefined pictures that are taken through mechanized cameras, sensors, and various other propelled techniques, for instance, Satellite, space tests and carriers for various applications. At the point when someone suggested a large number of years earlier that "a picture talks a thousand words", probably handling was limited to basic figuring. Above axiom still has gigantiness to figuring with pictures. Most authorities in PC vision and picture taking care of go for deciding feasible and better contraptions similarly as proper techniques that give different contemplations on a comparative picture by offering means to value the substance of the image just as give significance, and centrality of the image. It is profoundly impossible picture taking care of can be differentiated or facilitated and the human eye similar to precision, yet it can outmaneuver it viably on observational consistency, and ability to do bare essential logical errands. Again, picture planning can be used to figure and find answers for clear or sorted out tasks by giving reliable, unsurprising and ratty results. Not under any condition like a couple of years back, asks about coordinated reliant on picture taking care of starting late have been extended widen to cover a colossal extent of information running from clear and basic pixel based low-level errands to anomalous state assessment that at present joins the use refined contraptions including frameworks like man-made awareness for the explanations behind clarification and appreciation of the image. These new and present day techniques for dealing with pictures are being made to give indications of progress hugeness and understanding of pictures subject to the association between its portions, its particular situation, and its history if it is a bit of a progression, and from the prior taking in got from an extent of pictures.

2.1 Uses of Image Processing

(Jayamala K. Patil and Rai Kumar, 2011) recognized around five essential vocations of picture getting ready as to green plants and their normal items. In their assessment, they recognized that image planning is incredibly useful to:

1. Perceive plant leaves, stems and common items that are affected by diseases.
2. Measure the areas affected by disease in plant leaves, nourishments developed starting from the earliest stage.
3. Perceive the condition of the locale of the leaves, nourishments developed starting from the earliest stage has been impacted.
4. Choose the shade of the impacted zones ultimately
5. Find the size and condition of characteristic items.

(K.M.M. Rao, 2014)also recognized a couple of jobs of Image Processing as associated and used in various applications, for instance, Material Science, Agriculture,Remote Sensing, Medicine,Document planning, building, Non-risky Evaluation, Forensic Studies, Textiles, Military,Printing Industry, Film industry and Graphic structure.

2.3 Image Processing Methods

Rao (2014) showed two key techniques for picture dealing with. In his paper, he displayed Analog picture getting ready as the primary system. This procedure insinuates the changes, adjustment and alteration of picture through electrical strategies. An ordinary instance of this system is the image made by the TV. The TV transmits banner in a sort of voltage which moves in plentifulness to address wonder through the image. The writer continues with the second method which he recognized as cutting edge technique for taking care of picture. For this circumstance, accepted picture will be change or changed over to electronic structure through a contraption known as scanner digitizer for additional taking care of.

2.3 Image Processing Techniques

2.3.1. Picture division

(Ballard and Brown, 1982) portrayed picture division as the route toward apportioning or breaking an image into different parts reliant on explicit characteristics. The parts generally speaking conform to something that individuals can without a lot of a stretch discrete, see and research as individual things. The mechanized PC as we most likely am mindful doesn't have the option to see questions definitely without any other person; this is the explanation different researchers have turned out with different philosophies and procedures to segment pictures. Pictures are for the most part parceled depending upon the various qualities and features found in the image. These features may fuse concealing information that is used to make histogram, information about pixels that show cutoff points and surface information. Because of PCs, picture division can be portrayed as the path toward disconnecting electronic picture into a couple of areas or parts (a great deal of pixels that can in like manner be implied as super pixels). The explanation behind dividing any image is to unravel (make the image less complex or less tangled) and change the depiction of the image into something significant for the inspirations driving easier assessment. Picture division is commonly used to recognize and discover traits, articles and cutoff points, for instance, curves and lines in pictures. Picture division can basically be described as the path toward allocating some depiction to every pixel in an image to recognize pixels with practically identical and exceptional traits. The consequence of the division system depends upon a great deal of portions that together the entire picture or a ton of result found from the image. All of the pixels in a particular region is near concerning some trademark or

figured property, including power, surface and concealing. Neighboring regions are basically extraordinary in regards to the practically identical characteristics. Exactly when associated with a pile of pictures, ordinary in remedial imaging, the resulting outline after picture division can be used to create 3D entertainments with the help of a formed computation.

