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A QUICK AND ACCURATE TOMATO LEAF DISEASE DISCOVERY AT EARLIER STAGE OF HARVESTING BY UTILIZING THRESHOLD SEGMENTATION AND RFO CLASSIFIER

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ABSTRACT

In Agriculture, the prior period of harvesting feature gives splendid effectiveness. It lessens the collect disease rate with the ultimate objective that the economy has been balanced. The import and toll of agro things are extends because of the previous period of yield gathering technique. The various conventional methods can deal with a past development of harvesting, anyway improvement is required. Hence random forest optimization and T_h segmentation schemes have used to find the diseases in the harvests, moreover predicts the sort of plant-infirmity. In this investigation, the continuous prior period of tomato leaf illness and its contrasting compost is proposed. For this tomato crop leaf pictures has been assembled from various data bases like reap science, yes-modes, nelson. wisc datasets. Dependent upon singular thought, plants give the Rise in progress, yet by using the manual methods for cultivating, more creation rate is past the domain of creative mind. So IoT with front line Machine Learning methodologies and huge making sure about pre-processing techniques can uphold the sound cultivation. Until various procedures are delivered for agribusiness at a previous period of social occasion, anyway they have more imperatives. Current development doesn't work with past procedures; thusly, improvement is required for future sound agribusiness systems. In this investigation, threshold-based segmentation is used for pre-processing, and Random Forest optimization for classification of tomato leaf disease detection at prior stage. Proposed threshold segmentation RFO (TS-RFO) gives the 97.6% detection accuracy and 99% True certain rate 59.82PSNR, 0.9989SSIM, 0.0081MSE has been gotten; this is a splendid achievement stood out from existed systems.

Keywords: *Crop Harvesting, Detection Of Plant Disease RFO, Classification, Threshold Segmentation*.

1. INTRODUCTION

The prior stage of crop harvesting is an important agriculture change for a future phase of production. The agricultural analyzer thinks that disease prediction plants are a significant role for farmers. This work can help the farm productivity at any time-varying nature of harvestings. I India most of the income rates depending on agriculture productivity; therefore, the prior stage of disease deduction in plants place a significant role. To predict plant disorders at an initial step is a better disease detection mechanism compared to conventional methods. The exited methods for plant disease detection is a natural observation by manual processes. This model can't identify the exact problems of leaf disease. For this, a large amount of economic and human resources as needed for monitoring the plants. Some of the country's formers had utilized the old conventional methods with expert suggestions. Due to this time has been consuming for evaluating the disease type and corresponding fertilizer. Plant infection expectation by visual nature is a more convoluted undertaking and a similar less proficient model. This model has a greater number of limitations, whereas auto-machine techniques can easily handle the above-discussed problems. They proposed in this research of tomato plant, disease identification method at a prior stage of harvesting. Various diseases related to tomato plants are listed as bacterial _spot, early_blight, late_blight, leaf_mold, septoria_leaf_spot, spider_mites, target_spot and yellow_leaf_curl_virus. These diseases may be observed in the tomato plant. Image processing and embedded system combination can help the prior stage disease of tomato plant detection system.

Figure-1 Raspberry Pi And Pi Cam.

Figure -1 explains that a general PCB diagram of Raspberry pi and pi cam devise. These two devices are identifying the tomato plant leave diseases. Image processing is a significant analysis for determining the effected area of plant disease. The image processing further divided into steps, and this is image acquisition and segmentation. Image acquisition also classified into three sub-stages those are clipping, smoothing and enhancement. Coming to segmentation three more substages are present, there are binarization, thresholding and segmentation. The above two main steps can quickly identify the tomato leaf disease.Image segmentation is one of the best procedure differentiation the image parts. In image segmentation, many models are performing the segmentation process; in that threshold segmentation method has been used in our approach.

The IoT can perform more application such as Agriculture, industrial and naval. In any field, IoT and machine learning tools might be providing excellent optimization outcomes, and modern approaches identify the crop diseases and corresponding fertilizers. Yet, these are less proficient, so profound learning and AI calculations have been used to improve the pace of acknowledgment and precision. Various agents have involved AI enhancement for plant illness ID and grouping. SVM- support vector machine, nural networks, FCNN, CNN, fuzzy logic and RFO.

2 RELATED METHODS

Various learning methods classify plants disease detection and classification. They can also categorize the plant disease type based on rank and accuracy. RGB to Gray convention, histogram equalization, sensor calibration and segmentation are the various methods for identifying the crop disease. The nearest neighbours, DT- decision tree and GWO- Gray wolf optimization are the methods that can regulate crop monitoring. The below table 1.1 explains about various surveys of agriculture concerning IoT.

ARTICLE NO	SURVEY ARTICLE METHODOLOGY OF COMMUNICATION	TECHNIQUE	KEY POINTS
[1]	Detection and classification of plant leaf disease	Image acquisition	Image segmentation Leaf image Histogram equalization
[2]	Agriculture crop disease identification	Image processing	Threshold segmentation Image filtering
[3]	Crop disease using pattern recognition	K-mean clustering	Crop disease based on AI Gaussian filtering Machine learning
[4]	Unhealthy plant leaves detection	Image texture features	Discovery of harmful crop leaves detection Disease classification regression
[5]	Image processing technique on plant disease detection	Conventional methods	Image acquisition Segmentation Histogram equalization
[6]	Remote area plant Detection	Image training techniques	Plant health detection Fertilizers suggestion
[7]	Advanced crop maintenance system	Machine learning	Image processing techniques on prior stage of plants
[8]	Disease stage measurement	Geometrical tools	Leaf disease with image acquisition Segmentation mechanism
[9]	Disease prevention	RGB colour transformation	Spot detection discrete wavelet transformation
[10]	Image processing techniques with IoT	Leaf disease estimation	Region of interest disease detection classification
[11]	Morphological segmentation	Watershed transforms	Mathematical morphology segmentation Classification
[12]	IoT agriculture	Adaptive image segmentation	Genetic algorithm image segmentation Disease classification
[13]	Object and spot recognition	Adaptive integration	Image acquisition cyber IoT data
[14]	Colour image segmentation	Review of agriculture	Image segmentation RGB colour estimation
[15]	Disease prediction	Artificial neural networks	Mechanical characteristics of agriculture sensor analysis

