CITRUS DISEASES CLASSIFICATION AND AREA DETECTION USING IMAGE PROCESSING

A. R. Luaibi, T. M. Salman, A. H. Miry

Mustansiryah University, Baghdad, Iraq

E-mail: ahmedraheem175@gmail.com, tjibori@gmail.com, ab-basmiry83@gmail.com

This paper presents a technique for discovering and classifying major citrus diseases of economic importance. Because of the slight difference in symptoms of various plant diseases, the diagnosis requires the expert opinion of the disease detection. An inappropriate diagnosis may result in huge economic losses for farmers in terms of inputs such as pesticides. For several decades, computers have been used to provide automatic solutions rather than a manual diagnosis of plant diseases that are costly and error prone. three classes of citrus diseases with healthy class are discussed by using the top-hat enhancement method and the K-mean segmentation method. Finally, the MSVM method used to classify the leaf class. Also, the area of the diseases is evaluated. The results show an accuracy with 93.18%.

Key words: *citrus diseases; Top-Hat filter; GLCM; K-Mean; MSVM.*

Introduction. Citrus is one of the most important products. The Agricultural Statistics Directorate has completed the report of the citrus trees production survey for the year 2019, which is a survey within the annual plan of the Central Bureau of Statistics and covers five main types (orange, sour lemon, sweet lemon, mandarin, and bitter orange). Because of the citrus trees infected with several diseases, including (Phyllocnistis citrella, lack of elements, scale insect, etc.). and its spread gradually over the past years and its continuing impact on the season due to poor treatment and the lack of use of pesticides to reduce the impact of these diseases on citrus production in middle east, knowing that the impact of diseases has caused the destruction of large numbers of citrus trees and low productivity. Where the average productivity of the orange tree was estimated at 13.5 kg only, which is a very low rate, given that it is considered the first tree of citrus fruits, and the average productivity of other citrus trees is close to the rate of orange production [1]. The major citrus diseases can be observed and classified by experts on basis of their symptoms. But this requires continuous monitoring and manual observation which could be error prone and costly. Therefore, in underdeveloped countries, where most farmers are uneducated, must pay for such cost in addition to other expenses (e.g. fertilizer and pesticides). Moreover, farmers are unaware of non-native diseases. In this paper 80 image of citrus with different diseases and healthy leaves are used, 60 images used as dataset for training and the other used to test the accuracy of the system. First, the original image was enhanced and background removable before the segmented process applied by using the

K-means algorithm. Then, the grey Level Co-occurrence Matrices (GLCMs) applied to extract the feature of the segmented image and evaluate the area of the diseases in the citrus leaf. Finally, detect the leaf disease class by using the Multi-Class support vector machine (MSVM) algorithm.

Common diseases affecting citrus trees

Phyllocnistis citrella. The citrus leaf miner (CLM) Phyllocnistis citrella Stainton (Lepidoptera: Gracillariidae) is a serious pest of commercial citrus production throughout the world [2].

Lack of elements. Citrus trees in commercial and dooryard plantings can exhibit a host of symptoms reflecting various disorders that can impact their health, vigor, and productivity to varying degrees, such as lack of some micronutrients such as Zn, Mn, and Fe [3].

Scale insects. Scale insects refer to a large group of insects within the super family Coccoidea. Feeding on leaves may cause them to yellow and plants may appear water stressed [2]. Figure 1 shows the different disease in citrus leaf.

Fig. 1**.** different disease in citrus leaf.

Proposed methodology. In this paper, the procedure used to detect, and classification the citrus leaf diseases consist of four steps as shown below. To measure the performance of the proposed system, 80 images are used for training and 60 images for testing. The initial step of the system is image acquisition when the image captured ans saved as image processing supported format such as JPEG, JPG, BMP, PNG etc. So, image enhancement by adjusting the intensity using the top-hat filter [4]. Segmentation is the process used to subdivide an image into parts or objects. Image. The k-mean clustering methods [5]. The GLCM function characterize the texture feature of a citrus leaf image and it calculated by occurrence of pixel in an image with specific values and in a specific spatial relationship. By creating a GLCM followed by extracting statistical measure from this matrix [6,7].