2.3.2 Image Thresholding

Picture Thresholding implies the path toward making a matched picture (bitonal) by setting a starting stage which fills in as the base estimation of the pixel power of the primary picture. Thresholding system is typically performed on grayscale pictures; nevertheless, thresholding may be associated with special (genuine nature) picture. The edge estimation of each image can either be set physically or normally using a specific programming or application. For this circumstance, all pixels that fall underneath that set point of confinement worth are changed over to dim which addresses bit estimation of zero while some different pixels over the edge worth are changed to white addressing a piece estimation of one. The thresholding can in like manner be depicted as the route toward breaking an image isolated in order to get frontal region regards similarly as establishment regards (profoundly differentiating). Thresholding can be essential or on the other hand complex depending upon the edge regard. Thresholding is said to be essential if there is only a solitary farthest point worth set for all of the pixels in the image for paying little heed to the qualification or assortments then again. Of course, confounding and present day thresholding (adaptable thresholding) takes number of regions of the image and set the edge regard as requirements be. It should be seen that, quality can't be undermined in thresholding especially when overseeing checking pictures with Optical Character Recognition (OCR) structures. The most clear sort of division is by techniques for thresholding. This is in light of the fact that you simply need to portray an edge by then dissect all pixels in the image by differentiating them and the breaking point regard. All pixels found over the edge worth are considered as nearer see, while the pixels arranged underneath the edge worth are considered as establishment. Oftenly, the edge addresses the power or the concealing estimation of the image. Various kinds of thresholding award unprecedented or variable farthest point regards all through the image. For this circumstance, the point of confinement is permitted to understanding through a couple of changes all through the entire picture. Thresholding is said to be a rough strategy since it works for most undertakings that need division.

2.3.3 Image thresholding counts

There are such an enormous number of experts who have proposed different counts to the degree picture thresholding is concerned. This bit of the assessment hopes to discuss and separate a part of these counts as proposed by specific

researchers. Surely, picking right an appropriate computation is an inconvenient action. This is a direct result of the assortment coming about in view of different computations since they expect contrastingly about the substance of the image. (Ridler and Calvard, 1978) coordinated an assessment into plant diseases using picture thresholding framework. They proposed an estimation that usages iterative gathering approach to manage check sickness reality on leaves. In their system, they used an approximated edge, for instance, mean picture power as the hidden edge regard. Considering the starting worth, they accumulated the pixels in the image by dispensing white to all pixels found over the edge all underneath it are designated dim independently. The farthest point is reiterated a couple of times and re-approximated as a mean of the two class suggests. (Tsai, 1985) proposed a count that is used to choose the threshold of an image by protecting the First three minutes in the data image. (Otsu, 1979) proposed a paper that showed a figuring that usages discriminant assessment approach to manage distinguish moved tones in plant leaves. This technique uses the zeroth and the chief solicitation joined previews of the histogram for processing the edge regards. (Kapur et.al, 1985) displayed a count that gauges the level of deficiency of an image using the thresholding methodology through an estimation they proposed. This count takes the point of confinement picture as two unmistakable get-together

2.4 Measuring Disease earnestness on Leaves

(Pradnya R. Narvenar et al, 2014) showed a paper on the systems for recognizing and analyzing leaf diseases using SGDM arrange methodology. In their assessment, a couple of systems were revealed concerning techniques for evaluating leaf diseases. (Libo Liu and Ouomin Zhou, 2009) conducted an investigation on the methodologies for perceiving leaf ailments in rice reliant on the characteristics of the shades of leaf sore district using the thresholding procedure. (Vane Zhang, 2005) drove an investigation on cucumber to choose the techniques for diagnosing the supporting status of green harvests using machine vision development. The result exhibited a typical relationship between the green fragments and other colour components of the leaves with the nitrogen which could be used rapidly as diagnosis of reaper disorders pointer under comparative conditions. (Chunhua Hu et.al, 2004) used two particular statistical features of the ROB system to perceive the deficiency cucumber bleeding edges, using features of the Ohta structure.

