iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34077

Plant Leaf Disease Detection using SVM

Riya Roy[1], Savitha K V[2], Prof. Leya Elizabeth Sunny[3]
[1, 2, 3]*Mar Athanasius College of Engineering, Kothamangalam*

Abstract: Agriculture and crop production play an important role in our everyday lives. The primary source of food and clothing is agriculture. Food and clothing are currently being lost due to contaminated crops that decrease production rates. There are a variety of diseases that affect the plant's leaves, fruits, and stem. Bacteria, fungi, viruses, and other microorganisms are the most common causes of plant disease. Diseases are often difficult to monitor, and observations made with the naked eye are unreliable in detecting them.If we can't detect the disease quickly, we won't be able to take the appropriate action. The quality and quantity of goods would improve if pesticides are used less in agriculture. The technique is now mostly used in image processing for the identification of plant diseases. The technology is used in this method for detecting and classifying leaf diseases using SVM classification. Image acquisition, image preprocessing, feature extraction, and classification are all steps in this technology. Banana, pepper, and rice were the three crops we used. A total of 400 leaf sample images were used. From there, 80% will be used for preparation and 20% for research. With an accuracy of 92.99 percent, this device can successfully diagnose and identify the disease.
Keywords: Image processing, SVM

I. INTRODUCTION

Agriculture production is extremely important to India's economy. In India, agriculture is the primary source of income for the majority of the population. Agriculture is a vital component in many economic sectors.The majority of plants in agricultural fields are infected with bacterial, fungal, and viral diseases. Agriculture is also affected by population growth and climatic changes. As a result, we must detect diseases at an early stage in order to protect the crops. Pesticide use will be reduced as a result of this. Farmers would profit from the earliest forecast by avoiding agricultural and financial losses. Human observation with the naked eye is unreliable. As a result, farmers need technical assistance. There are a variety of technologies available for detecting plant disease symptoms. Visible spectroscopy, remote sensing, light reflectance, and the thermograph technique are the instruments used. Digital image processing is the most widely used technique in a variety of fields, including medical imaging, industrial inspection, agricultural processing, and soil quality estimation, among others. We're going to use an image processing technique with a support vector machine in this case. Photo acquisition, image preprocessing, feature extraction, and classification are all techniques used in image processing. For classification, the help vector machine is used. We took 400 image samples, 80 percent of which were used for training and 20 percent for testing. We've chosen three different types of crops: banana, pepper, and rice. For each disease, each crop has 40 samples. Bacterial siga toka, Black wilt, Bacterial spot, Brown spot, Leaf smut, and other diseases affect these leaves.

II. RELATED WORKS

There are a variety of technologies that can be used to identify diseases. Image prediction approaches are also available in image processing. Kiran R. Gavhale and U. Gawande present an overview of their research on plant leaf disease identification using image processing techniques. Give a brief overview of the different image processing techniques. They go over spatial gray-level dependency matrices, back propagation neural networks, support vector machines, and K-nearest neighbour methods. These techniques are used to examine the leaves of both healthy and diseased plants. There are several drawbacks to these methods. The effect of background data on the resulting image, optimization of the technique for a particular plant leaf disease, and automation of the techniques for continuous automated monitoring of plant leaf diseases in real-world field conditions are all discussed. According to the study, the disease detection technique has strong potential for detecting plant leaf diseases.

K. Padmavathi and K.Thangadurai used RGB and grayscale images to detect disease in plant leaves. In the process of detecting leaf disease, this method has given comparative results of RGB and Gray scale photographs. Color becomes a key feature in identifying infected leaves and determining disease severity. They used the median filter for image enhancement and segmentation for extraction of the diseased section, which is used to determine the disease stage, on Grayscale and RGB images. The plant disease recognition model has been built based on leaf image classification and deep convolution networks. With the ability to distinguish healthy leaves from their surroundings, 13 different diseases have been reported. Each colour in the RGB model represents the three basic colour components Red, Green, and Blue. The RGB colour model uses an 8-bit monochrome standard to represent RGB colour images as red, green, and blue.

