POMEGRANATE FRUIT DISEASEPREDICTION USING MACHINE LEARNING

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ABSTRACT : Pomegranate is a widely grown plant in India. This highly beneficial fruit is infected by multiple pests and diseases which cause great economical losses. Different forms of pathogen diseases on leaf, stem and the fruits are present. Some of the diseases that affect pomegranate fruits are anthracnose, heart rot and bacterial blight. There is a need for disease control strategies to incorporate timely action on the developed diseases. Thus, there is a need for intelligent and selflearning recognition systems to detect these diseases on time. This study is aiming to classify pomegranate fruits into two classes normal and abnormal using CNN LSTM technique. This research work uses a hybrid CNN LSTM technique to detect four types of diseases present in the pomegranate fruits and classify them into four classes. The results obtained using CNN LSTM are then optimized using dragonfly algorithm. The features like colour, texture and shape of the fruits are collected and fed into the hybrid CNN LSTM. The dataset for the classifier is given as an excel file which is initially pre-processed using map reduce technique and dimensionality reduction carried using Principal Component Analysis and Discriminant analysis. The CNN LSTM classifier identifies the 4 types of diseases and normal fruit. The classification is further optimized using dragonfly algorithm. The optimized weight and cost function has further explored to support the multi-class disease detection process. Experimental results have shown an accuracy of 92% in classification using CNN- LSTM technique and optimization using dragonfly techniques shows an improvedclassificationaccuracyof97.1%.

INTRODUCTION

One of the most common fruits grown in India is the pomegranate. As to the International Trade Centre, India leads the world in pomegranate production. Every year, around 5% of the fruits produced in our nation are exported. Although pomegranate exports bring in a significant amount of foreign cash for our nation, little study has been done on the categorization of pomegranate fruit quality. Because of this, it is crucial to precisely categorize the fruits into normal and aberrant postyield given marketing and export. External characteristics such as the fruit's color, lesions or black spots, weight, plant stand, and so on may readily reveal if the fruit is diseased. In India, addressing food needs, promoting economic growth, and reducing poverty all depend on the development of sustainable agriculture. India is the nation that produces the most pomegranates. Agriculture is negatively impacted by climate change, yet conventional methods such as planting, fertilizing, and harvesting according to a set timetable are still used. In order to address climate change and all of its negative impacts A

disease prediction system for pomegranate farms may help identify diseases early on, save losses, and boost output. SVM classifiers are used in this system to classify data using data mining techniques. Pomegranate crop losses as a result of pests and illnesses are common in semi-arid regions. Pomegranate illnesses including bacterial blight, thrips, fruit borer, and wilt are seen to be strong assaults that cause financial loss and compel growers to use pesticides repeatedly. The environment in which agriculture operates is dynamic and ever-changing. Some of the new issues facing the agricultural industry right now include groundwater depletion, soil erosion, the threat of new pests and illnesses, land fragmentation, rural-urban migration, and the availability of electricity supplies for farms.We have a suggested mechanism called an agro advisory to address these problems. The advice section of the document gives farmers advice on water irrigation, managing nutrients, and timing pesticide and disease spray applications correctly. Several research have been conducted utilizing Convolutional Neural Networks to identify illnesses in fruits. Below are some examples of work pertaining to CNN application.This section examines the several methods now in use for identifying fruit diseases and gives a quick summary of important studies that have been done to better identify fruit diseases and increase the effectiveness of fruit disease identification procedures. To far, there have been few studies or research projects using machine learning approaches for the identification of pomegranate illness.Manish Bhange and Hingoli Wala categorize the pomegranate fruits [4] as infected or uninfected using an SVM classifier.On the pomegranate photos, characteristics such local binary patterns, coherence, and color histogram were used. After that, k-mean clustering algorithms were used to the retrieved characteristics, successfully classifying the identified sick apples. The system was unable to manage the identification of several illnesses. Their accuracy rate was 82%. Pooja Kantale and Shubada Thakare use the Ada-boost Ensemble classifier in another study to classify pomegranate diseases.Three diseases—bacterial blight, anthracnose, and anthracnose fruit rot—have been recognized and categorized by the researchers.14.15 seconds is the processing time that the Ada-Boost classifier requires for training. Ada-boost classifier yielded 92.9% classification accuracy, 90.6% sensitivity, and 89.83% f-score. Three pomegranate fruit diseases, including cercospora, bacterial blight, and pomegranate borers, are identified using image processing methods in a different study by Shaath D M [6] and colleagues. It provides an 85% detection accuracy.Mrunmayee Dhakate and Ingole A. B.[7] attempt to identify problems in pomegranates with the use of artificial neural networks, and in this study, feature extraction is carried out using the GLCM approach.The total accuracy of the ANN classification using the Back Propagation technique is 90%.It is possible to diagnose pomegranate illness early using machine learning and the Internet of Things, according to Prof. Sona Pawara, Dnyanesh Nawale[8], Kunal Patil, and Rakesh Mahajan. They have also proposed a practical model for this purpose.