2.4.1 Methods of Quantifying Leaf Disease Severity

There are a couple of methods used by various authorities to gauge leaf sickness reality. A part of these methodologies are analyzed in this paper. Plant leaf disease can be assessed and estimated either by the domain been affected or by the level of which the sickness has been set up (how significant the

companionship is) on the leaf that can be evaluated through features like concealing and surface. Most of the systems and computations used to assess disease reality consolidate a division dare to segregate the reactions in order to focus features and fittingly process the features to achieve a measure for the earnestness of the infection. This paper bunches the techniques and procedures used by other researcher reliant on the specific philosophy used to check the ailment reality.

2.4.5 Using Neural Network

Neural System is a Man-made brains structure that hopes to duplicate the human cerebrum. Bernard Widrow of Stanford College previously made neural framework in the mid 1950s. Neural framework s is used in various fields in enrolling most especially in voice affirmation structures, picture affirmation systems, mechanical innovation, remedy, etc. (Pydipati et al, 2005) perceived and assembled a couple of diseases in citrus plants using two one of a kind strategies. They aggregated features like shape, concealing, surface and measure, made four different smaller get-togethers of those features, and masterminded them by two philosophies. They used Mahalanobis least detachment classifier in their first procedure together with a rule known as Closest Neighboring Rule to perceive the illnesses. The subsequent advance was the portrayal sort out where they used Spiral reason Capacities (RBF) Neural System Classifiers together with the back inciting count to gather the plants subject to similar characteristics. They shut by communicating that both portrayal procedures conveyed identical results.

2.4.6 The use of Support vector machines (SVM)

Support vector machines are Learning models related with learning counts that examine data with the objective of requesting and dismembering objects. They are discriminative classifiers subject to decision planes that describe decision limits. (Youwen et al. 2008) used a computation based an estimation plan affirmation to perceive a couple of afflictions that impact cucumber leaves. The computation was used to segment the leaves into sound and wiped out territories. That is trailed by evacuating concealing, shape and surface features from the image. The last request is done by supporting the features into the SVM. They wrapped up by communicating that, Bolster Vector Machine produce favored results over Neural frameworks reliant on their experimentation. (Camargo and Smith 2009) in like manner endeavored to perceive and check the level of defect in cotton plants. Pictures were gotten from the stem, leaves and the results of the cotton plant for the preliminary. They separated the photos using a system they had formally developed before which was depicted in this paper under Thresholding. They by then expelled a couple of features from the undesirable territories. Those features are then used to support the SVM for ID and estimation of the unfortunate pieces of the photos. (Jian and Wei,2010) showed a paper that

uses the SVM to perceive cucumber leaf sicknesses. They used the essential thresholding procedure to section the sound and undesirable districts of the leaves. That was trailed by isolating features like concealing, shape and surface from the image for additional getting ready. Those features are sustained into the SVM with Spiral Premise Capacity (RBF) as piece, which plays out the last request. Generally, the examination attempts to measure how much developments caused contaminations impact plants most especially, plant leaves. Expressly the assessment attempts to:

1. Perceive and recognize parasites caused sicknesses on plant leaf.
2. Assess and measure the reality of the parasites caused disease on plant leaves.
3. Prescribe the fitting sum and assembly of fungicides to use on plant leaves subject to the infirmity earnestness.

2.5 Exploration Question

1. How best can picture-dealing with strategy be used to recognize developments caused affliction on plant leaf?
2. What strategies could be used to check and assess the earnestness of life forms caused sickness on leaves?
3. What proportion of fungicides could be used on plant leaves?

2.6 Confinements of the Examination

Over the range of the investigation, the expert comprehended that particular pieces of the examination were outside his capacity to control. Therefore, little or nothing was done about such conditions. Some of such restrictions fuse the going with:

The assessment work was restricted to only three plants specifically, watermelon, cassava and sugarcane. Due to compelled time and budgetary resources, the expert couldn't collect all the crucial information expected to cover most plants that have their leaves been affected by developments. Moreover, it was fairly irksome getting exact and bleeding edge information from experts who had data on a bit of the issues that could have been discussed in the assessment.