The RGB colour image has 24 bits per pixel, with 8 bits for each colour band (red, green and blue). The RGB colour represents a single pixel red, green, and blue value as a colour pixel vector and can be used to refer to an arrow or column as a vector (R, G, B).
Image Processing Techniques for Diagnosing Paddy Disease are being researched. Nunik Noviana Kurniawati, Siti Norul Huda Sheikh Abdullah, Salwani Abdullah, and Saad Abdullah from Universiti Kebangsaan Malaysia conducted a study to develop a prototype system to detect and identify paddy diseases such as Blast Disease (BD), Brown Spot Disease (BSD), and Narrow Brown Spot Disease (NBSD) using image processing techniques as an option or supplemental method. The disease detection component of this system uses a Haar-like feature and an AdaBoost (Adaptive Boosting) classifier to locate the diseased paddy plant. SIFT is used in the disease identification section. The distinctions of the aggregate of pixels of zones inside the rectangle, which can be at any position and scale inside the rectangle, can be described as a simple rectangular Haar like part. 2-rectangle highlight is the name given to this new set of capabilities. The value represents the characteristics of a specific area of the picture. The value represents the characteristics of a specific area of the picture..
A. Meunkaewjinda, P. Kumasawat, K. Attakitmong col, and A. Srikew on Grape Leaf Disease Detection from Colour Imagery using Hybrid Intelligent System by A. Meunkaewjinda, P. Kumasawat, K. Attakitmong col, and A. Srikew The most important agricultural exports in Thailand are vegetables and fruits. Product quality management is ultimately required in order to achieve more value-added products. This method uses various non-natural intelligent techniques to perform an automated plant infection analysis. Inspection of leaf features is primarily used to detect disease infection. When qualified, the system can analyse and diagnose plant leaf disease without requiring any expertise.The disease in the system was studied using grape leaf colour segmentation and grape leaf disease segmentation.
Y. Q. Xia, Y. Li, and C. Li developed an Android-based intelligent diagnosis system for wheat diseases. This study proposes a disease detection and classification system based on Android. Young farmers with smartphones would be able to photograph diseased plant leaves using the proposed method.. The picture will be sent to the server, which will perform the classification. The app will give the farmer some management tips for the detected disease based on the classification results. The disease that has been identified, as well as how to prevent it in the future. The app should also be able to be used without an internet connection, with the option to upgrade the system once one is created. Client-side and server-side operations make up the structure. The mobile application can not perform any inference due to the classification's high computational requirements. Dedicated servers can perform all machine learning operations separately. The client-side will be a JAVA-based Android mobile app. The user will be able to take pictures with their smartphone, upload pictures from their phone gallery, or take a live picture through the camera using the mobile app. The user interface must be user-friendly, with minimal navigation, and allow the user to complete the tasks with ease. The mobile app will also provide a library of popular diseases, allowing users to scan for and access information on disease management.

III. PROPOSED WORK

The device uses image processing to display the affected portion of the leaf. Only the type of disease that affects the leaf can be identified using the current method. Hear quickly explain about the experimental study of the technique. A total of 150 photographs of various plant diseases were collected as samples. For each disease, a different number of images were collected and labeled as database images and input images. The form and texture based features have been the image's primary attributes. The plant disease detection using a color-based segmentation model is shown in the sample screenshots.

1) *Plant Diseases:* Plant disease is a major factor in crop production that reduces the eminence and quantity of the plants. The classification and detection model is a popular approach in plant diseases. Engineering and IT fields are also interested in the classification and detection models.
2) *Bacterial Diseases:* Bacterial leaf spot is the common name for this bacterial disease. It begins as small yellow-green lesions on young leaves that are normally deformed and twisted, or as dark, water-soaked, greasy lesions on older foliage.
3) *Viral Diseases:* All viral diseases cause a reduction in yield, and virus- infected plants typically have a limited lifespan. The most common symptoms of virus-infected plants are on the leaves, but some viruses can affect the leaves, fruits, and roots as well. The study of viral disease is extremely difficult. Due to the virus, leaves appear wrinkled and twisted, and growth may be stunted.
4) *Fungal Diseases:* Contaminated crop, soil, yield, weeds, and wind and water may all be affected by fungal disease. It appears as water-soaked, grey-green spots on lower or more experienced clears in the beginning arrange.. After that, these spots fade away, and white fungal growth spreads over the undersides. A yellow to white streak appears on the upper surfaces of more seasoned clears in wool buildup. It causes the leaf surface to turn yellow as it spreads outward.