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The multi genetic algorithms for agriculture disease predictions and soil water retention characteristics are analyzed by using computational image processing techniques [16]. An integrated genetic program-based agriculture disorders estimation based on artificial intelligence technique can be applied on various datasets [17]. Estimation of agriculture mechanical properties and its functionality is explained with artificial intelligence methods in [18]. Medical image processing and computational parameters are used to debug the agriculture IoT methods of various crop datasets [19 20]. The above all implemented methods have more limitations and along with necessary improvements also needed. So, we are moving to advanced machine learning based tomato leaf disease identification system using threshold segmentation. [21,22]

3. METHODOLOGY

In this technique mainly random forest optimization (RFO) is applied for the classification stage, threshold-based segmentation has implemented for the preprocessing stage. The whole work can be partitioned into two stages one for preparing stage and the subsequent one is the trying stage. In this work, a tomato crop leafs are collected from various databases which are discussed above. Selected tomato leaves are used to identify the disease and corresponding fertilizers, this work can help for formers, import and exports of agro products etc. The brief explanation of tomato plant disease detection and classification is explained clearly in the below sections.

a) Pre-processing

b) Classification

3.1 Pre-processing At preprocessing, stage selected database images are composed for segmentation and image acquisition. Various segmentation methods are available but those have limited number of applications. So, threshold based segmentation mechanism is selected for training the tomato leaf images.

Figure 2: Tomato leaf images.a) Leaf image 1, b) leaf image 2.

Figure 2 explains about tomato leaves which are collected from available datasets. These leaves are healthy, and no disease can be identified like various leafs are collected for an experiment to identify the disease

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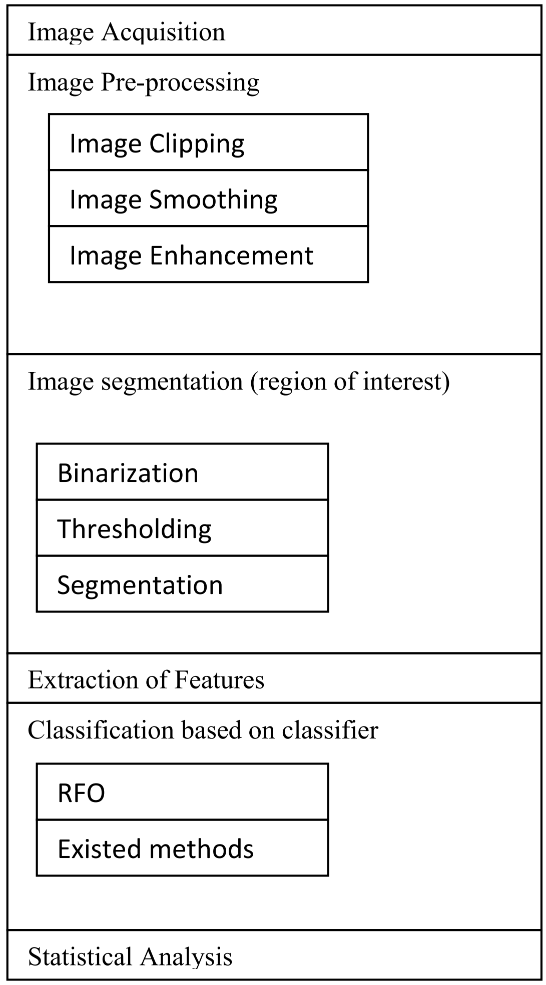

Figure.3 Main Block Diagram

i) Image clipping

ii) Image smoothening

iii) Image enhancement

In image clipping input images has been clipped with the assistance of PCA (Principle Component Analysis) by utilizing back projection lost pixels technique (BPLPT) with the assistance of this strategy can personality the spots in the leaves. It can verify the background of crop pre-harvesting images and removes the waste layers. The clipped images are variable in nature and individually locating the disease spot by using below function that is shown in equation1.

$$clip\_img = f(row{:}row50 - 1, col{:}col + 70 - 1) \text{ – (1)}$$

Because of this localization function, background pixels are lost, separate the main image. and background image. In the second step image smoothening has been performed with help of low pass filtering (LPF) by removing the spatial noise from selected crop image. This LPF usually adjusting the window operator, which can affect every pixel of the selected image at a time. The image varying nature and its characteristics values has been adjusted by particular function of a local region show in equation 2.

$$Kavj = low\_filter(f\ special(\text{‘}avj\text{’}, 4), J)/255 \text{ – (2)}$$

In the third step, picture upgrade has been performed by utilizing histogram equalization technique. In this, the sharpness of the image and mast correlation adjustment parameters are implemented using the below mathematical computations.

$$J = histeq(I, hgram)$$

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$$J = histeq(I, n)$$
$$[J, T] = histeq(I)$$
$$newmap = histeq(X, map)$$
$$newmap = histeq(X, map, hgram)$$
$$[newmap, T] = histeq(X, \_\_) \text{ ---- (3).}$$

