ISSN 2278-3091
Volume 9, No.4, July – August 2020
International Journal of Advanced Trends in Computer Science and Engineering
Available Online at http://www.warse.org/IJATCSE/static/pdf/file/ijatcse102942020.pdf
https://doi.org/10.30534/ijatcse/2020/102942020

Segmentation of Diseased Leaf Images using Hybrid Clustering Algorithm

Shabari Shedthi B[1], M Siddappa[2], Surendra Shetty[3], Sarika Hegde[4]
[1]Dept of CSE, NMAM Institute of Technlogy (Affiliated by Visvesvarararaya Technological University, Belagavi), Nitte,India.
[2]Dept of CSE, Sri Siddhartha Institute of Technology, Tumkur, India.
[3]Dept of MCA, NMAM Institute of Technlogy (Affiliated by Visvesvarararaya Technological University, Belagavi), Nitte,India.
[4]Dept of CSE, NMAM Institute of Technlogy (Affiliated by Visvesvarararaya Technological University, Belagavi), Nitte,India.

ABSTRACT

Plant disease identification at early stage is signficant in agriculture beacause it can save the crop and also the amount of pesticide to be used. This process can be automated using various image processing techniques. Image segmentation is one of the technique which is useful in automatic plant diseaese identification, where it highlights the diseased portion in leaf. Since, the color space considered for segmentation is very important as it may vary the result, we experiment with various color spaces like, RGB, L*a*b, and HSV, then select the best one for further processing. In this paper, a hybrid clustering algorithm consisting of K-means and Genetic Algorithm (GA) algorithm is proposed for image segmentation. The proposed algorithm is that it selects the number of clusters automatically and also overcome the local minima problem of K-means algorithm by providing an optimal solution for selection of intial cluster centroids using GA.

Key words: Color space, Genetic Algorithm, Hybrid clustering, Plant disease detection

1. INTRODUCTION

Agriculture plays an important role in economic sector of a country. The plant disease is one of the main causes for decreasing the quality and quantity of the agricultural product [1]. By identifying the disease in early stage, we can reduce the pesticide usage. Farmers, instead of following the traditional naked eye observation for disease identification, if they make use of advanced technology, then they can raise their income.

Most commonly, plant images are considered as input for disease identification system. Various image processing techniques are available for this. Segmentation is one of such technique which extracts the region of interest i.e. diseased portion, from the given image. The process of segmentation is directly bound to recognition of diseased portion. Segmentation accuracy determines the success or failure of further processing i.e. disease classifications [2]. However, segmentation of image is affected by various factors like image type, color, level of noise etc. [3]. Originally, the image will be in RGB color space. But it can transform into other color spaces like, L*a*b, HSV, CMY etc [4]. The result of segmentation varies with the choice of color space. Hence, it is important to choose an appropriate color space for a given dataset. In this paper, segmentation is done on RGB, L*a*b and HSV.

In spite of the many segmentation techniques presently available [5, 6], no general methods have been considered as the efficient approach for image segmentation. Most of the clustering algorithms [7] can also be used for image segmentation. K-means is more popular among them because it is fast and simple. The result of K-means algorithm is sensitive to two factors i.e the cluster number and initial cluster centroids. Due to this, K-means algorithm gives local optimal solution.

In this research paper, we propose a hybrid algorithm for segmentation of leaf disease using K-means and GA algorithm. The advantage of this hybrid algorithm is that the number of clusters will be chosen automatically and it provides a global optimal solution for clustering.

2. LITERATURE SURVEY

Bhanu and Lee [8] have discussed about the many image segmentation algorithm namely, Edge based, Region based and Clustering based. Meyer[9] used region growing technique for color image segmentation extract the required part of the object from the image.

Pratheba et al. [10] used clustering based algorithm for image segmentation to segment the agricultural image to identify the pest. K-means and Fuzzy C-means are compared and claimed that K-means takes less time for evaluation. Senthilkumaran and Rajesh [11] discussed about various techniques like genetic algorithm, Fuzzy etc for image segmentation. Woods and Keri [12] have done literature

review on different algorithm for segmentation on color images like Edge detection,Thresholding, Region growing and GA. At the end concluded that GA gives better result than other algorithm.