A. Proposed Methodology

The training method is the first step in the proposed plant disease detection system. A digital camera is used to capture images of the plants at this time. The images are then subjected to image preprocessing techniques. After preprocessing, useful image features are extracted using a feature extraction method, and the training samples for the support vector machine algorithm are used (the proposed machine learning algorithm in this system). The photos will be collected first in the detection process by recording them with a digital camera. Following that, the image processing methods discussed during the training phase will be used, and the case will be labelled as infected or safe using a support vector machine (SVM).

B. Image Processing Steps

Image acquisition, image preprocessing, feature extraction, and neural network-based classification are all steps in this system. It functions like this:

1) *Image Acquisition:* The first step is to gather data from a publicly accessible repository. The picture is used as the input for further processing. We've chosen the most common image domains so that we can accept any format as input to our method, including.bmp,.jpg, and.gif.
2) Image Preprocessing: Since the photographs were taken in the field, they can contain noise such as dust, spores, and water spots. The aim of data preprocessing is to reduce image noise so that pixel values can be adjusted. It improves the image's accuracy.
3) *Image Segmentation:* The third stage in our proposed method is image segmentation. Using the Otsu classifier and the k-mean clustering algorithm, the segmented images are clustered into different sectors. The RGB colour model is converted to the Lab colour model before clustering the files. The Lab colour model was created to make clustering segmented images easier.
4) *Feature Extraction:* The ability to gracefully predict the infected area relies heavily on feature extraction. The extraction of form and textural features takes place here. Area, Color axis length, eccentricity, solidity, and perimeter are all measured as shape-oriented features. Similarly, texture- oriented features such as contrast, correlation, energy, homogeneity, and mean are extracted. To assess the health of each plant, a leaf image is captured and processed. Following steps are used to calculate the colour features of an image

a) The RGB image is converted to HSV colour spaces for the first time.
b) An picture is uniformly subdivided into 3X3 blocks.
c) For each of the nine, the average colour (H/S/V).

C. Classification

To determine the type of leaf disease, a classification technique is used. Associating a given input pattern with one of the distinct classes is what classification is all about. A Linear Support Vector Machine (LSVM) is used to classify leaf diseases in the given framework. Despite the fact that Neural Networks are thought to be simpler to use than this, often unsatisfactory results are obtained. A classification task typically necessitates the use of training and testing data, all of which contain a variety of data instances. In the training set, each instance has one target value and many attributes.

SVM's aim is to create a model that predicts the target value of data instances in the testing set that are only given attributes. Supervised Learning is an example of classification in SVM. Known labels aid in determining whether or not the device is operating correctly. This data can be used to help the system learn to behave correctly by pointing to the desired answer and validating the system's accuracy. Identification of as which are intimately related to the recognised classes is a step in SVM classification. This is known as feature extraction or feature collection. Even when the prediction of unknown samples is not needed, feature selection and SVM classification can be used together. They can be used to find keysets that are active in the processes that differentiate the classes. SVM is a binary classifier that uses a decision boundary between two groups, which is a hyper plane. This hyper plane tries to divide the training vectors into two groups, one containing the target training vector (labelled as +1) and the other containing the training vectors (labelled as -1).

D. Performance Parameters

The accuracy and complexity of classification models are greatly influenced by support vector machine (SVM) parameters such as kernel parameters and the penalty parameter. In the past, various evolutionary optimization algorithms were employed for optimising SVMs. For optimising the parameters of SVMs with the goal of improving classification efficiency, there is a social ski driver (SSD) optimization algorithm that is inspired by different evolutionary optimization algorithms.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

The algorithm (SSD-SVM) was improved to deal with the problem of imbalanced data, which is one of the most difficult problems to solve when constructing robust classification models. The SSD-SVM algorithm's results are compared to grid search, a traditional method of searching parameter values, and particle swarm optimization for verification (PSO). The SSD-SVM algorithm is capable of finding near-optimal SVM parameter values, according to the results of the experiments. In comparison to the PSO algorithm, the results showed excellent classification accuracy.