The above all mathematical equations are train the selected tomato leaf and identify the particular disease clearly. But necessary improvements are needed this can possible by powerful segmentation mechanism.[23] In this scenario, threshold-based image segmentation has been implemented for accurate and efficient tomato plant leaf disease detection. The equation 4&5 are performed on tomato leaf image after the acquisition process. Because of segmentation clear effected area of disease is located the region of interest ROI can handle the infected diameter of the disease.

$$g(x, y) = \begin{cases} 1, & if\ f(x, y) > T \\ 0, & if\ f(x, y) \le T \end{cases} \text{ ----- (4)}$$

$$g(x, y) = \begin{cases} a, & if\ f(x, y) > T_2 \\ b, & if\ T_1 < f(x, y) \le T_2 \\ c, & if\ f(x, y) > T_1 \end{cases} \text{ -- (5)}$$

Here g(x,y) explains the threshold segmentation method. In this first threshold value has been fixed with the fallowing technique. In the threshold value calculation first image height and width has been fixed. E.g 256 X 256, in the second step RGB pixel values is to be fix by using get r();, get g();, getb(); these three commands gives the total number of red, green, blue number of pixel values, average the red, blue, green pixels after that mean of RGB(); gives the threshold value T. Using this threshold value differentiate the pixel tends to either may be a background or object.

Algorithm 1: Threshold Segmentation

Step 1 : Input Image
Step 2 : Image clipping
Step 3 : Image histogram
Step 4 : Image smoothening
Step 5 : Segmentation
Using the below formulas segmentation has been performed.

$T_{xy} = a\sigma_{xy} + bm_{xy}$

$T_{xy} = a\sigma_{xy} + bm_G$

$$g(x, y) = \begin{cases} 1, & if\ Q_{xy} \\ 0, & otherwise \end{cases}$$

$f(x, y) > T_{xy}$

$f(x, y) > a\sigma_{xy}$ AND $f(x, y) > bm_{xy}$.

3.2 Classification of Tomato Crop Disease

Tomato Crop images are selected from the database which is presented in Matlab 2015b local server. The selected harvest images related to various tomato leaf disease; every set consists of 15 samples; these are required for both training and testing. 75% of images are using for training the remaining 25% used for testing. The below block diagram figure 3 explains that pre-processing and classification of pre-crop harvesting disease recognition method. In the first step, crop images are selected after that pre-processing and classification has been performed again classification is divided into two steps that are prediction and description. The prediction process classifies the disease or regression has occurred. In the classifier with the help of logistic regression, support vector machine, k-nearest neighbour, naive Bayes methods are performed and at final proposed TSRFO compared with the existed method.

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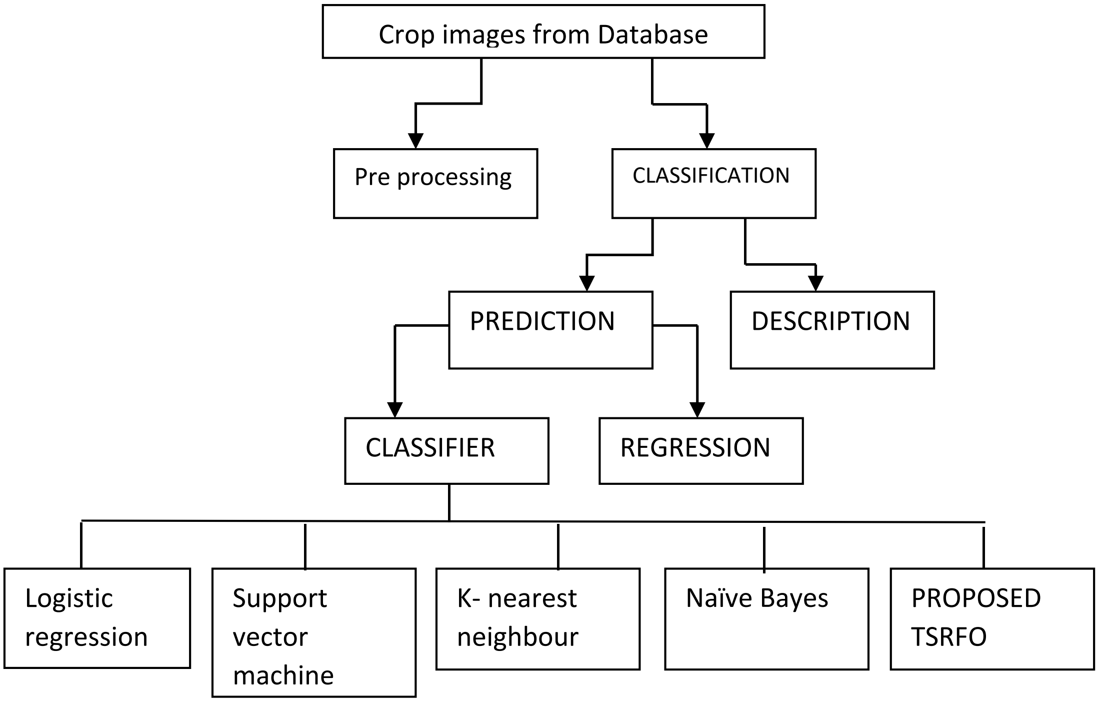

Figure 4: Pre-Processing And Classification Of Disease.

The final computational procedure can calculate the accuracy, overall accuracy average, type of diseases like bacterial leaf spot, leaf frogeye spot, sunburn disease, fungal disease and early scorch disease. According to disease nature fertilizers can apply on the infected leaf.The quality assessment parameters are MCC, accuracy, F1score, sensitivity and specificity are calculated for identify the efficiency of system.