Calculation for Disease Area in Leaf. For area calculation. First, the RGB image loaded and converted to HSV (Hue Saturation Value). Then, the background and healthy area pixels are counted. Figure (2) show the result of one of the diseases leaf area calculation.

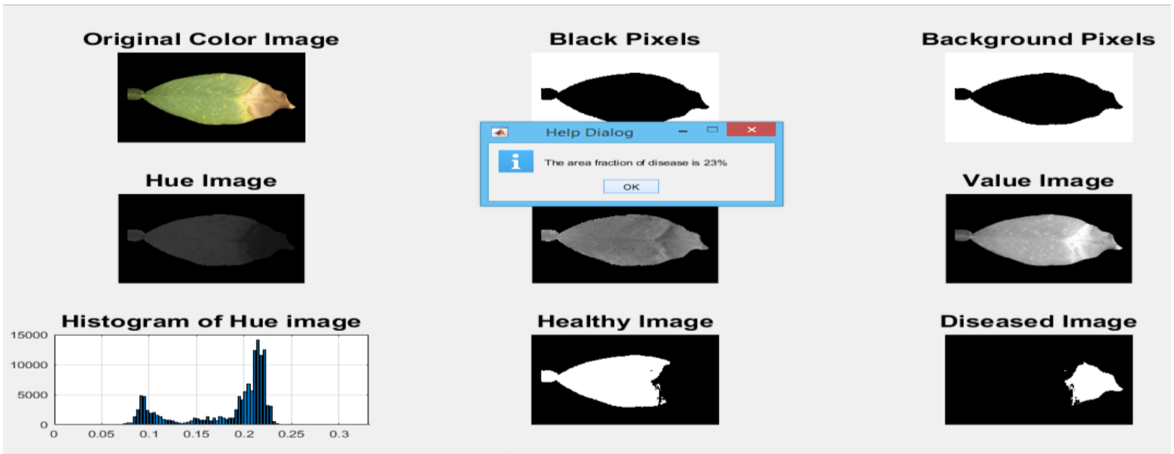

Fig. 2. the result of one of the diseases leaf area calculation.

Classification. In this stage, the features extractions are used for classification training. A list of healthy and diseases features of the citrus leaves with the target class are fed into the classifier [8].

Results and discussion. For the training and testing purpose 125 images with dimension 540×405 of citrus leaves include healthy, Phyllocnistis citrella, lack of elements and scale insect diseases. The feature extraction average ;Contrast = 0.106852, Correlation = 0.981464, Energy=0.625118, Homogeneity = 0.979058, Mean = 27.05427, Standard- Deviation=55.77264, Entropy = 2.354984, RMS = 6.01001, Variance =2542.151, Kurtosis = 7.914382 and Skewness = 2.071239.Figure (3) shows the accuracy results for each cluster with different healthy and diseases leaves.

