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Classification of Segmented Image Using Increased Global Contrast for Paddy Plant Disease

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ABSTRACT

In this paper, we have studied the two classification techniques for paddy plant disease. Then we presented a new technique for classification of diseased paddy plant using global contrast enhancement. The work is developed using MATLAB and tested on different images. The results shows very promising as the segmentation are very correct.

Keywords: Rice Plant Disease, Digital Image Processing

I. INTRODUCTION

Plant diseases are important factors, as it can cause significant reduction in both quality and quantity of crops in agriculture production. Therefore, detection and classification of diseases is an important and urgent task. The problem in image segmentation occurs when an image has a varying gray level background [1]. Traditionally farmers identify the diseases by naked eye observation method. In this method disease is visually detected by the experts, who have the ability to detect subtle changes in leaf color. This method is very laborious, time consuming and impractical for large fields. Different experts can detect same part as different disease. To increase accuracy paper grid method is used. Drawback of this method is that this method is laborious. So a fast and accurate approach to identify the plant diseases is needed.

Most of the classical approaches rely on filtering and statistical techniques [3]. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

Plant diseases have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products. It is estimated that 2007 plant disease losses in Georgia (USA) is approximately $539.74 million. Of this amount, around 185 million USD was spent on controlling the diseases, and the rest is the value of damage caused by the diseases.The naked eye observation of experts is the main approach adopted in practice for detection and identification of plant diseases. However, this requires continuous monitoring of experts which might be prohibitively expensive in large farms. Further, in some developing countries, farmers may have to go long distances to contact experts, this makes consulting experts too expensive and time consuming .Automatic detection of plant diseases is an essential research topic as it may prove benefits in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on plant leaves .Therefore; looking for fast, automatic, less expensive and accurate method to detect plant disease cases is of great realistic significance.

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Agriculture has become much more than simply a means to feed ever growing populations. Plants have become an important source of energy, and are a fundamental piece in the puzzle to solve the problem of global warming. There are several diseases that affect plants with the potential to cause devastating economical, social and ecological losses. In this context, diagnosing diseases in an accurate and timely way is of the utmost importance. There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of remote sensing techniques that explore multi and hyperspectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals.

Detection Because the information gathered by applying image processing techniques often allows not only detecting the disease, but also estimating its severity, there are not many methods focused only in the detection problem. There are two main situations in which simple detection applies: • Partial classification: when a disease has to be identified amidst several possible pathologies, it may be convenient to perform a partial classification, in which candidate regions are classified as being the result of the disease of interest or not, instead of applying a complete classification into any of the possible diseases.

Timely diagnosis of crop diseases in fields is critical for precision on-farm disease management. Remote sensing technology can be used as an effective and inexpensive method to identify diseased plants in a field scale. However, due to the diversity of crops and their associated diseases, application of the technology to agriculture is still in research stage, which needs to be elaborately investigated for algorithm development and standard image processing procedures. In this paper, we examined the applicability of broadband high spatial-resolution ADAR (Airborne Data Acquisition and Registration) remote sensing data to detect rice sheath blight and developed an approach to further explore the applicability. Based on the field symptom measurements, a comprehensive field disease index (DI) was constructed to measure infection severity of the disease and to relate to image sampled infections. In addition to direct band digital number (DN) values, band ratio indices and standard difference indices were used to examine possible correlations between field and image data. The results indicated that the broadband remote sensing imagery has the capability to detect the disease. Some image indices such as RI14, SDI14 and SDI24 worked better than others. A correlation coefficient above 0.62 indicated that these indices would be valuable to use for identification of the rice disease. In the validation analysis, we obtained a small root mean square error (RMS = 9.1), confirming the applicability of the developed method. Although the results were encouraging, it was difficult to discriminate healthy plants from light infection ones when DI < 20 because of their spectral similarities. Hence, it was clear that identification accuracy increases when infection reaches medium-to-severe levels (DI > 35). This phenomenon illustrated that remote sensing images with higher spectral resolution (more bands and narrower bandwidth) were required in order to further examine the capability of separating the light diseased plants from healthy plants.

II. RELATED WORK

Devi et.al in [1] for any automated image analysis process, the segmentation is an important task because all subsequent tasks in image processing heavily rely on the quality of image segmentation. It determines the eventual success or failure of the analysis.

Chaudhary et.al in [2] in this research, an algorithm for disease spot segmentation using image processing techniques in plant leaf is implemented. This is the first and important phase for automatic detection and classification of plant diseases. Disease spots are different in color but not in intensity, in comparison with plant leaf colour. So we colour transform of RGB image can be used for better segmentation of disease spots.