3. PROPOSED APPROACH

3.1 Introduction

This part thinks about the principles, frameworks and methods of reasoning used to achieve the typical results and consequence of the investigation. These methods join consolidates the system for picking up the photos, procedures for dividing and thresholding the image, and computation to check the earnestness of the tainted zone of the leaf through the image. The going with gadgets and materials were used for the endeavor; Test spot defiled plant leaves, 20 tests, Computerized Camera, dull sheet/texture, Light Framework, PC and MATLAB programming Form R2015a.

3.2 Principles and systems

Three essential stages are related with undertaking this endeavor. These fuse picture acquiring, picture division in conclusion leaf region division. In any case, various measures like difference in picture into various structures were moreover considered.

A. Image securing

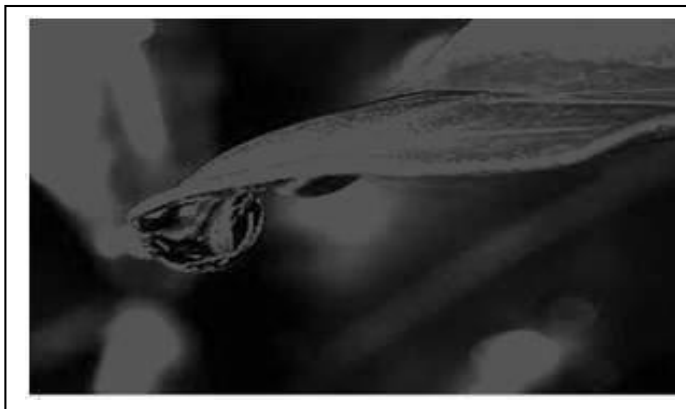
Suspected plant leaves are used to finish this undertaking. The mechanized camera was used to get pictures in controlled condition with the dull establishment. The photos were taken care of in either JPEG or PNG gathering. In the first place, the wiped out leaf was set level on the dim establishment (dull texture) with right proportion of light sources. This was to get rid of any reflection and get light similarly spread any place to improve view and quality of the image to be readied. The article (leaf) was properly zoomed using the propelled camera to ensure that the picture taken contained only the leaf and dull establishment with the real picture measure.

B. Image division

The division step was used to segregate the image into different locale subject to similar characteristics in the image. These regions show specific and novel qualities from one another and should not meet one another. All of the areas should portray some component of consistency in the region. The division arrange experienced two unmistakable stages to get hard and fast leaf pixels and the pixels in the leaf sore zone. For the purposes behind fitting division, the image is changed over to grayscale from the RGB structure. This can be cultivated by finding the typical of the three concealing sections in the veritable nature. First get the supposed picture, evacuate the red, green and blue estimations of pixel using their looking at numbers ultimately supersede the first RGB values with the new characteristics. The change is done by handling the ordinary of the three.

Figure 3.0: sample true colour image

If you have any color image like the image shown in figure 3.0 above and you want to convert it into grayscale using



average method, the following result would be achieved as shown in figure 3.1



Figure 3.1: gray scale of figure 3.0

One thing is that, the normal strategy doesn't give precise outcomes despite the fact that it works splendidly. This is on the grounds that this strategy figures the normal of the three hues. Since the three hues have various wavelengths and contribute in the arrangement of the picture, they produce mistaken outcomes. This can be amended by registering the normal dependent on the commitment made by each shading in the picture.

Scientifically, this can be communicated as: $G1 = (R+G+B)/3$ where

- G1= dim,
- R=red,
- G2=green and
- B=blue Henceforth,
- Gray= (Red + Blue + Green)/3

Calculation to accomplish this is expressed underneath with respect to every pixel in picture

```
{
Red =pixel.Red
Green=pixel.Green
```

```
Blue = pixel.Blue
Dim =(Red+Green+Blue)/3
Pixel. Red=Gray
Pixel. Green=Gray
Pixel. Blue=Gray
}
```

C. Leaf district division

To play out the division technique, the image was first changed over into grayscale from the authentic nature. This caused in isolating as a result of the assortment in obscurity estimations of the two (establishment and real picture). The establishment concealing if the image was addressed as dull whiles the veritable picture was addressed as white. After picture division, the parallel picture containing leaf zone is obtained by area filling and ousting each hole in the white district. The image is then sifted through, through, and from left to right using the MATHLAB programming to choose the hard and fast the amount of pixels in the leaf.