Raj and Sethi[13] explained about Genetic algorithm in image segmentation. It is proven an effective algorithm finding the global optima and it gives optimum solution. Reddy and Malleshwari[14] proposed a algorithm where GA is used for improving the quality of the medical image. Until one gets the satisfactory result, GA repeatedly modifies a population of individual solutions. Rathod et.al [15] surveyed about different techniques for leaf disease detection and for future scope we can use hybrid algorithm for classification for increasing the final recognition rate of classification. Singh et.al [16] explained about GA for segmentation of diseased leaf and that is considered further for plant disease identification and classification using machine learning techniques [17].

Eva et.al [18] Compared different color models for plant disease detection and got good result in HSI space while considering only H component because Hue gives pure color which is independent of device effect.

Ujjwal and Bandyopadhyay [19] used GA based clustering where GA is used for search the appropriate cluster centers in the feature space. Euclidean distance is used to find the similarity between the pixels. Results of GA shows better than over K-means because K-means may converge to not optimal value[20].

3. PROPOSED SYSTEM

In this paper, the input image is represented in RGB is converted into different color space like HSV and LAB space. Then experimented on different color spaces and observed that H component gives better result so considered that for further process. K-means and hybrid algorithms (GA-kmeans) are applied to segment the disease portion of the leaf. Four types of plant diseases images are considered for segmentation experiments i.e. grapes black rot, grapes black measles, pepper quick wilt and rice blast diseases.

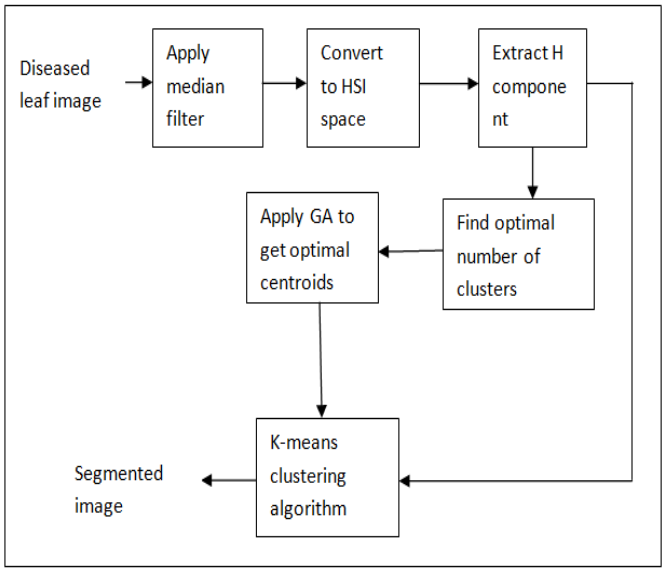


Figure 1: Proposed algorithm block diagram

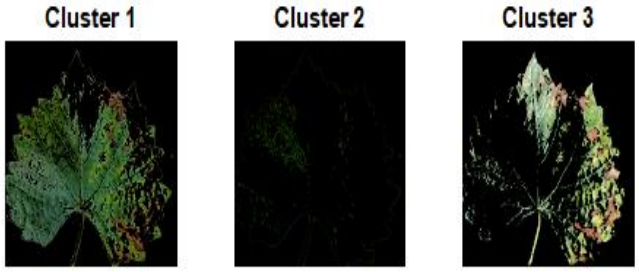
The proposed algorithm has following steps:

1. Median filter is applied to remove the noise from acquired image.
2. Image is converted to HSV space and then only H component is considered for further as it gives the best result.
3. The optimal cluster numbers i.e. K is calculated based on Davies Bouldin Evaluation method.
4. Optimal cluster centroids for K-means algorithm are calculated using GA algorithm.
5. Apply K-means algorithm for the given data.