The pomegranate is one of the most profitable fruits on the market and grows with an exceptionally high yield in several Asian countries. Unfortunately, a number of factors lead to the plants being afflicted with many diseases, which decimate the whole crop and drastically reduce product production. Therefore, the paper suggests a neural network strategy and image technique to address the most pressing phytopathology issues, such as wellness categorization and detection. The fact that diseases brought on by plants and weather may also be ascribed to pomegranate fruit. These illnesses include leaf spot, plant spots, seed site rot, and blight microorganisms. others images are used by the system for coaching, others for function testing, and so on.The horticulture industry has seen a number of developments in recent years that have made it a reliable source of revenue for Generation Age. Fruit varieties are exported worldwide as cold storage and transportation infrastructure expands.

Maintaining the necessary level of export quality is crucial, and it is mostly done via exports' visual inspection This takes a lot of time and money because of where the farms are located. Thanks to advancements in technology and exposure to a variety of sectors, precision agriculture enables farmers to manage technology and empower themselves with affordable and adequate information. The reduction of environmental harm, systematization of agricultural inputs, and increase in revenues are the goals. The deciduous pomegranate tree, Punica granatum, is found in dry and semiarid climates. It thrives in regions with 25–35 degree temps and 500–800 mm of yearly rainfall. Diseases have caused significant losses in pomegranate production in recent years. Typically, bacteria, viruses, and fungus are the microorganisms responsible for these disorders. Fruit rot, leaf spot, bacterial blight, and fruit spot are the main illnesses. Orchards are destroyed by these very serious diseases. Fruit sales do actually fall within the high-risk category.For fruit disease prevention and control, an intelligent decision support system makes use of both cutting-edge and useful technologies to accurately identify and diagnose fruit illnesses. The foundation of each nation's agricultural growth is its fruit horticulture. Fruit quality is determined by two factors: weight and nutritional content, and disease detection .

In India, developing a healthy agricultural sector is essential to reducing poverty, boosting the economy, and meeting food needs. India is the nation that produces the most pomegranates. Agriculture is negatively impacted by climate change, yet conventional methods such as planting, fertilizing, and harvesting according to a set timetable are still used. A disease prediction system for pomegranate farms can help detect diseases early on, save losses, and boost output in response to climate change and its many negative consequences. SVM classifiers are used in this system to classify data using data mining techniques. 2. The creation of literature surveys is not met in order to minimize the use of chemical therapies.[2] 2.3. Classification-Based Data Mining Techniques for Crop Disease Prediction To forecast the grass grub damage in this system, a thorough investigation of several data mining classifiers is conducted on various feature sets. In order to increase the accuracy of weak classifiers, new ensemble models are also created by merging several classifiers.[3] 2.4. Using Weather Parameters to Forecast Disease in Grapes using Neural Networks By leveraging the information obtained on the weather prediction and disease forecast and instantly communicating it to the farmers via ICT, this method may significantly improve crop and environmental protection.[4] 2.5. Using Wireless Sensor Networks for Agriculture Field Monitoring and Analysis to Enhance Crop Production The general architecture of the WSN system and its data is outlined in this document. The designs of the subsystems and modules make perfect sense for farming productivity and are incorporated to protect agricultural land from weather-related impacts, pests, and other hazards.[5] 3. GUIDE TO ARCHITECTURE 2.1. A Pomegranate Field Agro-Advisory Utilizing a Wireless Sensor Network Based on current environmental circumstances, a wireless sensor network-based agro-advisory system for pomegranate fields is presented. The disorders are addressed in accordance with the identification of climate changes. Farmers are advised to use insecticides, fertilizers for crops, and water as efficiently as possible.[1] 2.2 A data mining approach to identify fruit diseases early.