D. Diseased area division

To achieve the exact results, there is the need to area the image to procure only the contaminated zone. In the occasion that suitable thought isn't taken, division probably won't be correct an immediate consequence of concealing assortment. If the central vein of the leaf (midrib) is shallower than that of the real leaf, it may incite inaccurate results. Furthermore, considering the way that leaf diseases experience different periods of the sickness as a result of components, for instance, water, light and neutrino, the irritated shows various signs, which makes the division methodology inconvenient. Considering the factors referenced, it is more intelligent to change over the image to HIS concealing space from the RGB concealing space to make it evident to the human eye. The human eye is progressively sensitive to tint pictures when appeared differently in relation to doused pictures, due to that the image was changed over to the inundation structure. This is a result of the way that, the wonder part in the image is liberated from the human eye henceforth that makes it less complex to oust shadow, glare and other light factors during concealing picture division. To an immense degree, the tantamount diminish estimation of the shallow shade of the midrib and the leaf concealing fragment can decrease the impedence of the midrib in the irritated picture division. In case the irritated characteristics are moved, by then the cutoff points between the sore and the strong parts are also contrasted and make a delicate edge. That necessary the triangle thresholding procedure as the best philosophy for achieving the perfect results for this endeavor.

Calculation

1. Check to guarantee that the client has introduced Image handling Toolbox in Matlab.
2. Load the picture into Matlab (with full document area)
3. Get the elements of the picture
4. Convert the picture to HSV shading space
5. calculate the dark pixels
6. Find just the dark that is outside the leaf, not inside the leaf
7. Mask the H, S, and V pictures
8. Plot the histogram of the tone zone
9. Call anything with a tone of somewhere in the range of 0.15 and 0.5 "sound".
10. Call whatever else (that isn't foundation) "sick."
11. Compute the unhealthy zone portion
12. end

Mathematically, algorithm for estimating diseased severity can be expressed as:
 $DS = DA / TA$ (1)

$$= P \Sigma 1 / P \Sigma 1$$

$$(X, Y) \in DR(X, Y) \in LR$$

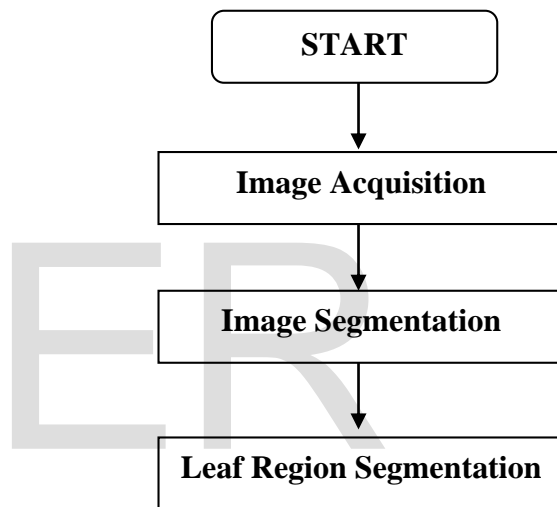
$$= \Sigma 1 / \Sigma 1$$

$$(X, Y) \in Rd (X, Y) \in RI$$

$$= Pd / P1(2)$$

Where,
 DS = Disease Severity, P = Unit pixel value,
 DA = Diseased leaf Area TA = Total Leaf Area, DR = Diseased Region, LR = Leaf Region,
 Pd = Total pixels in Diseased Area, P1 = Total Pixels of the Leaf.

Every pixel in the image has equal value therefore it is easier to extract the diseased portion by counting the numbers in the region and express it in the ratio of the total leaf area as shown in the algorithm above.



System shows leaf disease detection of *P. vulgaris* using digital image processing techniques

Figure 3.2: The figure above represents all the stages to go through in order to achieve the accurate results of this project.