4. RESULTS AND DISCUSSION

4.1 Choosing the best color space

The first experiment done was to choose the best color space for our further experiment. For this image is converted from RGB to L*a*b and HSV. Experiment result is shown in figure 2 and from result observed that H component of HSV space considered image performs well compared all other spaces.



(a)

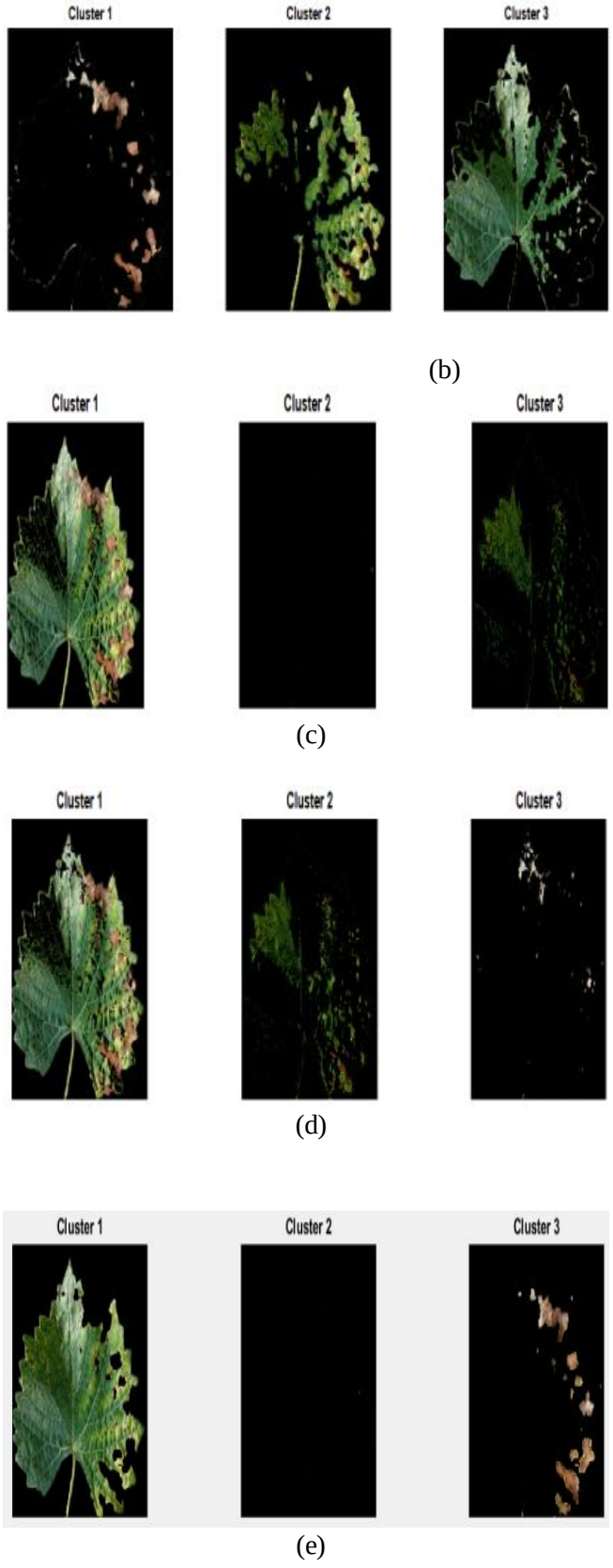


Figure 2: Segmented images on different color spaces and considering various color components (a)RGB, (b)L*a*b space considering a* and b* component, (C) HSV, (d) H and S (e) H

4.2 Segmentation using proposed hybrid algorithm

Proposed hybrid algorithm is applied on given image dataset where Devise Bouldin index value(DBI) is computed to find the best cluster. Cluster which returns less DBI value is considered for further.

Then, we apply the hybrid clustering algorithm to get the diseased portion cluster of the leaf and the results are comapred with that of K-measn algorithm. The results of clustring using K-means and hybrid algorithm for Grapes black rot and black measles, Pepper quick wilt and Rice blast diseased images are shown in the figures 3,4,5 and 6 respectively. In each of the figure, the first coloum is a given input image, second coloum shows the diseased portion cluster using K-means and last coloumn shows the diseased portion cluster using Hybrid algorithm.