IV. DESIGN

The aim of this project is to find a way for farmers to protect their plants from disease. There is a clear margin of distinction between classes when using the SVM classifier. SVM is more effective in high- dimensional spaces and uses a small amount of memory. The total percentage of the affected leaf and its surrounding area is examined in this study.

A. System Model

The system is divided into three modules: image preprocessing, training, and testing. The diagram depicts the overall layout of the various modules.

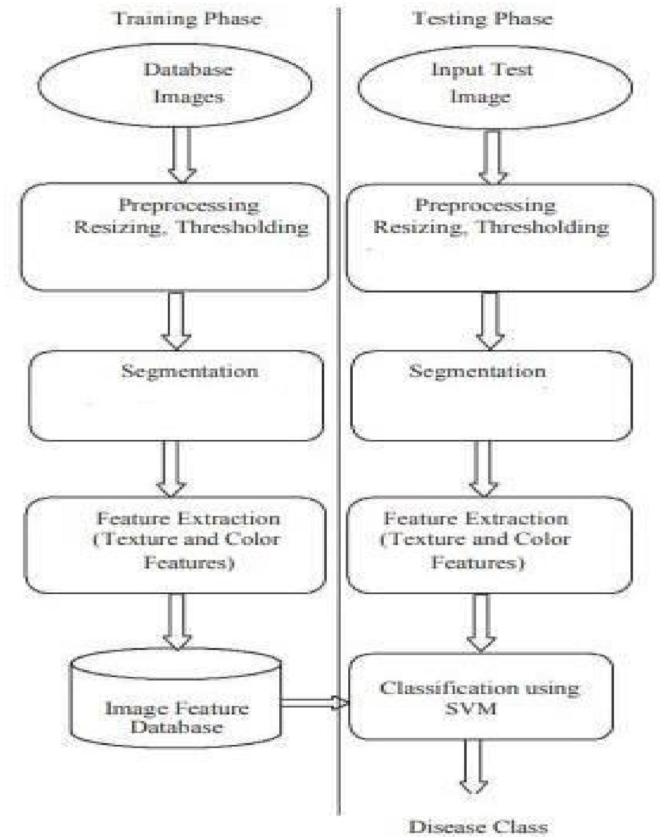


Figure 1: System Design

V. SOFTWARE DESCRIPTION

1) *Language:* Python
2) *OS:* Microsoft Windows 10 x64
3) *IDE:* Python IDLE

VI. HARDWARE DESCRIPTION

1) *Processor:* Intel Core i3
2) *Hard Disc:* 500 GB internal storage drive
3) *RAM:* 8 GB RAM

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

VII. IMPLEMENTATION

Using the SVM algorithm, the proposed method predicts plant diseases at an early stage. It would be particularly useful for identifying various crop diseases.

A. Dataset

The photos for this project were gathered from a variety of sources, including a field visit to Kerala Forest Research Institutes. Due to the difficulties of performing field visits as well as seasonal conditions, the researcher was forced to use images from websites, most of which were sent to a community of foreign universities.