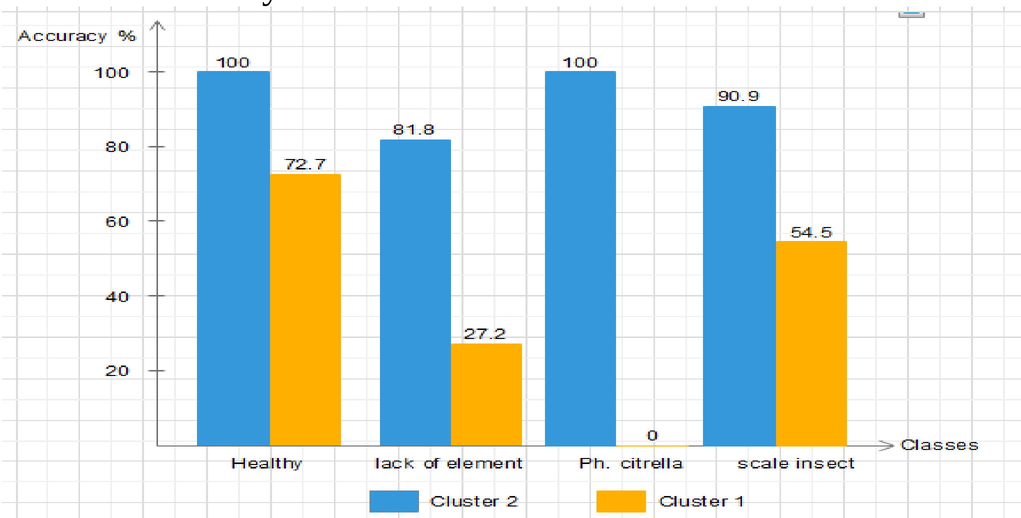

Fig. 3. The accuracy results for each cluster with different classes

Conclusions. In this paper, a major problem had been addressed for different types of citrus leaf diseases. By using image processing tools with MATLAB program, the proposed system had successfully enhanced by using top-hat enhancement method and segmented with k-mean clustering method and classify with MSVM method to healthy, Phyllocnistis citrella, lack of elements and scale insect diseases. The area of the diseases in the leaves are calculated in efficient way with other GLCM features. The result of system accuracy for cluster 2 obtained with 93.18% which is more efficient from the classification with cluster 1.

REFERENCES

1. Central Statistical Organization / Iraq - Directorate of Agricultural Statistics. 2019.
2. B. Scale, Scale insects Nu sery Production Plant Health Biosec urity Project.
3. Adhiwibawa M. A. S. Detection of Anomalies in Citrus Leaves Using Digital Image Processing and T2 Hotelling Multivariate Control Chart // Int. Conf. Artif. Intell. Inf. Technol. 2019. P. 310–314.
4. Hassanpour H., Samadiani N., Salehi S. M. M. Using Morphological Transforms To Enhance The Contrast Of Medical Images // Egypt. J. Radiol. Nucl. Med. 2015. Vol. 46. N2. P. 481–489.
5. Yadav J., Sharma M. A Review of K-mean Algorithm // Int. J. Eng. Trends Technol. 2013. Vol. 4. N7. P. 2972–2976.
6. Shaikh R. P., Dhol S. A. Citrus Leaf Unhealthy Region Detection By Using Image Processing Technique // Proc. Int. Conf. Electron. Commun. Aerosp. Technol. (ICECA). 2017. P. 420–423.
7. Veling P. S. Mango Disease Detection By Using Image Processing // Int. J. Res. Appl. Sci. Eng. Technol. 2019. Vol. 7. N4. P. 3717–3726.
8. Chinnasamy D. Swarm Intelligence Based Detection of Citrus Plant Diseases and Their Severity Level // Int. J. Innov. 2020. Vol. 9. N3. P. 428–433.

ВОЗМОЖНОСТИ АНАЛИЗА НЕЗАВИСИМЫХ КОМПОНЕНТ ТРАНСКРИПТОМОВ РАКА ПОДЖЕЛУДОЧНОЙ ЖЕЛЕЗЫ ПРИ ОЦЕНКЕ МОЛЕКУЛЯРНО-ГЕНЕТИЧЕСКИХ СВОЙСТВ ОПУХОЛЕВОЙ ТКАНИ

А. К. Какойченкова[1,2], М. К. Чепелева[3,4], П. В. Назаров[4]

[1]Витебский Государственный медицинский университет, Витебск, Беларусь
[2]СООО «Нативита», Витебск, Беларусь
[3]Белорусский государственный университет, Минск, Беларусь
[4]Luxembourg Institute of Health, Strassen, Luxembourg
E-mail: Maryna.chepeleva@gmail.com, petr.nazarov@lih.lu

Использование методов геномных исследований является актуальным для современной медицины, т. к. позволяет выявить индивидуальные особенности патологических процессов. Оценка транскриптомных данных является сложной для клинической интерпретации. В нашей работе был применен анализ данных методом независимых компонент, который позволил выделить отдельные транскрипционные сигналы, ассоциированные с клеточными процессами, участвующими в прогрессии рака поджелудочной железы. Показано, что метод позволяет связать влияние отдельных