Algorithm 2: RFO Random Forest Optimization

Step 1 : Input dataset
Step 2 : Set No. of Classes = N
No. of Features = M
Step 3 : Determine No. of features by nodes m
Step 4 : Decision Tree = m<M
Step 5 : Select decision tree by random manner
Step 6 : calculate the split data by using for loop .
Step 7 : end for
Step 8 : predicted output.
Using below formulas this RFO has been performed.

$$v_{TSRFO} = \arg\max \left[\sum_{-1\le F(v_i)\ge m} P(x_i, v_i)\right] \prod_{j=1,j\ne 1}^{n} P(x_j|x_i v_{ij})]$$

$$W_i = \frac{GainRatio(A_i)*m}{\sum_{i=1}^{m} GainRatio(A_i)}$$

$$W_i = \frac{1}{\sqrt{indexrank((A_i)+1}}$$

$$v_{DTWTSRFO} = \arg\max \left[\sum_{-1\le F(v_i)\ge m} P(x_i, v_i)\right] \prod_{j=1,j\ne 1}^{n} P(x_j|x_i v_{ij})]^{w_j}$$

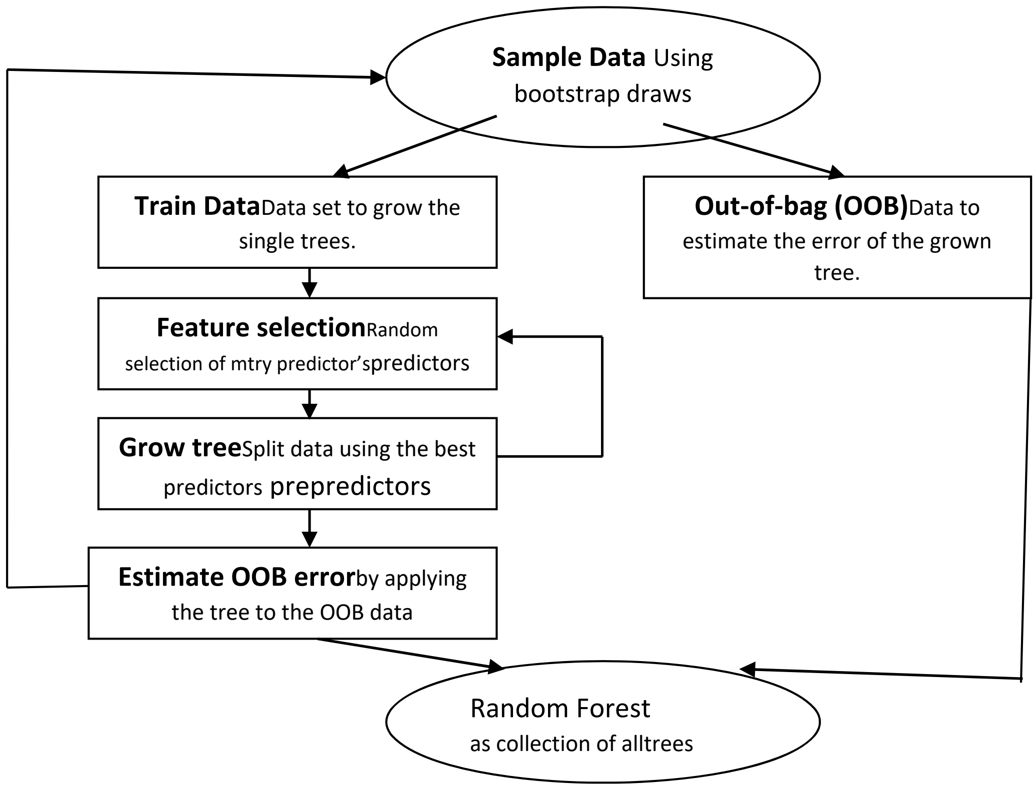

Figure 5: RFO optimization

All mathematical steps of RFO optimization have been performed by using shown in above figure 4. In this, each step calculates the train data weights, tree establishment and growth of trees information are calculated. At the final stage, estimate the disease of tomato leaf and the error probability, the classification of the disease is followed by below figure 5.[24]. with limited memory calculate aggregate value [25,26,27] are also used for improve the performance.

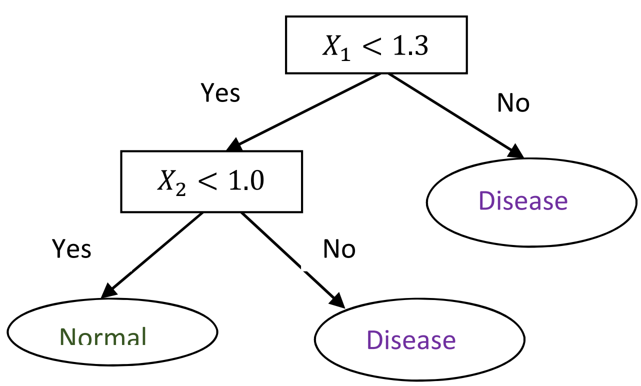

Figure 5: weight calibration for the disease.

Fig5 explains that normalization or disease classification graphical step based on weight form sensing RFO optimization method, which is discussed in the above section. Finally, parameters are calculated for quality assessment checking.