LITERATURE SURVEY

A deep model based on deep features retrieved using CNN and LSTM network is suggested in the present research. The completely linked layers are used to extract the deep features. The LSTM layer receives the retrieved deep features as input. Following the LSTM layer, pictures are sorted into normal and abnormal

categories using fully connected, softmax, and classification layers, which are denoted by the class labels 0 and 1, respectively. Before changing the deep network parameters in the present investigation, we retrieved deep features from samples.Numerous studies on the use of deep learning to identify plant or fruit diseases have shown that the CNN technique yields accurate findings that are useful.This research presents the classification accuracy of pomegranates into two classes: normal and pathological, using machine-based models. Fruits that are disease-free are referred to as abnormal, and healthy fruits as normal. The key characteristics of fruits that rapidly demonstrate their quality are observed in order to gather data, which is then documented. Numerous parameters, including the fruit's weight, amount of spots, form, plant stand, and defoliation of the tree, are related to the prediction of disease in fruit. A classifier model that was trained on training data predicts the class label of fresh testing data, which is how pomegranate fruits are classified. The peculiarity of our work is that, while the feature extraction operation is carried out using CNN as in other studies, the LSTM model is coupled with CNN to identify fruits, significantly increasing the classification accuracy. M. Kavitha, G. Hemalatha, and Vishalakshi.

In order to identify illnesses in pomegranate fruits, this research investigates the use of machine learning methods including Support Vector Machine (SVM) and k-Nearest Neighbors (k-NN). In order to extract characteristics from photos of healthy and sick fruits and feed them into classifiers for disease diagnosis, the authors use image processing methods. P. D. Lokhande and S. Dhumal. The primary goal of this study is to employ machine learning algorithms to identify illnesses in pomegranate fruit. In order to identify diseases based on color and texture information taken from photos, it uses methods like Principal Component Analysis (PCA) for feature extraction and Random Forest and Naive Bayes classification algorithms.The significance of the alpha asymmetry and the ability of various frequency bands to identify depression were also investigated by a large number of other studies. Prakash, H. P. Nagendra, and K. V. Arya are the authors of Liao et al. The authors suggest using image processing and feature extraction approaches to pomegranate fruit disorders in order to classify them using machine learning. They test several classifiers, such as Decision Trees, SVM, and Neural Networks, to precisely categorize illnesses according to characteristics like color, texture, and form. K. K. Sud, P. S. Bhatia, and R. Yadav.This research looks at the autonomous illness detection of pomegranate fruits using machine learning methods such as Convolutional Neural Networks (CNN). The authors get promising results in illness classification by directly learning discriminative features from raw picture data via the use of deep learning architectures.A CNN model was developed by Li et al. [5] using a spectrogram as input to the network. Their goal was to identify minor depression in clinical practice, therefore they used CNN to create a CAD system. Their categorization system took into account 128 channels of EEG data. Additionally, the research classified the EEG data using both unique and temporal information. But 128 electrodes need a lot of implantation time, and not many clinics can afford such an expensive device. The network's performance has room to be improved. written by M. Vatsa, S. S. Gorsi, and A. Garg. The scientists suggest using machine learning techniques to create an automated method for identifying illnesses in pomegranate fruits. They extract features from photos using a variety of image processing approaches, and then they evaluate how well classifiers such as Random Forest, k-NN, and SVM do in correctly diagnosing illnesses in images. written by K. S. Santhi, S. P. Deepa, and M. N. Kalpana.