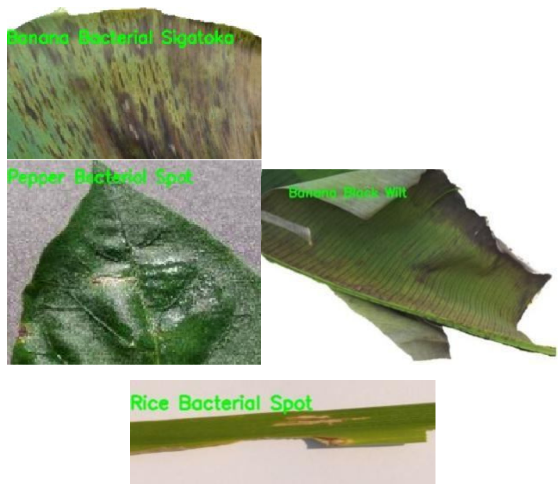


Figure 2: Type of Plant diseases

GUI

Figure 3: GUI of Plant Disease Detection

VIII. RESULT

There are two basic stages to identifying patterns using a machine learning approach. The classifier is trained using the training samples to extract the weights in the first step. The machine then uses the test samples to assess the system's accuracy. As a result, the overall sample set had to be split into training and research samples. We divided the total samples in this study into 80 percent preparation and 20 percent research. The total dataset (300 images) was split into 80 for training and 20 for testing the SVM classifier. To achieve the best performance, the following SVM settings were used. The Figure shows all of the SVM settings that were used. The same ratios were used in the diagnostic process to divide disease samples. Following the training, the classifier will test the accuracy of the method using 20% of the total samples based on the uncertainty matrix. Were 90.6.1% accurate in detecting disease cases and 77.4% accurate in detecting safe cases, with an average accuracy of 88.1 percent for the detection system. We can see a button in Figure that was used to pick the testing pictures. Select the button and enter one image of a leaf as an input. Then it can easily predict the plant disease and Rice.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

A. Disease Prediction

Banana, pepper, and rice are among the plants we chose. The picture goes through the training process after it is entered. Then we get the diseases that are predicted, as shown in the diagrams below.

1) Banana Leaf Diseases

Figure 4: Banana Back Wilt Disease

2) Pepper Leaf Disease

Figure 5: Pepper Bacterial Spot Disease

3) Rice Leaf Diseases

Figure 6: Rice Brown Spot Disease

B. The Predicted Class

This diagram depicts the disease's expected class. This is the exact outcome. This diagram depicts the path of an image being picked, loaded, extracted, and featured, and finally predicted..

Figure 7: Predicted Class

IX. PERFORMANCE EVALUATION

The proposed system's performance was assessed. Some parameters are defined based on them. The two algorithms KNN and SVM are compared here. The N cross-validation method was used to create both algorithms. And the accuracy, model build time, search time, and memory used are all factors in the performance analysis.

The time it takes to construct a model using supplied data is referred to as model build time. Or, to put it another way, the data model's training period.

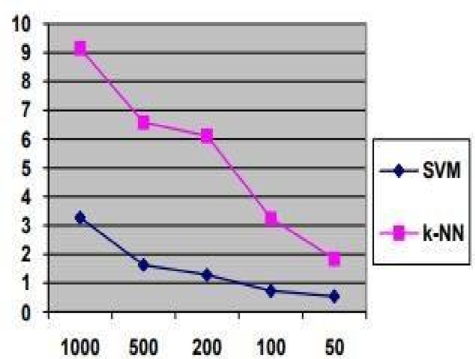


Figure 8: Time taken for both KNN and SVM

A. Search Time

It's the amount of time it takes to estimate values.

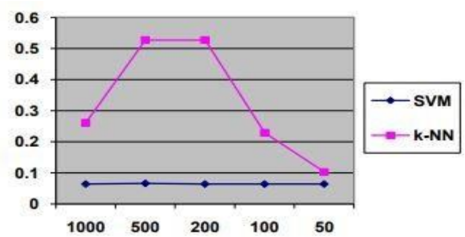


Figure 9: Search time is taken for both KNN and SVM

B. Memory Used

The memory used in this system is described as the amount of main memory that is needed for the system to function properly.

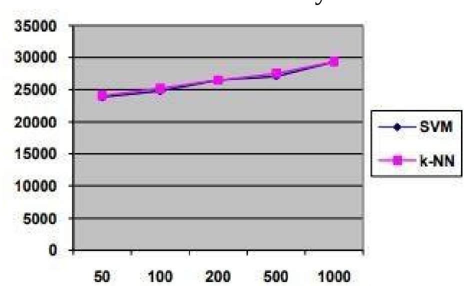


Figure 10: The memory used for both KNN and SVM

X. CONCLUSION

In the agriculture sector, data mining tools have been implemented. However, there are many drawbacks to using data mining technologies. As a result, this project incorporates a revolutionary concept to classify the affected crops and provide agricultural industry remediation steps. The contaminated area of the leaf is segmented and analysed using the machine learning SVM algorithm. The photos are fed into the technology, which allows diseases to be identified. It is an excellent option for the agricultural community, particularly in remote villages. It's a good system for reducing clustering time and the size of the infected region. For image preprocessing, this technology employs resizing and thresholding. After that, both texture and colour features are used to extract features from the image. The form of leaf disease is then detected using the SVM classification technique.