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3.4 QUALITY ASSESSMENT

MCC (Matthews correlation coefficient, True positive rate, true false rate PSNR, MSE, SSIM all parameters are to be analysed with the help of below mathematical approach.

$$\text{MCC} = \frac{TP\,.\,TN\ -\ FP\,.\,FN}{\sqrt{(TP+FP)\,.\,(TP+FN)\,.\,(TN+FP)\,.\,(TN+FN)}}$$

(MCC: worst value = -1; best value = +1)

$$F_1\ score = \frac{2.TP}{2.TP+FN+FP}$$

$(F_1\ score : worst\ value = 0; best\ value = 1)$

$$sensitivity = \frac{TP}{TP+FN}$$

$(sensitivity: worst\ value = 0; best\ value = 1)$

$$specificity = \frac{TN}{TN+FP}$$

$(specificity: worst\ value = 0; best\ value = 1)$

Above all equations are mainly used for calculating the performance estimation parameters, these are useful for comparing the designed application with existed methods

4. RESULTS

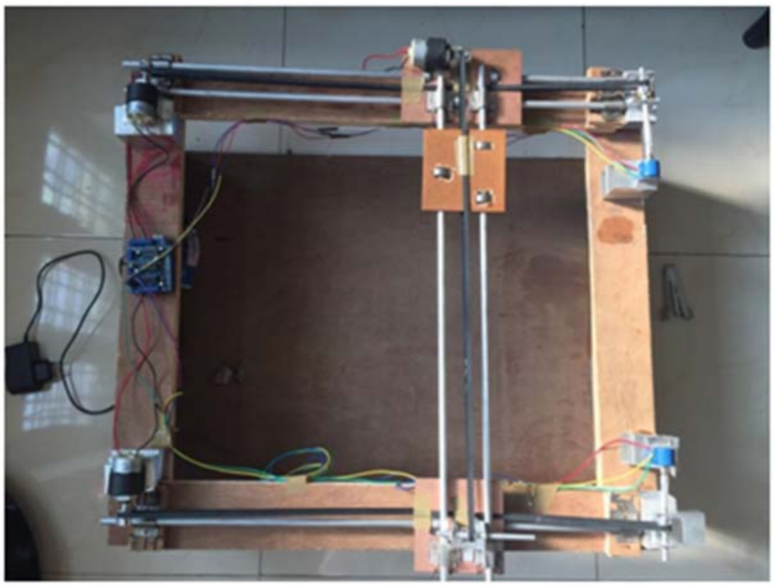

Figure 5b. Experimental Setup

Fig 5b explains about experimental setup of agriculture crop prior stage maintenance system; this can used to identify the tomato tree diseases with accurate manner.

Table:1 Type Of Tomato Disease

S No	Disease	Fertilizer
1	“bacterial _spot	2” min 10% chlorine bleach
2	early_blight	Backing soda and oil
3	late_blight	Fungicidal sprays
4	leaf_mold	Polestar Food waste
5	septoria_leaf_spot	Vermicomposite
6	spider_mites	Phytoseiulus persimilis
6	target_spot	Funtgicidal sprays
7	yellow_leaf_curl_virus”	Myro fertilizers

Table:1 explains about, different diseases observed at tomato leaves; these are listed for the type of disease and corresponding fertilizer identification purpose.

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Table 2: Accuracy Detection

Samples of Diseases	Number of images used for training	Number of images used for testing	Detection accuracy/%			
			MDC with K-Mean	MDC with algorithm	SVM with algorithm	Proposed TSRFO
bacterial _spot tomotao leaves	15.00	10.00	80.000	90.000	90.000	99.850
early_blight tomotao leaves	15.00	14.00	92.850	92.850	92.850	99.890
late_blight tomotao leaves	15.00	10.00	90.000	100.000	100.0	99.920
leaf_mold tomotao leaves	15.00	12.00	83.330	91.660	100.0	99.980
septoria_leaf_spot tomotao leaves	15.00	10.00	90.320	82.710	97.120	99.890
spider_mites tomotao leaves	15.00	12.00	88.450	87.320	98.7230	99.980
target_spot tomotao leaves	15.0	11.00	88.454	87.321	98.7233	99.981
Overall accuracy			86.540	93.630	95.710	99.980

Table 2 explains that different methods for calculating the accuracy and crop leaf disease recognition using MDC,SVM,TSRFO on various tomato plant leaves, this has been examined by using the sample images from the database.

Table 3. Disease finding and pesticide.

S No	Type of Tree	Disease	Results	Pest Type
1	**Tomato leaves data set_1**	bacterial _spot		2" min 10% chlorine bleach

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2	**Tomato leaves data set_1**	early_blight		Backing soda and oil
3	**Tomato leaves data set_1**	late_blight		Fungicidal sprays
4	**Tomato leaves data set_1**	leaf_mold		Polestar Food waste

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5	**Tomato leaves data set_1**	septoria_leaf_spot		Vermicomposite
6	**Tomato leaves data set_1**	spider_mites		Phytoseiulus persimilis
7	**Tomato leaves data set_1**	target_spot		Funtgicidal sprays

Table 3 explains that outcome that is obtained from the proposed TSRFO method and attains the disease recognition and corresponding pesticide. In this various sample, pre-harvesting images are selecting for input from database.

Table 4. Accuracy And Diseases

leaf disease	**bacterial _spot**	**bacterial _spot**	**bacterial _spot**	**bacterial _spot**	**bacterial _spot**	**bacterial _spot**	**Accuracy**
bacterial _spot	15	1	0	0	0	0	93
early_blight	2	11	0	0	0	1	97.8

late_blight	0	0	21	0	0	14	100
leaf_mold	0	0	0	21	0	60	100
septoria_leaf_spot,	0	0	0	0	19	90	100
spider_mites	2	0	11	1	0	12	98.64
Average							97.6

Table 4 explains that the average accuracy of some of the diseases, find with proposed methodology and obtain the accuracy is 97.6% which is better compared to conventional and modern models.