This study investigates the use of image processing and machine learning methods for pomegranate fruit disease diagnosis. The authors use classifiers like Decision Trees and SVM for illness classification based on derived

features, and techniques like Histogram of Oriented Gradients (HOG) for feature extraction.written by M. Jindal, S. Jain, and P. Gupta.Although not particularly centered on pomegranates, this study offers valuable insights into the wider field of machine learning-based fruit disease diagnosis. It covers a range of methods, difficulties, and potential applications for machine learning in fruit disease detection, which might be quite insightful for pomegranate fruit disease detection study.written by A. Kumar, S. Thakur, and A. Verma.This research employs machine learning algorithms to identify and categorize illnesses that harm pomegranate fruits. To precisely diagnose illnesses from photos, the authors use methods like Artificial Neural Networks (ANN) for classification and Wavelet Transform for feature extraction.

1 SYSTEM ARCHITECTURE

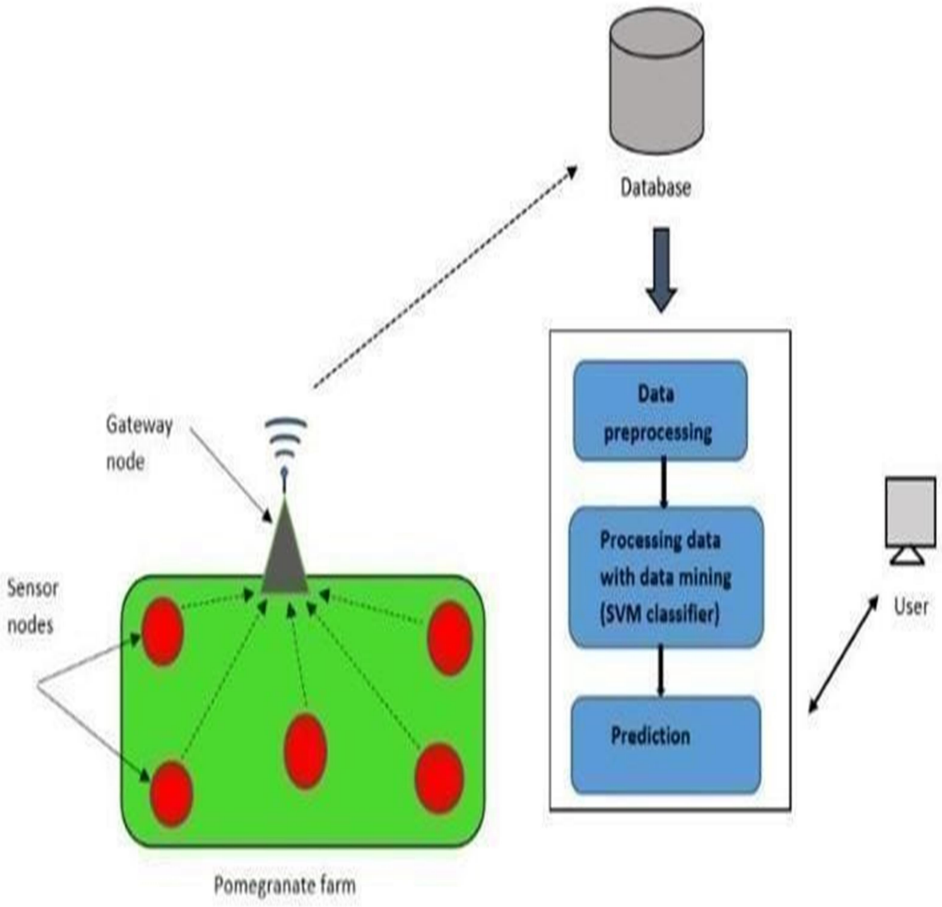

Fig.1 System architecture

The proposed CNN, DeprNet, consists of five convolutional layers, five batch normalization layers, five max-pooling layers, and three fully connected layers. The last fully connected layer uses SoftMax activation function, while all other layers use leaky rectified linear unit (LeakyReLU) activation function. The details of parameters and filters are reported in Table Even though the input data are 2-D, the network performs a 1-D

convolution operation. The 1-D convolution is applied on the time dimension, i.e., y-axis, and it ensures that the information associated with the spatial dimension, i.e., x-axis, remains as it is.