Bhattacharyya et.al in [3] multichannel information processing from a diverse range of channel information is highly time- and space-complex owing to the variety and enormity of underlying data. Most of the classical approaches rely on filtering and statistical techniques. Methods in this direction involve Markov random models, vector directional filters and statistical mixture models like Gaussian and Dirichlet mixtures.

Vijayakumar et.al in [4] the aim of this research paper is to identify the foot rot disease infected in the betelvine plants using digital imaging techniques. The digital images of the uninfected betelvine leaves and the digital images of the infected in foot rot diseased betelvine leaves at different stages are collected from different betelvine plants using a high resolution digital camera and collected betelvine images are stored with JPEG format. The digital image analyses of the betelvine leaves are done using the digital image processing toolbox in MATLAB. The median values for all betelvine leaves are computed and calculated median values are stored in the system. The median values of test betelvine leaves are computed and compared with the stored median values. As the consequence of this evaluation, it is identified whether test betelvine leaves are affected by foot rot disease or not. Finally this research work is helps to recognize the foot rot disease can be acknowledged before it spreads to complete crop.

Singh et.al in [5] in India a majority of the population in rural areas is working in the agriculture field for their livelihood. They not only have to struggle for the better yield against the natural disasters but also have to tackle the losses of the net output because of land fertilization specifications and unskilled labour too. In the event of inadequate utilities and resources, in the face of unpredictable crises, their gain opportunities and livelihood are proportionally and adversely affected. However in this era of technology, the scenario may get changed as the Information and Communication and related fields of technology are providing a great for such type of crisis handling. Here in this paper, the method which may be used to compare the crop leaf color with the leaf color chart (LCC), has been proposed for getting a detail about the requirement of plant, before enough to get the yield affected. By making use of image processing technology a simple and robust method for the color prediction of paddy crop plant has been discussed along with the mathematical modelling which may provide a great platform to the advisory bodies in the agriculture field for the atomization of the crop health problems and solutions.

Asfarian et.al in [6] the efforts to increasing the quantity and quality of rice production are obstructed by the paddy disease. This research attempted to identify the four major paddy diseases in Indonesia (leaf blast, brown spot, bacterial leaf blight, and tungro) using fractal descriptors to analyze the texture of the lesions. The lesion images were extracted manually. The descriptors of 'S' component of each lesion images then used in classification process using probabilistic neural networks. This techniques achieved at least 83.00% accuracy when identifying the diseases. This method has a potential to be used as one of the feature if it combined with other features, especially when two diseases with relatively same color involved.

Paproki et.al in [7] the proposed method produces a smart partition of the initial mesh that allows to identify the main stem, branches, and leaves of the plant. Extracted regions are then processed through the next stage of the automated analysis, which retrieves accurate plant information such as stem length, leaf width, length or area. Results involved applying our top-down approach on a prototype population of 6 cotton-plant meshes studied at 3 or 4 time points. Using our partitioning pipeline, we obtained accurate meshes segmentations for 20 plants out of the initial 22. Results validate the feasibility of an automated analysis of plant data. Future work will involve extending our approach to multiple plant varieties and using an atlas-based iterative feedback scheme to improve the 3D plant reconstruction.

Choong et.al in [8] segmentation on synthetic images and natural images are covered to study the performance and effect of different image complexity towards segmentation process. This study gives some research findings for effective image segmentation using graph partitioning method with computation cost reduced. Because of its cost expensive and it becomes unfavourable in performing image segmentation

on high resolution image especially in online image retrieval systems. Thus, a graph-based image segmentation method done in multistage approach is introduced here.

Kurniawati et.al in [9] the objective of this research was to develop a diagnosis system to recognize the paddy diseases, which are Blast Disease (BD), Brown-Spot Disease (BSD), and Narrow Brown-Spot Disease (NBSD). This paper concentrates on extracting paddy features through off-line image. The methodology involves converting the RGB images into a binary image using variable, global and automatic threshold based on Otsu method. A morphological algorithm is used to remove noises by using region filling technique. Then image characteristics consisting of lesion percentage, lesion type, boundary color, spot color, and broken paddy leaf color are extracted from paddy leaf images. Consequently, by employing production rule technique, the paddy diseases are recognized about 87.5 percent of accuracy rates. This prototype has a very great potential to be further improved in the future.