4. RESULTS AND IMPLEMENTATION
INTRODUCTION

Color saturation in image processing and graphics is used to describe the intensity of color in a particular image. A saturated image has overly bright colors. The more saturated a colour, the more vivid it appears to be

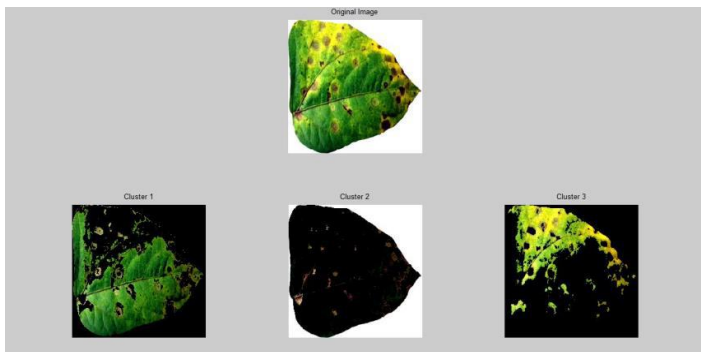
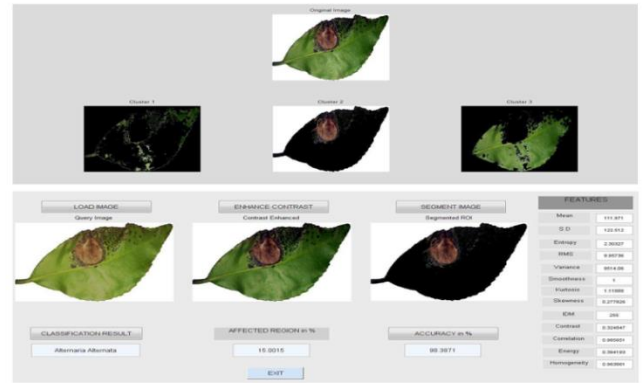


Fig 4.1 Image Enhancement

The less saturated a colour is the closer it is to grey. There is no right or wrong answer to how saturated colours should be in an image; it largely depends on how you want your images to look. When there is too much saturation in an image, the image looks like a cartoon. It is also difficult to accurately print images that are too saturated. However, an image which is less saturated (desaturated) is also said to be dull, less colorful or washed out but can also make the impression of being softer. The image (A) was converted into saturated form to determine the intensity of color in the image.

Fig 4.2 Daises detection

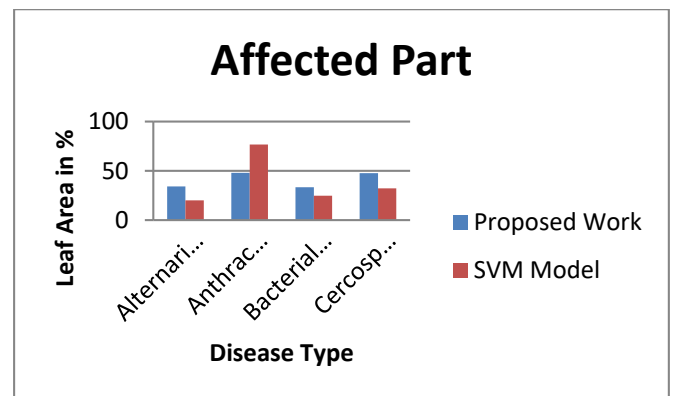
Applicable Sample applied with proposed model and produce relevant outcomes which are comparable with base model

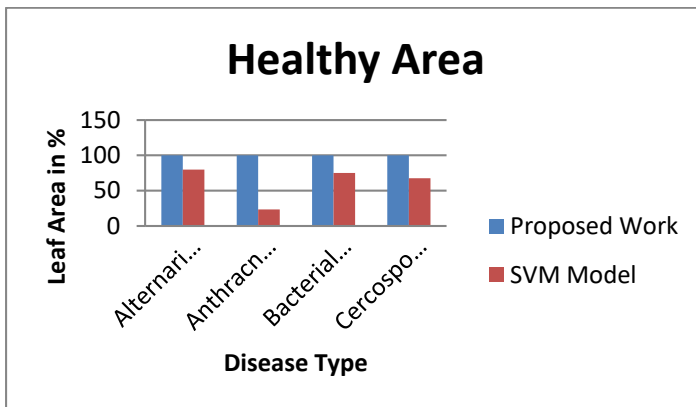


System shows leaf disease detection of *C. assamica* using digital image processing techniques

Result Comparisons

Sample Leaf Disease	Affected Part %		Healthey Part %		Sample Covered
	Proposed Work	SVM Model	Proposed Work	SVM Model	
Alternaria Alternata	34.22	20.1	65.78	79.9	100
Anthracnose	48	76.63	52	23.37	100
Bacterial Blight	33.33	24.8	66.67	75.2	100
Cercospora Leaf Spot	47.69	32.27	52.31	67.73	100