PROJECT IMPLEMENTATION PLAN

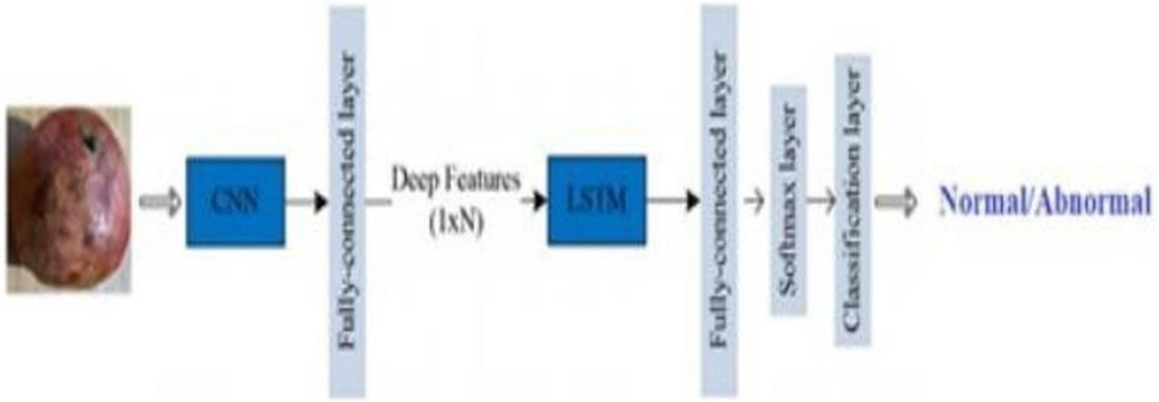

Fig.2 Project Implementation Plan

ALGORITMS USED FOR PROPOSED MODEL

Using a Convolutional Neural Network (CNN) for pomegranate fruit disease prediction involves several steps:

1. Data Collection: Gather a dataset of images of pomegranate fruits, with labels indicating whether they are healthy or diseased, and if diseased, which disease is present.
2. Data Preprocessing: Resize the images to a consistent size, normalize pixel values, and augment the dataset with techniques like rotation, flipping, and zooming to increase variability and improve model generalization.
3. Model Architecture Design: Design a CNN architecture suitable for image classification tasks. This typically involves alternating convolutional layers with activation functions like ReLU, followed by pooling layers to reduce spatial dimensions, and finally fully connected layers to perform classification.
4. Training: Split the dataset into training, validation, and test sets. Train the CNN model on the training data, using techniques like gradient descent and backpropagation to optimize the model parameters based on a chosen loss function.
5. Hyperparameter Tuning: Experiment with different hyperparameters such as learning rate, batch size, and architecture parameters to optimize model performance on the validation set.
6. Evaluation: Evaluate the trained model on the test set to assess its performance in terms of metrics like accuracy, precision, recall, and F1-score.
7. Deployment: Once satisfied with the model's performance, deploy it for real-world use, potentially integrating it into a software application or system for automated disease detection in pomegranate fruits.

RESULTS AND DISCUSSION

a) Output screens:

Home page is the main web page of a website. It may also refer to the start page shown in a web browser when the application first opens.