Abdullah et.al in [10] the main objective of this research was to develop a prototype system for diagnosing paddy diseases, which are blast disease (BD), brown-spot disease (BSD), and narrow brown-spot disease (NBSD). This paper concentrates on extracting paddy features through off-line image. The methodology involves image acquisition, converting the RGB images into a binary image using automatic thresholding based on local entropy threshold and Otsu method. A morphological algorithm is used to remove noises by using region filling technique. Then, the image characteristics consisting of lesion type, boundary colour, spot colour, and broken paddy leaf colour are extracted from paddy leaf images. Consequently, by employing production rule technique, the paddy diseases are recognized about 94.7 percent of accuracy rates. This prototype has a very great potential to be further improved in the future.

Huang et.al in [11] mean shift algorithm is a statistics iterative algorithm which is widely used, its increment (namely mean shift vector) of iterative point in each iteration step changes adaptively. This paper presents an extensional mean shift vector, and proves convergence of mean shift algorithm which using the extensional mean shift vector. In addition, we did an experiment - using mean shift algorithm to solve the local Maximum of kernel-based density estimation, in our experiment, the convergence rate of mean shift algorithm which using extensional mean shift vector reach twice the convergence rate of mean shift algorithm which using traditional mean shift vector.

Jain et.al in [12] the proposed method starts with the center pixel of the image as the initial seed. The region growing formula uses three homogeneity criteria local, global and relative, in two steps to label the pixel to a region. It first checks for the color similarity of the pixel with respect to the connected labelled pixel and secondly with the mean value of a growing region. If the similarity criterion is fulfilled then this pixel is included in the growing region. Otherwise the similarity of the pixel with respect to its 8-neighbors is compared with respect to the mean value of a growing region. If the pixel is closer to the growing region as compared to its neighbors then it is included in the growing region, otherwise it is labelled as boundary pixel. After one region is completely grown, the next seed pixel is selected from the boundary pixel stack. Region merging is performed to reduce over segmentation in the results. They have applied our algorithm to Berkley images with successful results and the evaluation of the segmented images has been done using Liu's F-factor, total number of regions segmented and time taken by the algorithm. A fuzzy rule based modification of the algorithm is also proposed to further improve results. The proposed algorithm is also compared with SSRG algorithm using Otsu's threshold, SRGRM algorithm and MRG region growing techniques and is shown to outperform all methods.

Hayashi et.al in [13] paper introduces a new approach to the construction of a sequence set with a zero-correlation zone. The proposed sequences can be constructed from a pair of Hadamard matrices of the orders n0 and n1. The constructed sequence set consists of n0n1 ternary sequences, each of length n0(m+2)(n1+2), for a non-negative integer m. The zero-correlation zone of the proposed sequences is |ô| d— n0m+1- 1, where τ is the phase shift. The sequence member size of the proposed sequence set is equal

to n1/n1+2 times that of the theoretical upper bound on the member size of a sequence set with a zero-correlation zone. The proposed sequence set consists of n0 subsets, each of member size n1. The correlation function of the sequences of a pair of different subsets, refereed to as the inter-subset correlation function, has a zero-correlation zone with a width that is almost twice that of the correlation function of sequences of the same subset (intra-subset correlation function). This wider inter-subset zero-correlation contributes to the performance improvement of applications of the proposed sequence set. The proposed sequence set has a zero-correlation zone for both periodic and a periodic correlation functions.

III. SEGMENTATION USING NORMALIZED CUT

In this work a paddy plant disease image segmentation method is presented which uses gap portioning method for classification. Since it only uses the gap portioning for the segmentation it misses many colours which are out of the limits of the thresholds set. Since the angle of image taken varies it is very difficult to manage colours with this segmentation method. This study also looses the emasculate results because the prime focus is on cost reduction which compromises the overall quality of segmentation. We can use the image equalization method which will enhance the segmentation results of the system.

IV. TEXTURE BASED SEGMENTATION

In this it is presented that the segmentation can be done very efficiently using the global and automatic thresholding methods which increase the step complexity of the proposed system. Since the light variations are uncontrollable in these kinds of images the use of automatic thresholding increases the vulnerability of the system. Due to the lack of control over the lighting conditions the difference in boundary colour and spot colour cannot be differentiated. We can use enhanced global contrast to remove the problem of light variation to improve the segmentation performance of the system.

V. PROPOSED WORK

We have used the image equalization method which will enhance the segmentation results of the system [8]. We have eradicated the problem of colour variation due to angle by boosting the colours using image equalization [8]. The use of image equalization will automatically reduce the error in segmentation which will improve segmentation results unlike the research in which they, for reducing the cost of the system have compromised with the results [8]. We have used enhanced global contrast to remove the problem of light variation to improve the segmentation performance of the system [9]. We have solved the problem caused by global and automatic thresholding by the use of enhanced global contrast which reduces the need of thresholding itself [9]. The differentiation of boundary colour and spot colour will possible by using increased global contrast [9]. We have suggested a method with an enhanced form of segmentation. The segmentation we are using also does image equalization before the actual region of interest detection. Thereby using the segmentation with increased global contrast using image equalization, we have improved the feature extraction in the

VI. EXPERIMENTAL SETUP

In our work, we have developed a new thresholding technique to segment the region of diseased portion of the leaf. The experiment is performed by testing the algorithm of segmentation in MATLAB. The steps of segmentation are:

- We loaded the image in MATLAB
- We performed the global contrast enhancement
- We applied the base work technique called region growing to cluster or segment the image.