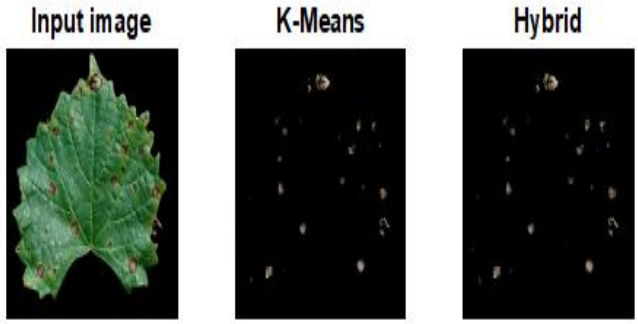


Figure 3: Segmented images Grapes Black Rot diseased leaf.

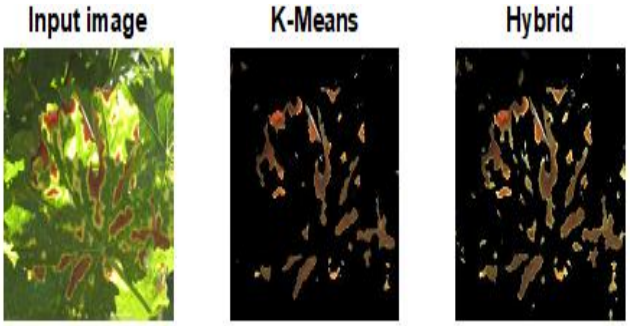


Figure 4: Segmented images Grapes Black measles diseased leaf.

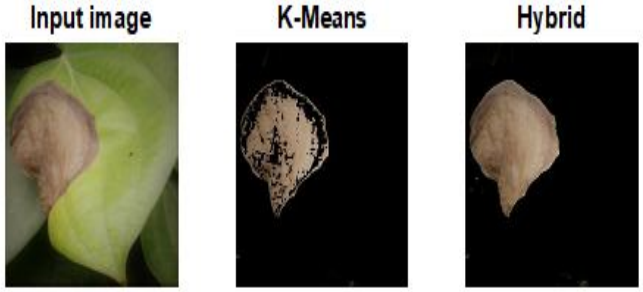


Figure 5: Segmented images Pepper quick wilt diseased leaf

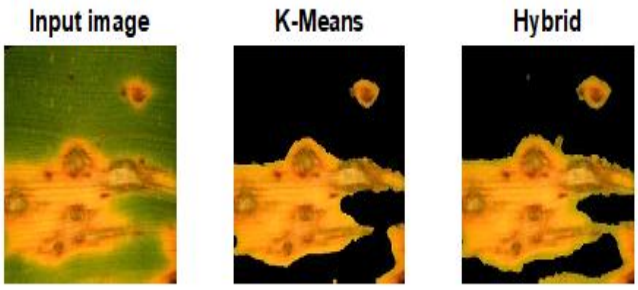


Figure 6: Segmented images Rice blast diseased leaf.

In those figures image segmentation results of k-means and hybrid algorithm can be compared. The brown and yellow color in input image indicates diseased portion of the leaf which need to be segmented as separate cluster shown in second and third column.

5. CONCLUSION

We have proposed a hybrid clustering algorithm which automatically selects the best number of clusters, based on DBI value. It also computes the best cluster centers automatically using GA algorithm and performs the robust search for finding the global optimum solution. Selection of initial centroids decides the consistent results of clustering algorithm. We have done segmentation experimentation with different color spaces and found that the hue component of HSV color space gives better segmented results than other as hue gives pure color. Hybrid clustering algorithm provides optimized solution for image segmentation to find the leaf diseases. Effectiveness of proposed algorithm is compared with that of K-means algorithm using with various evaluation metrics and found to be better in image segmentation. In future, the result of hybrid algorithm can be used for further classification of diseased plant images.