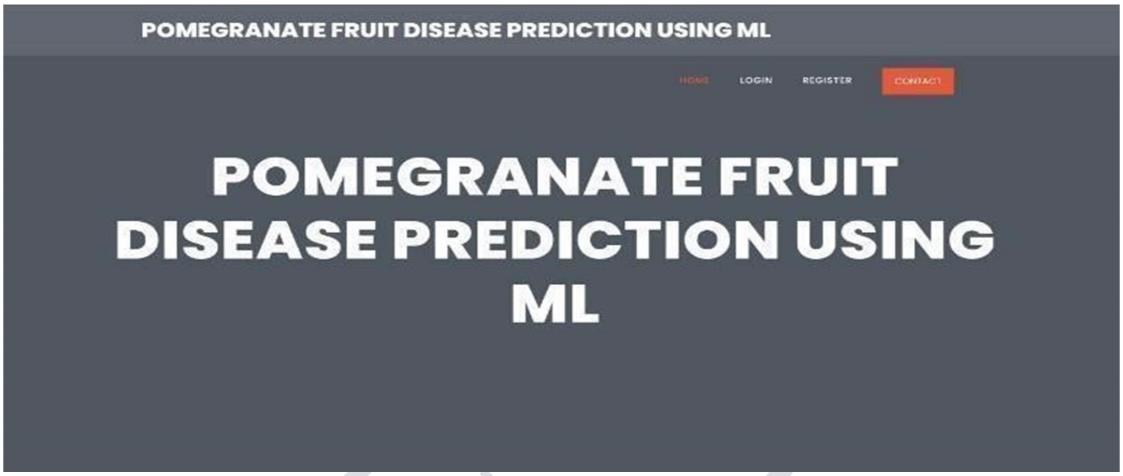

Fig 3: Home page

Select the Input image from dataset. Drag and drop to uploadthe dataset we click the button named Upload. The dataset isuploaded successfully.

Fig 4: Select The Input Image

When the dataset is uploaded successfully, we view images and track then go to click to predict. It verifies the Pictures &predict the diseases.