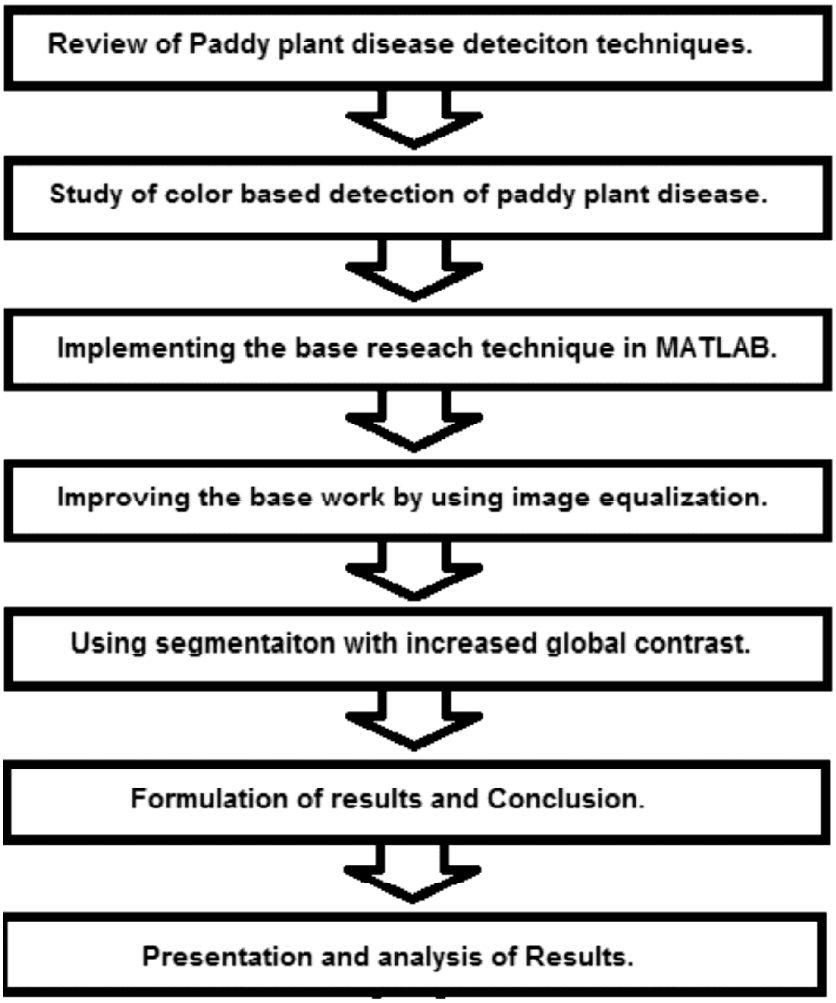

Figure 1: Proposed Methodology

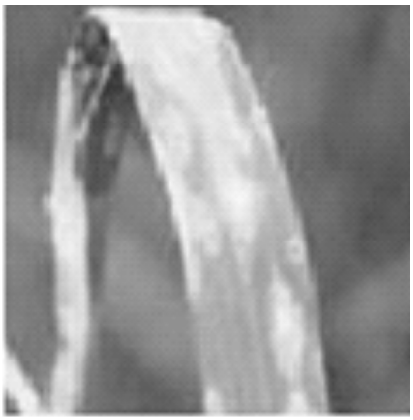

Figure 1: The Original Image

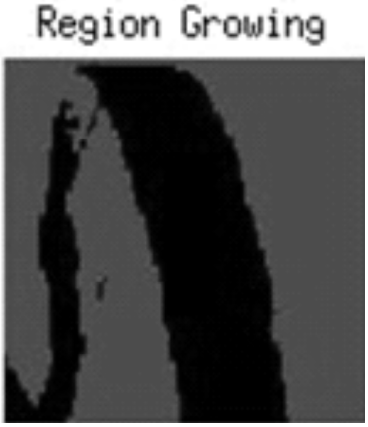

Figure 2: The Region Growing Segmentation

Figure 3: Our Proposed Thresholding

- We then applied our color based segmentation over contrast adjusted image.
- We then showed the results of both the segmentation techniques.