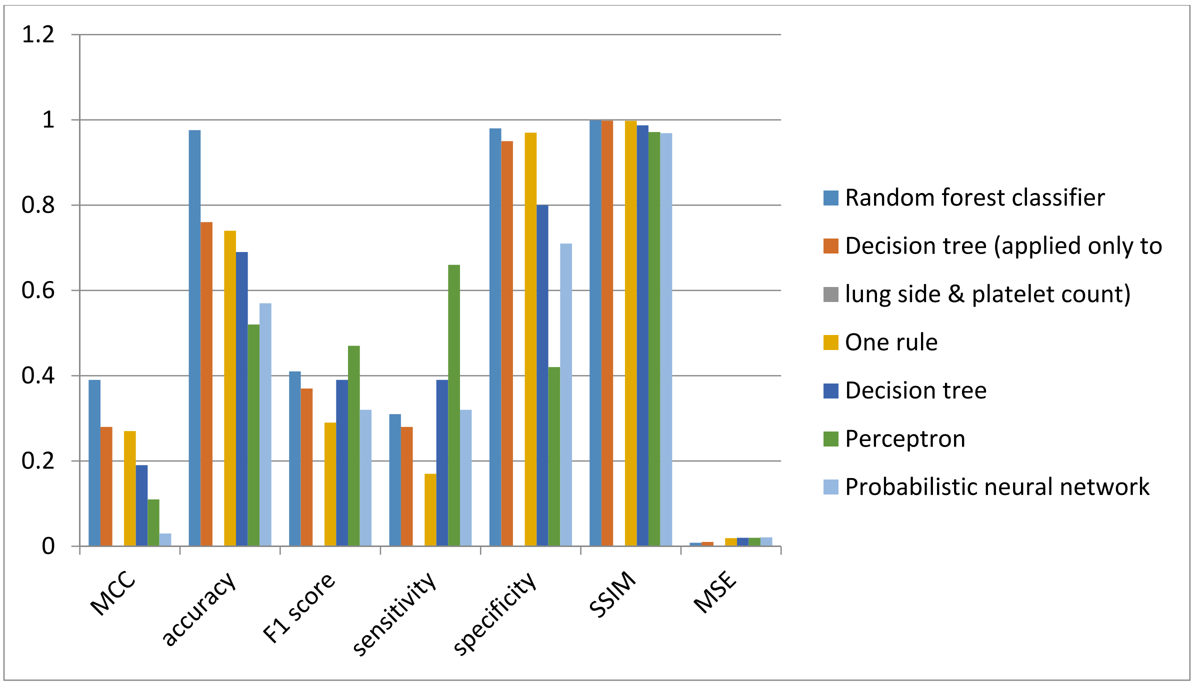

Figure:6. MCC, Accuracy, F1score Detection.

Fig 6 explains that various methods on selected tomato images; these are gain accuracy, True positive rate, MCC values. Here proposed method achieves the better improvement compared to existed methods.

Table 5 Quality Assessment Analysis

Method	MCC	accuracy	F_1 score	sensitivity	specificity	PSNR	SSIM	MSE
Proposed TSRFO	**+0.390**	0.976	0.410	0.310	0.980	59.82	0.9989	0.0081
Decision tree (applied only to lung side & platelet count)	**+0.280**	0.760	0.370	0.280	0.950	58.81	0.9981	0.0099

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Method	MCC	accuracy	F_1 score	sensitivity	specificity	PSNR	SSIM	MSE
One rule	**+0.270**	0.740	0.290	0.170	0.970	57.12	0.9978	0.0189
Decision tree	**+0.190**	0.690	0.390	0.390	0.800	50.54	0.9871	0.0198
Perceptron	**+0.11**	0.52	0.47	0.66	0.42	50.12	0.9714	0.0199
Probabilistic neural network	**+0.03**	0.57	0.32	0.32	0.71	49.98	0.9689	0.0210

Table 5 explains that quality assessment parameters in which MCC value is +0.390, accuracy 0.976, f1score 0.410, sensitivity 0.310, specificity 0.980 and PSNR 59.82, SSIM 0.9989, MSE 0.0081 has achieve which is much accurate compared to all existed methods.

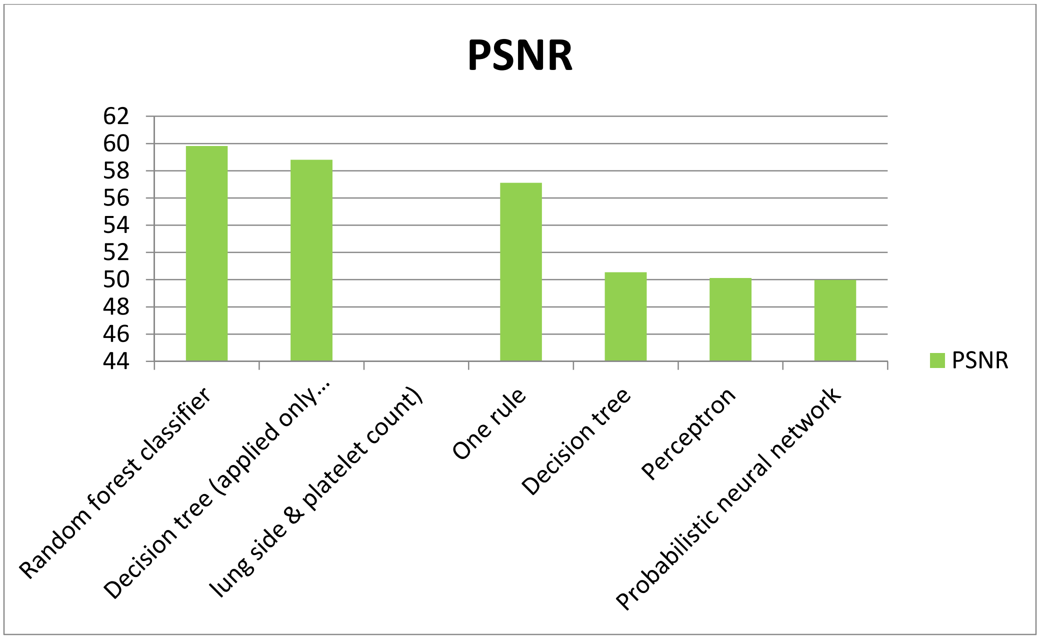

Figure 7 PSNR Analysis

Fig 7 explains that peak to signal noise ratio, which is 59.82 has been achieved compared to existed methods; this is a better achievement. Based on these quality parameters like image quality and IoT data acquisition are estimated.