Fig 5: Predict disease

After predict the disease. It will display the result whichdisease is predicte

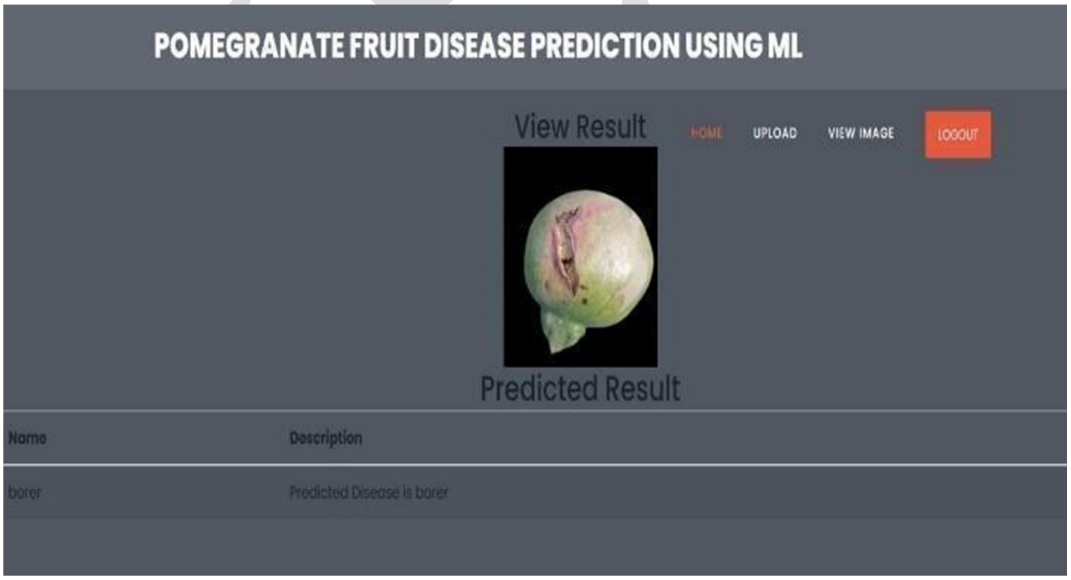

Fig 6: Predicted Result

Unhealthy Pomegranate fruit

Healthy Pomegranate fruit

8. CONCLUSION

Promising outcomes have been seen in the use of machine learning, namely the CNN algorithm, for pomegranate and pomegranate fruit disease detection in conjunction with a Flask web application. The system's main objectives are to identify three diseases—bacterial blight, cercosporin, and borer—and categorize fruits that are healthy. The CNN method is used by the model to extract relevant information from photos of pomegranates and pomegranate fruit, which enables it to discriminate between fruits that are healthy and those that are afflicted with certain illnesses. Because CNNs can recognize hierarchical patterns and spatial connections in the data, they are very useful for picture classification applications. The illness detection system may be accessed with ease thanks to the Flask web application's user-friendly interface. Users may submit pictures of pomegranates and their fruits, and they will instantly get back information on whether the fruits are healthy or if they are impacted by any of the listed illnesses. Comparing this strategy to more conventional manual categorization techniques reveals a number of benefits. It increases overall efficiency, saves time, and lowers work intensity. Furthermore, productivity is maintained since automating the process reduces the possibility of incorrect categorization and aids in halting the transmission of illness to healthy crops. Ongoing data collection and augmentation may be carried out to expand the variety and amount of the dataset in order to further improve the system. This would enhance the model's capacity for accurate fruit classification and generalization. Furthermore, as necessary, the system's routine upgrades and maintenance may add new illnesses for detection or integrate new disease patterns. In general, farmers and other agricultural stakeholders may benefit greatly from the combination of machine learning—more especially, the CNN algorithm—with a Flask web application for pomegranate and pomegranate fruit disease detection. In the end, it helps to enhance crop output and quality by streamlining the categorization process and preventing disease.

REFERENCE

[1] Kaur R, Kaushal S. Antimicrobial and antioxidant potential of pomegranate (Punica granatum L.) peel. International Journal of Chemical Studies . 2018;3441(3449).

[2] Prajwal TM, Pranathi A, Sai Ashritha K, Chittaragi NB, Koolagudi SG. Tomato Leaf Disease Detection Using Convolutional Neural Networks. In: and others, editor. 2018 Eleventh International Conference on Contemporary Computing (IC3). Noida. 2018;p. 1–5. doi:10.1109/IC3.2018.8530532.

[3] Militante SV, Gerardo BD. Detecting Sugarcane Diseases through Adaptive Deep Learning Models of Convolutional Neural Network. In: and others, editor. 2019 IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS). 2019;p. 1–5. doi:10.1109/ICETAS48360.2019.9117332.

[4] MRaikar. M. ChaitraKuchanur, M. ShantalaGirraddi, M. PratikshaBenagi. Classification and Grading of Okra-ladies finger using Deep Learning. Procedia

[5] Dhakate, Mrunmayee, & A. B. Ingole. "Diagnosis of pomegranate plant diseases using neural network." 2015 fifth national conference on computer vision, pattern recognition, image processing and graphics (NCVPRIPG). IEEE, 2015.

[6] Deshpande, Tejal, Sharmila Sengupta, & K. S. Raghuvanshi. "Grading & identifying of diseases in pomegranates leaves and fruit." International Journal of Computer Science and Information Technologies 5.3 (2014): 4638-4645.

[7] Pawara, Sona, et al. "Early detection of pomegranate disease using machine learning and internet of things." 2018 3rd International Conference for Convergence in Technology (I2CT). IEEE, 2018.

[8] Patil, Jayashri. "Pomegranate Fruits diseases detecting utilizing Image Processing Techniques: a review." Information Technology in Industry 9.2 (2021): 115-120.

[9] More, Sunil, & Mininath Nighot."An agro advisory to pomegranate fields utilizing wireless sensoring networks." 2016 International Conferences on the Automatic Control and Dynamic Optimizing Techniques(ICACDOT). IEEE, 2016.

[10] Bhange, Manisha, & H. A. Hingoliwala. "Smart Farming: Pomegranates diseases detecting utilizing Image Processing." Procedia computer science 58 (2015): 280-288.

[11] Deshpande, Tejal, Sharmila Sengupta, & K. S. Raghuvanshi. "Grading & identification of diseases in pomegranates leaves & fruits" International Journal of Computer Science and Information Technologies 5.3 (2014): 4638-4645.

[12] Dubey, Shiv Ram, & Anand Singh Jalal. "Detecting & classifying of the Apple fruit diseases utilizing complete local binarys patterns." 2012 Third International Conferences in Computer & Communication Technology. IEEE, 2012.

[13] Zhang, Chunxia, Xiuqing Wang, and Xudong Li. "Design of the monitoring and controling plant diseases system based upon DSP&FPGA." 2010 Second International Conferences in Network Security, Wireless Communication & Trusted Computing. Vol. IEEE, 2010.