After application of these steps, we get our results as followed in images.

As seen in the Figure 1, the paddy leaf is diseased and yellow region which is diseased can be seen clearly.

In figure 2, the region is segmented using region growing algorithm. The region growing algorithm performs poorly as it requires a prior knowledge of diseased region in order to segment the image. Such a prior is not available in most cases of automatic image segmentation system and thus we need another technique which is independent of any sort of initial position of iteration.

In figure 3, we applied our concept of global contrast enhancement. In this technique we have normalized the color space so that we can perform color based segmentation very effectively. It can be seen from the image that a correct region of color is segmented and thus the diseased region is segmented very accurately in our proposed work.

VII. CONCLUSION AND FUTURE SCOPE

In this paper, we have comparatively studied two segmentation methods for segmenting plant image for the detection of paddy plant diseases. Further, we proposed a new technique of global contrast enhancement which normalizes the color vector space so that the region can be grown easily and the image can be segmented with low computational time. The system is highly robust as it normalizes the color vector space so as to induce accurate color based segmentation.

REFERENCES

[1] Devi, D.A. and Muthukannan, K., 2014, May. Analysis of segmentation scheme for diseased rice leaves. In Advanced Communication Control and Computing Technologies (ICACCCT), 2014 International Conference on (pp. 1374-1378). IEEE.

[2] Chaudhary, P., Chaudhari, A.K., Cheeran, A.N. and Godara, S., 2012. Color transform based approach for disease spot detection on plant leaf.International Journal of Computer Science and Telecommunications, 3(6), pp.65-70.

[3] Bhattacharyya, S., 2011. A brief survey of color image preprocessing and segmentation techniques. Journal of Pattern Recognition Research, 1(1), pp.120-129.

[4] Vijayakumar, J. and Arumugam, S., 2013, October. Certain investigations on foot rot disease for betelvine plants using digital imaging technique. InEmerging Trends in Communication, Control, Signal Processing & Computing Applications (C2SPCA), 2013 International Conference on (pp. 1-4). IEEE.

[5] Singh, A. and Singh, M.L., 2015, July. Automated color prediction of paddy crop leaf using image processing. In Technological Innovation in ICT for Agriculture and Rural Development (TIAR), 2015 IEEE (pp. 24-32). IEEE.

[6] Asfarian, A., Herdiyeni, Y., Rauf, A.M. and Mutaqin, K.H., 2013, November. Paddy diseases identification with texture analysis using fractal descriptors based on fourier spectrum. In Computer, Control, Informatics and Its Applications (IC3INA), 2013 International Conference on (pp. 77-81). IEEE.

[7] Paproki, A., Fripp, J., Salvado, O., Sirault, X., Berry, S. and Furbank, R., 2011, December. Automated 3D segmentation and analysis of cotton plants. In Digital Image Computing Techniques and Applications (DICTA), 2011 International Conference on (pp. 555-560). IEEE.

[8] Choong, M.Y., Kow, W.Y., Chin, Y.K., Angeline, L. and Teo, K.T.K., 2012, November. Image segmentation via normalised cuts and clustering algorithm. In Control System, Computing and Engineering (ICCSCE), 2012 IEEE International Conference on (pp. 430-435). IEEE.

[9] Kurniawati, N.N. and Abdullah, S., 2009, August. Texture analysis for diagnosing paddy disease. In Electrical Engineering and Informatics, 2009. ICEEI'09. International Conference on (Vol. 1, pp. 23-27). IEEE.

[10] Kurniawati, N.N., Abdullah, S.N.H.S. and Abdullah, S., 2009, December. Investigation on image processing techniques for diagnosing paddy diseases. In Soft Computing and Pattern Recognition, 2009. SOCPAR'09. International Conference of (pp. 272-277). IEEE.

[11] Huang, J., Li, S. and Zhou, C., 2008, November. Extension of Mean Shift vector with theoretical analysis and experiment. In Intelligent System and Knowledge Engineering, 2008. ISKE 2008. 3rd International Conference on(Vol. 1, pp. 1007-1012). IEEE.

[12] Jain, P.K. and Susan, S., 2013, December. An adaptive single seed based region growing algorithm for color image segmentation. In India Conference (INDICON), 2013 Annual IEEE (pp. 1-6). IEEE.

[13] Hayashi, T., Maeda, T. and Okawa, S., 2010, October. A novel zero-correlation zone sequence set with sequence subsets. In Communications and Information Technologies (ISCIT), 2010 International Symposium on (pp. 384-388). IEEE.