REFERENCES

[1] K. Padmavathi, and K. Thangadurai,"Implementation of RGB and Gray scale images in plant leaves disease detection – comparative study," Indian

[2] Dr.K.Thangadurai, K.Padmavathi, "Computer Vision image Enhancement For Plant Leaves Disease Detection", 2014 World Congress on Computing and Communication Technologies.

[3] Kiran R. Gavhale, and U. Gawande, "An Overview of the Research on Plant Leaves Disease detection using Image Processing Techniques," IOSR J. of Compu. Eng. (IOS- RJCE),vol. 16, PP 10-16, Jan. 2014.

[4] Y.Q. Xia, Y.Li, and C. Li, "Intelligent Diagnose System of Wheat Diseases Based on Android Phone," J. of Infor. Compu. Sci., vol. 12, pp. 6845-6852, Dec. 2015.

[5] Wenjiang Huang, Qingsong Guan, JuhuaLuo, Jingcheng Zhang, Jinling Zhao, Dong Liang, Linsheng Huang, and Dongyan Zhang, "New Optimized Spectral Indices for Identifying and Monitoring Winter Wheat Diseases", IEEE journal of selected topics in applied earth observation and remote sensing,Vol. 7, No. 6, June 2014

[6] Monica Jhuria, Ashwani Kumar, and RushikeshBorse, "Image Processing For Smart Farming: Detection Of Disease And Fruit Grading", Proceedings of the 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013)

[7] Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin MdShakaffRohaniBinti S Mohamed Farook, "Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques", 2012 Third International Conference on Intelligent Systems Modelling and Simulation.

[8] Mrunalini R. Badnakhe, Prashant R. Deshmukh, "Infected Leaf Analysis and Compar- ison by Otsu Threshold and k- Means Clustering", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 3, March 2012.

[9] H. Al-Hiary, S. Bani-Ahmad, M. Reyalat, M. Braik and Z. ALRahamneh, "Fast and Accurate Detection and Classification of Plant Diseases", International Journal of Com- puter Applications (0975 – 8887)Volume 17– No.1, March 2011

[10] Chunxia Zhang, Xiuqing Wang, Xudong Li, "Design of Monitoring and Control Plant Disease System Based on DSPFPGA", 2010 Second International Conference on Net- works Security, Wireless Communications and Trusted Computing.

[11] RajneetKaur , Miss. ManjeetKaur"A Brief Review on Plant DiseaseDetection using in Image Processing"IJCSMC, Vol. 6, Issue. 2, February 2017

[12] K. Elangovan , S. Nalini "Plant Disease Classification Using Image Segmentation and SVM Techniques" IJCIRV ISSN 0973-1873 Volume 13, Number 7 (2017)

[13] Sonal P Patel. Mr. Arun Kumar Dewangan "A Comparative Study on Various Plant Leaf Diseases Detection and Classification" (IJSRET), ISSN 2278 – 0882 Volume 6, Issue 3, March 2017

[14] R.Rajmohan, M.Pajany, Smart paddy crop disease identification and management us- ing deep convolution neural network svm classifier, International journal of pure and applied mathematics, vol 118, no 5, pp. 255-264, 2017.