CONCLUSION

This work is a procedure to quantify the seriousness of organisms caused ailments on leaf. The examination thought about the negative impacts of leaf illnesses on plants. Studies have demonstrated that, the results of plant leaf illnesses are extraordinary and hard to manage. Be that as it may, leaf maladies, most particularly those brought about by parasites can be estimated and evaluated to guarantee legitimate and sufficient use of the right convergence of fungicides to keep away from agrarian misfortune and inordinate utilization of synthetic compounds on ranch produce. Plant malady doesn't just diminish their items yet in addition fall apart of their assortment and its withdrawal from development. The utilization of pesticides and fungicides in abundance for the treatment of such infections builds the risk of poisonous buildup level on horticultural items and has been distinguished as a significant supporter of ground water defilement. Once more, ranchers acquire a lot of misfortune because of cost of these pesticides as applied on plants. Along these lines, there is the need to take more prominent alert and limit their utilization so as to ensure water bodies and human life. The calculation utilized in this examination ends up being perhaps the least complex methods for identifying and evaluating leaf sicknesses in plants. It additionally ends up being truly outstanding regarding exactness since it works up to 97% precision as far as results.

References

[1] Al Bashish, D., M. Braik and S. Bani-Ahmad, 2011. Detection and classification of leaf diseases using K-means-based segmentation and neural networks based classification

[2] Alexander A. Doudkin, Alexander V. Inyutin, Albert I. Petrovsky, Maxim E. Vatkin[2007] Three Level Neural Network for Data Clusterzation on Images of Infected Crop Field, Journal of Research and Applications in Agricultural Engineering, Vol.52(1).

[3] Brendon J. Woodford, Nikola K. Kasabov and C. Howard Wearing[1999] Fruit Image Analysis using Wavelets, Proceedings of the ICONIP/ANZIIS/ANNES.

[4] ChaohuLu, HuiRen (et.al) "Leaf area measurement based on image processing," IEEE, 2010, 580-582.

[5] Hu CH, P.P. Li, "Application of computer image processing to extract color feature of nutrient deficiency leaves," Computer Measurement & Control, vol.9, pp.859-862, Dec.2004 Pico F.X and N. J. Ouborg [2003] A Comparison of Stereomicroscope And Image Analysis For Quantifying Fruit Traits, SEED Technology, Vol.25 no.1.

[6] DaeGwan Kim, Thomas F. Burks, Jianwei Qin, Duke M. Bulanon, Classification of grapefruit peel diseases using color texture featureanalysis, International Journal on Agriculture and Biological Engineering, Vol:2, No:3, September 2009. Open access at <http://www.ijabe.org>.

[7] Fundamentals Of Digital Image Processing- Anil K. Jain, Prentice-Hall, 1989. HiroyaKondou, HatuyoshiKitamura, "Shape evaluation by digital camera for grape leaf." Science and Technology promotion center, 2002, 586-590.

[8] Rao et al., Design and Fabrication of Color Scanner, Indian Journal of Technology, Vol15, April 1997.

[9] Rao KMM, Image Processing for Medical Applications, Proc. Of 14th world conference onndt, 8th-13th Dec 1996.

[10] Rao KMM, Medical Image Processing, Proc .of workshop on Medical Image Processing and Applications, 8th October 1995 @ NRSA, Hyderabad-37.

[11] Wang, S.K. Li, CT. Wang, " Acquired chlorophyll concentration of cotton leaves with technology of machine vision," ActaAgronvol.1, pp.34-40, Sin.2006

[12] Li, G.M. Zhou, "Research on image feature extraction of crop disease," Transactions of the CSAE, vol.25, pp.213-217, 2009.

[13] Prasad Babu and B. SrinivasaRao[2007] Leaves Recognition Using Back Propagation Neural Network-Advice For Pest and Disease Control On Crops, IndiaKisan.Net: Expert Advisory System.

[14] Maliappis, K. P. Ferentinos, H. C. PassamAnd A. B. Sideridis [2008] Gims: A Web based Greenhouse Intelligent Management System, World Journal of AGRICLURAL Sciences 4(5):640-647.