Table 6 ML Accuracy Comparison

Various Machine learning models	Accuracy(percent)
Logistic regression	65.330
Support vector machine	40.330
k- nearest neighbour	66.760
CART	64.660
Random Forests	70.140
Naïve Bayes	57.610
Proposed method(TSRFO)	97.6

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Table 6 explains that various methods of accuracy comparison, in this many methods like logistic regression achieves 65%, SVM 40% KNN 67% and proposed TSRFO made 97.6% accuracy. Therefore implemented an application for agriculture prior stage crop harvesting method is more efficient and compete with adjusted methods.

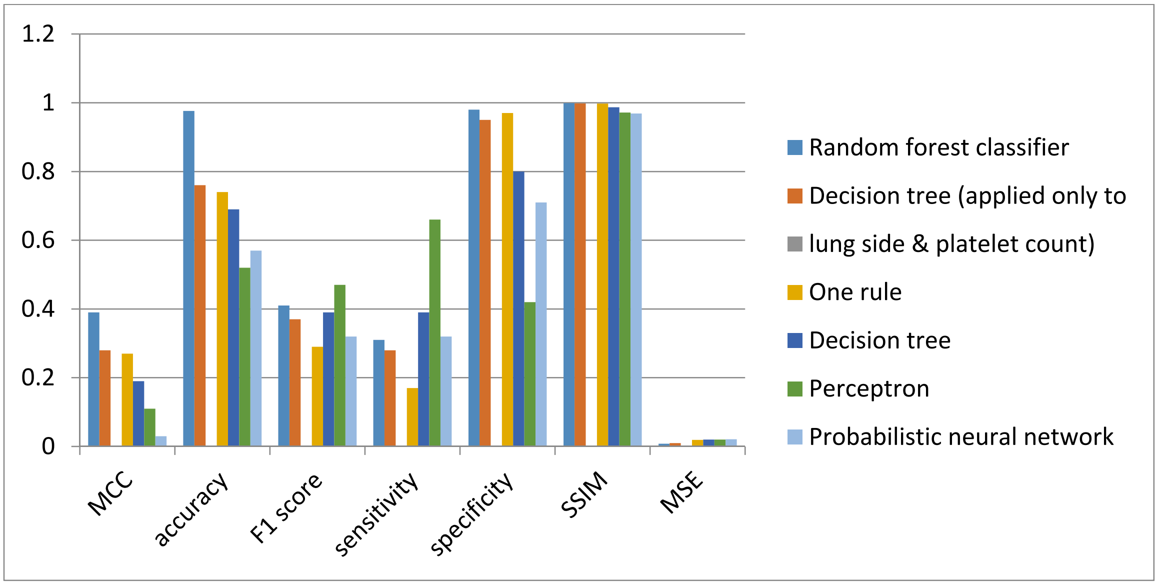

Figure 8 Parameter Assessment

Fig 8 explains that graphical representation of proposed Random forest classifier with threshold segmentation, this method is compared with conventional and modern methods conclude that TSRFO achieves good improvement at PSNR, MSE, SSIM, F1 score, etc.

5. CONCLUSION

In this work, a Tomato plant leaves prior stage disease prediction, and classification model is implemented. This application is beneficial for agriculture and healthy production. Conventional methods for tomato plant disease detection had achieved less accuracy, SSIM, MCC and F1 score. For any automatic application regarding IoT should improve the performance metrics. In this research TSRFO for tomato plant disease detection has attained more improvement and classify the disease at the prior stage. This work is very helpful for researchers who are deal with IoT and agriculture applications. The dataset which is obtained from crop science, yes modes, nelson. wisc databases. These are utilized to classify the tomato crop leaf disease with accurate manner. At final achieves the 97.6% accuracy 59.82 PSNR, 0.0081 MSE as improved, this method also competes with existed methods.

REFERENCES

[1] Savita N. Ghaiwat, Parul Arora. 'Detection and Classification of Plant Leaf Diseases Using Image processing Techniques: A Review'. International Journal of Recent Advances in Engineering & Technology. ISSN (Online): 2347 - 2812, Volume-2, Issue - 3, 2014. http://www.irdindia.in/journal_ijraet/pdf/vol2_iss3/1.pdf

[2] Prof. Sanjay B. Dhaygude, Mr.NitinP.Kumbhar. 'Agricultural plant Leaf Disease Detection Using Image Processing'. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. Vol. 2, Issue 1, January 2013. https://www.ijareeie.com/upload/january/5_Agricultural%20plant.pdf

[3] Mrunalini R. Badnakhe and Prashant R. Deshmukh. 'An Application of K-Means Clustering and Artificial Intelligence in Pattern Recognition for Crop Diseases'. International Conference on Advancements in Information Technology. 2011 IPCSIT vol.20 (2011). http://ijesta.com/upcomingissue/01.05.2016.pdf