REFERENCES

1. Sankaran, Sindhuja, et al. "A review of advanced techniques for detecting plant diseases." *Computers and Electronics in Agriculture* 72.1 (2010): 1-13.
2. D. S. *Gaikwad*, K.J.Karande, "Image Processing Approach for Grading And Identification Of Diseases On Pomegranate Fruit", *International Journal* of *Computer Science* and *Information Technologies* (*IJCSIT*) *s, Vol. 7* (*2*), *2016, 519-522*.
3. Jain S., Laxmi V. (2018) Color Image Segmentation Techniques: A Survey. In: Nath V. (eds) Proceedings of the International Conference on Microelectronics, Computing & Communication Systems. Lecture Notes in Electrical Engineering, vol 453. Springer, Singapore.
4. Gonzalez, Rafael C., and Richard E. Woods, "Image processing." *Digital image processing* 2 (2007).
5. Fu, King-Sun, and J. K. Mui. "A survey on image segmentation." *Pattern recognition* 13.1 (1981): 3-16.
6. Haralick, Robert M., and Linda G. Shapiro. "Image segmentation techniques." *Computer vision, graphics, and image processing* 29.1 (1985): 100-132.
7. Bhowmik, Santanu, and Viki Datta. "A survey on clustering based image segmentation." *International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)* 1.5 (2012): pp-280.
8. Bhanu, Bir, and Sungkee Lee. *Genetic learning for adaptive image segmentation*. Vol. 287. Springer Science & Business Media, 2012.
9. Meyer, Fernand. "Color image segmentation." Image Processing and its Application., International Conference on. IET,(1992).
10. Zhi-Gang, Chi, et al. "Image Segmentation Considering Intensity Roughness and Color Purity." *Journal of Software* 13.5 (2002): 5.
11. Senthilkumaran, N., and R. Rajesh. "Image segmentation-a survey of soft computing approaches." *Advances in Recent Technologies in Communication and Computing, 2009. ARTCom'09. International Conference on*. IEEE, 2009.
12. Woods, Keri. "Genetic Algorithms: Colour Image Segmentation Literature Review." (2007).
13. Mohanta, Raj Kumar, and Binapani Sethi. "A review of genetic algorithm application for image segmentation." *Int. J. Comput. Technol. Appl* 3.2 (2011): 720-723.
14. A.Srinivasa Reddy and G.Malleswari " Significance of Genetic Algorithm in image segmentation", International Journal of Signal Processing, Image Processing and Pattern Recognition ,9(2016)
15. Rathod, Arti N., Bhavesh Tanawal, and Vatsal Shah. "Image processing techniques for detection of leaf disease." *International Journal of Advanced Research in Computer Science and Software Engineering* 3.11 (2013).
16. Vijai Singh, Varsha and A. K. Misra. "Detection of unhealthy region of plant leaves using Image Processing and Genetic Algorithm." *Computer Engineering and Applications (ICACEA), 2015 International Conference on Advances in*. IEEE, 2015.
17. Singh, Vijai, and Ak K. Misra. "Detection of plant leaf diseases using image segmentation and soft computing techniques." *Information processing in Agriculture* 4.1 (2017): 41-49. https://doi.org/10.1016/j.inpa.2016.10.005
18. Eva Tuba, Raka Jovanovic, Milan Tuba, "Plant Diseases Detection Based on Color Features and Kapur's method', *WSEAS TRANSACTIONS on INFORMATION SCIENCE and APPLICATIONS*, vol 14, (2017):31-39.
19. Maulik, Ujjwal, and Sanghamitra Bandyopadhyay. "Genetic algorithm-based clustering technique." *Pattern recognition* 33.9 (2000): 1455-1465.
20. Selim, Shokri Z., and Mohamed A. Ismail. "K-means-type algorithms: A generalized convergence theorem and characterization of local optimality." *IEEE Transactions on pattern analysis and machine intelligence* 1 (1984): 81-87.