[15] Mohammed El.Helly, Ahmed Rafea and Salwa-El-Gammal, An Integrated image Processing System for Leaf Disease Detection andDiagnosis

[16] MorlonMarcon, Kleber Mariano (et.al), "Estimation of total leaf area in perennial plants using image analysis", R.Bras.Eng.Ambiental, 2011, v.15, 96-101.

- [17] Muhammad Hameed Siddiqi¹, Suziah Sulaiman, Ibrahim Faye and Irshad Ahmad, A Real Time Specific Weed Discrimination System Panagiotis Tzionas, Stelios E. Papadakis and Dimitris Manolakis [2005] Plant leaves classification based on morphological features and fuzzy surface selection technique, 5th International Conference ON Technology and Automation ICTA'05, Thessaloniki, Greece, pp.365-370,15-16 .
- [18] Hemalatha M , "Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge detection" , IEEE-20180, ICCCNT'12 ,26t _28t July 2012, Coimbatore, India.
- [20] Rafael C, Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB," Pearson Publication,2008. [10] Jain A K, Image Analysis and Computer Vision. PHI, New Delhi, 1997.
- [21] Rakesh Kaundal, Amar S Kapoor and Gajendra PS Raghava [2006] Machine learning techniques in disease forecasting: a case study on rice blast prediction, BMC Bioinformatics.
- [22] Ramanjaneyulu M, KMM Rao , A Novel technique to Resample High resolution remote Sensing Satellite Images, Proc. Of igrass-02, Colorado.
- [23] Sabine D. Bauer , Filip Korc, Wolfgang Forstner, The Potential of Automatic Methods of Classification to identify Leaf diseases from Multispectral images, Published online: 26 January 2011, Springer Science+Business Media, LLC 2011., Precision Agric (2011) 12:361-377, DOI 10.1007/s11119-011-9217-6.
- [24] Sanjay B. Patil et al. / International Journal of Engineering and Technology Vol.3 (5), 2011, 297-301
- [25] Sanjay B. Patil, Dr. S.K. Bodhe, "Betel leaf area measurement using image processing," IJCSE, 2011, pg.2856-2660.
- [26] Santanu Phadikar & Jaya Sil [2008] Rice Disease Identification Using Pattern Recognition Techniques, Proceedings Of 11th International Conference On Computer And Information Technology, 25-27.
- [27] Shen Weizheng, Wu Yachun, [et.al], " Grading method of leaf spot disease based on image processing", IEEE, 2008, pg.491-494.
- [28] Stephen Gang Wu, Forrest Sheng Bao, Eric You Xu, Yu - Xuan Wang Yi - Fan Chang [2007] A Leaf Recognition Algorithm for Plant Classification Using Probabilistic Neural Network IEEE 7th International Symposium on Signal Processing and Information Technology.
- [29] Tian You-wen, Wang Xiao-juan, "Analysis of leaf parameters measurement of cucumber based on image processing," World congress on software engineering, 2009, 34-37.
- [30] Using Multi-Level Wavelet Decomposition, International Journal of Agriculture & Biology, ISSN Print: 1560-8530; ISSN Online: 1814-9596, 0918/YHP/2009/11-5-559-565 , <http://www.fspublishers.org>. Wang Jun, Wang Shitong, Image Thresholding Using Weighted Parzen Window Estimation. Journal of applied sciences 8(5):772-779, 2008, ISSN 1812-5654, Asian Network for Scientific Information, 2008.
- [32] Weizheng S., Yachun W., Zhanliang C. & Hongda W. [2008] Grading Method Of Leaf Spot Disease Based On Image Processing, Proceeding Of 2008.
- [33] Yeo Zhang, M.Z. Li, "Nutrition information extraction of the cucumber leaves in the greenhouse based on computer vision technology," Transactions of the CSAE, vo1.21, pp.102-105, August 2005.
- [34] Yinmao Song, Zhihua Diao, Yunpeng Wang, Huan Wang, "Image Feature Extraction of Crop Disease", in IEEE Symposium on Electrical & Electronics Engineering (EEESYM), 2012
- [35] Zulkifli Bin Husin, et.al S Mohamed Farook, " Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques" in Proceedings of IEEE International Conference on Intelligent Systems Modelling and Simulation, 2012