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[4] S. Arivazhagan, R. NewlinShebiah, S. Ananthi, S. Vishnu Varthini. 'Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features'. AgricEngInt: CIGR Journal, 15(1): 211－217 2013. http://ijesc.org/upload/b638cdf37ffa00fd2c45dc0f07d6fb05.Plant%20Leaf%20and%20Disease%20Detection%20by%20Using%20HSV%20Features%20and%20SVM%20Classifier.pdf
[5] Anand.H.Kulkarni, AshwinPatil R. K. 'Applying image processing technique to detect plant diseases'. International Journal of Modern Engineering Research. Vol.2, Issue.5, Sep-Oct. 2012 pp-3661-3664. http://www.ijmer.com/papers/Vol2_Issue5/DN2536613664.pdf
[6] Sabah Bashir, Nav. deep Sharma. 'Remote Area Plant Disease Detection Using Image Processing'. IOSR Journal of Electronics and Communication Engineering. ISSN : 2278-2834 Volume 2, Issue 6 2012, PP 31-34. http://www.iosrjournals.org/iosr-jece/papers/vol2-issue6/H0263134.pdf?id=4462
[7] SmitaNaikwadi, NiketAmoda. 'Advances in Image Processing for Detection of Plant Diseases'. International Journal of Application or Innovation in Engineering & Management. Volume 2, Issue 11, November 2013.
[8] Sanjay B. Patil et al. 'Leaf Disease Severity Measurement using Image Processing'. International Journal of Engineering and Technology. Vol.3 (5), 2011, 297-301
[9] Piyush Chaudhary et al. 'Color Transform Based Approach for Disease Spot Detection on Plant Leaf'. International Journal of Computer Science and Telecommunications. Volume 3, Issue 6, June 2012
[10] Arti N. Rathod, BhaveshTanawal, Vatsal Shah. 'Image Processing Techniques for Detection of Leaf Disease. International Journal of Advanced Research in Computer Science and Software Engineering'. Volume 3, Issue 11, November 2013.
[11] S.Beucher, F.Meyer. 'The morphological approach to segmentation: The watershed transforms. Mathematical Morphology Image Processing', E. R. Dougherty, Ed. New York Marcel Dekker, 1993, vol. 12, pp. 433–481.
[12] B. Bhanu, S. Lee, J. Ming. 'Adaptive image segmentation using a genetic algorithm. In IEEE Transactions on Systems, Man and Cybernetics', volume 25, pages 1543–1567, Dec 1995.
[13] B. Bhanu, J. Peng. 'Adaptive integrated image segmentation and object recognition'. In IEEE Transactions on Systems, Man and Cybernetics, Part C. volume 30, pages 427–441, November 2000. https://ieeexplore.ieee.org/document/897070?section=abstract
[14] Keri Woods. 'Genetic Algorithms : Colour Image Segmentation Literature Review'. July 24, 2007. https://pdfs.semanticscholar.org/4478/cd7c6bf0dfc3cccb8320825861371d139b45.pdf
[15] VenkateshVijayaraghavan, AkhilGarg, Chee How Wong, Kang Tai1 and YogeshBhalerao. 'Predicting the mechanical characteristics of hydrogen functionalized graphene sheets using artificial neural network approach'. Journal of Nanostructure in Chemistry 2013, 3:83. https://link.springer.com/article/10.1186/2193-8865-3-83
[16] Kumar K.V.V., Kishore P.V.V. (2017),'Indian classical dance mudra classification using HOG features and SVM Classifier',International Journal of Electrical and Computer Engineering,7(5),PP.2537-2546.
[17] Rajyalakshmi.U. Koteswara Rao.S., Satya Prasad.K. (2017),' Supervised classification of breast cancer malignancy using integrated modified marker controlled watershed approach', Proceedings - 7th IEEE International Advanced Computing Conference, IACC 2017,(),PP.584-589.
[18] Sajana T., Narasingarao M.R. (2018),'Classification of imbalanced malaria disease using naïve bayesian algorithm',International Journal of Engineering and Technology(UAE),7(),PP. 786-790.
[19] Hasane Ahammad S.K., Rajesh V. (2018) , 'Image processing based segmentation techniques for spinal cord in MRI',Indian Journal of Public Health Research and Development, 9 (6),PP. 317- 323.
[20] Sridevi K., Ganesan T., Samrat B.V.S., Srihari S. (2019), 'Traffic analysis by using random forest algorithm considering social

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

media platforms', International Journal of Recent Technology and Engineering, 7(6), PP.620-625.

[21] Vamsidhar E., Rani P.J., Babu K.R. (2019), 'Plant disease identification and classification using image processing', International Journal of Engineering and Advanced Technology, 8(0), PP.442-446.355) Babu K.S., Vemuru S. (2019), 'Spectrum signals handoff in LTE cognitive radio networks using reinforcement learning', Traitement du Signal, 36(1), PP.119-125.

[22] Inthiyaz, Syed; Madhav, B. T. P.; Kishore, P. V. V., 'Flower image segmentation with PCA fused colored covariance and gabor texture features based level sets', AIN Shams Engineering Journal, 10.1016/j.asej.2017.12.007

[23] Venkatesh, C.; Bojja, Polaiah , 'A Novel Approach for Lung Lesion Segmentation Using Optimization Technique',9,2019, 4832-837, 10.29042/2019-4832-4837

[24] Ahammad, Sk Hasane; Rajesh, V.; Rahman, Md. Zia Ur,'Fast and Accurate Feature Extraction-Based Segmentation Framework for Spinal Cord Injury Severity Classification', 7,2019, 46092-46103, 10.1109/ACCESS.2019.2909583

[25] Ravi, P., Haritha, D. Computing iceberg queries on map reduce framework, "International Journal of Advanced Trends in Computer Science and Engineering", 2020, 9(5), pp. 8325-8329

[26] Ravi, P., Haritha, D. Average iceberg queries computation with state buckets counter, "SSRG International Journal of Engineering Trends and Technology", 2020, 68(8), pp. 53-57

[27] Ravi, P., Haritha, D. Efficient computation of min & max iceberg queries using value based property, "Journal of Engineering Science and Technology Review", 2019, 12(6), pp. 202-207.