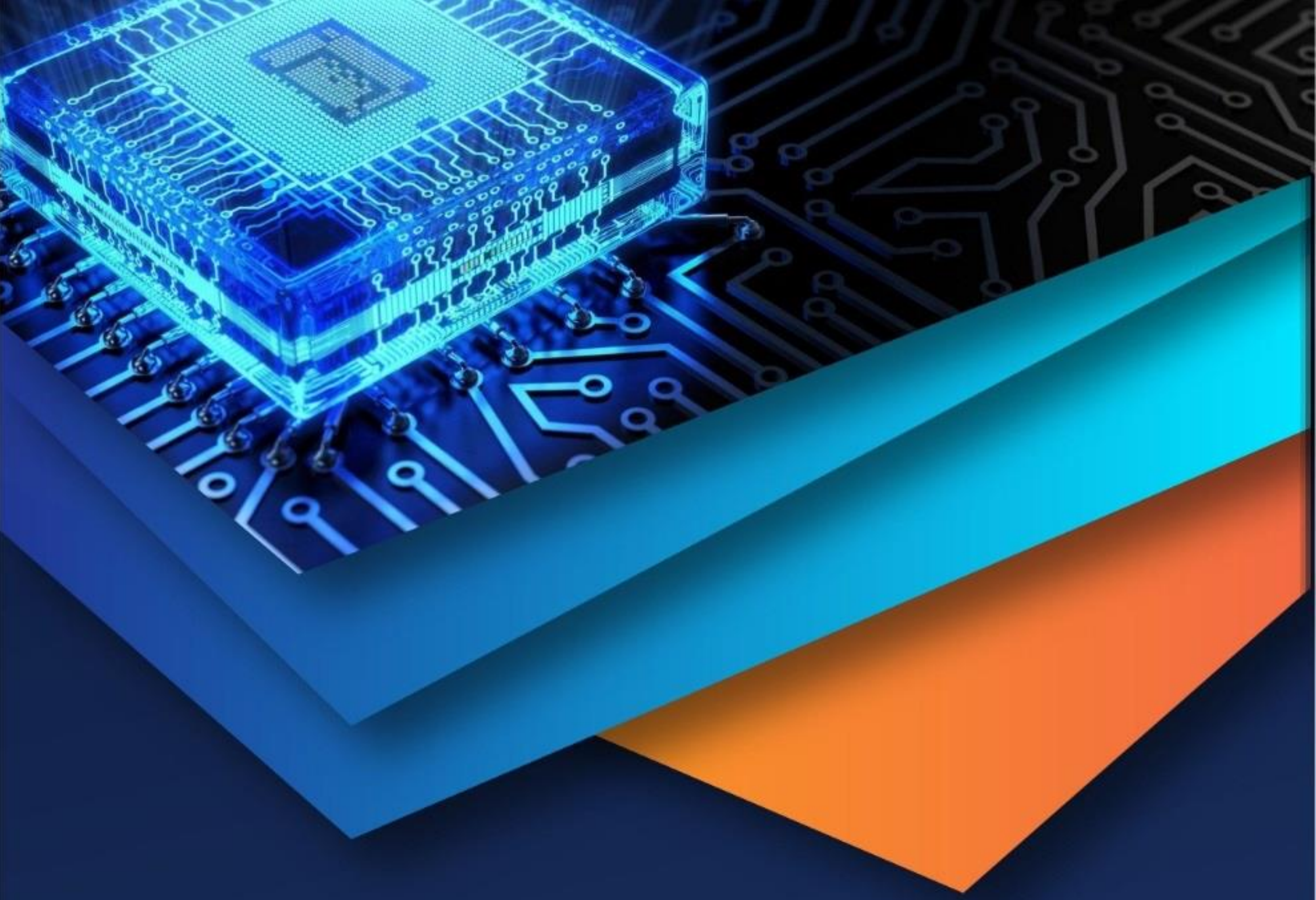
International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

AUTHORS PROFILE

Riya Roy received Bachelor of Technology degree and specialized in Computer Science and Engineering from Sree Narayana Gurukulam College of Engineering, Kadayiruppu, Kerala affiliated to Mahatma Gandhi University in 2018 and currently pursuing Master of Technology, specializing in Computer Science and Engineering from Mar Athanasius College of Engineering, Kothamangalam, affiliated to APJ Abdul Kalam Technological University. Her research interest is in Machine Learning and Internet of Things.

Savitha K V received Bachelor of Technology degree and specialized in Information technology from Govt.College of Engineering, Sreekrishna puram, Palakkad, Kerala affiliated to University of Calicut in 2017 and currently pursuing Master of Technology, specializing in Computer Science and Engineering from Mar Athanasius College of Engineering, Kothamangalam affiliated to APJ Abdul Kalam Technological University. Her research interest is in Machine Learning, Image processing, Big-data.

Prof. Leya Elizabeth Sunny is currently working as Assistant professor in the Department of Computer Science and Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India. She completed her BTech in Computer Science and Engineering in 2004 and MTech in Information Systems Security in 2011. She has published various journals in National and International journals and conferences. Her research interest includes Cryptography and Data security. She is a member of CSI.



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY