Prediction and Classification of Pomegranate Fruit Disease Using Proficient Classifier

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Abstract

Pomegranate is one of the commercial and drought tolerant crops so in India Pomegranate growers are the important part of agriculture sector where they present worthy share in agriculture economy. Pomegranates are one of the healthiest fruits which have a wide range of beneficial plant compounds while it cannot be compared with other foods. According to the research studies which found that they have incredible advantage for human body and reduces the risk of all sorts of diseases. Pomegranates are enjoyed by the human beings by getting the benefits of pomegranates by consuming it as a syrup or by eating seeds, juice, paste etc. Pomegranates are beneficial for cartilage related problems and at the time of baby's birth brain damage problem. To improve the prediction of diseases in pomegranates, computer aided technology was more helpful. The proposed research work contains four phases such as image pre-processing, Segmentation, feature extraction and classification with proficient algorithms.

Keywords: Image Pre-Processing, Segmentation, Feature Extraction and Classification.

I INTRODUCTION

According to the censes taken, from the year 2001 to 2020 the economy's level is increasing rapidly by exporting agricultural products. The Indian economy is heavily dependent on agricultural outputs. So, the newly developed technologies help farmers to rebuild the nation's pride. Image Processing and Data Mining has different types of applications and methods which provides significant change in the plant's life cycle.

"Detection is better than cure", the use of predictable models of data extraction helps to determine the fertility, rate of rainfall, disease outcomes, crop yielding and much more. Predictive models are produced based on a analytical formula with calculation techniques such as classification and clustering which includes attempting of labeling the expected sequence based on available historical data. Each and every country has their own unique soil, climate, rainfall, humidity, and other characteristics related to vegetation and plants. Some types of cash crops, sub crops, plants, trees, fruits and vegetables will be changing accordingly.

India is a unique country with land of diversity, climatic conditions, soil, and irrigation that is why the agricultural industry is active all year round. At the same time, however, due to modern industrialization, climate change, pollution, and a shortage of skilled workers in agriculture.

This results in sharp decline in productivity due to diseases occurring in several stages of the plant and fruit life cycle. For example, soybean rust, a type of soybean fungus, affected with significant economic losses. With early acquisition, farmers have increased harvesting a large yield in Soy production. Not only on the fruit but also on the trees the disease can be spread.

Hand-made automation is a proven method that can reduce the risk posed by a fruit or plant when it is detected early. However, using images for detection is a long way to go as the amount of data needed to process the sample. Observed data should be analyzed to prevent future causes.

Considering agricultural science, a new application has introduced for image processing technology. This contains color scanners, as well as other hardware tools used by the camera for capturing pictures. This is attempted for applying the concept of image processing and data analysis based on the collaboration in the field of agricultural growth. Computer-based image processing takes place in rapid evolution along with the emergence of computer systems.

This study was mainly focused on fruit planting; diseases often appear as spots on the fruit and can be a problem if they are not treated early. Excessive use of pesticides in fruit diseases increases the risk of toxic residues in agricultural products. It has been identified as a serious threat to groundwater pollution. Components used in pesticides are dangerous if not handled properly. Therefore, an effort is being made to provide the means by which fruit diseases can be identified as soon as they manifest their symptoms in the growing fruit.

II EXISTING WORK

Digital Image Processing Techniques for Detecting, Quantifying and Classifying Plant Diseases

Barbedo (2013)[1] proposed a study on methods similar to those usage of image processing methods to detect, measure and classify plant diseases by visualizing. Although symptoms of the disease can occur in any part of the plant, the authors classify the proposals into three main classes according to their purpose, and they are perceptions, size estimates, and classifications. Each of these classes, too, was categorized according to the main technical solution used in the algorithm.

Pomegranate Leaf Unhealthy Region Detection and Classification

Srunitha and Bharathi (2018)[2] introduced a classification model to find a diseased leaf by pre-processing and classifying regions with unhealthy leaves. They used the discovery of the unhealthy Pomegranate leaf region and the classification methods by Multi-class SVM. The test results shows the effectiveness of the proposed method by detecting the diseases affected in the leaf of pomegranate.

Automatic Recognition of Quarantine Citrus Fruit Diseases

Stegmayer et al. (2013)[13] introduced a quarantine detection model. A combination of a different set of feature selection and a classifier such as a classification and regression tree (CART), Naive Bayes (NB), Multilayer perceptron (MLP) are trained to detect traces of

confinement in Citrus Fruit. Several tests have been performed on 212 mandarin samples. Also, this method shows an 83 percent classification rate in all types of classes.

Grading and Classification of Anthracnose Fungal Disease of Fruits that is Based on Statistical Texture Features

Pujari et al. (2013)[24] Produced a process of analysis that includes two phases. In the first stage, the segmentation methods, such as threshold, regional growth, K-means clusteringand watershed integration to separate the anthracnose-affected lesion area into a common area. These affected areas are then calculated by calculating the percentage of the affected area. In the second stage, the texture elements are extracted using the Run-length Matrix.[3] Then next, the quantification of the affected area is calculated. Extraction of texture elements made using Run-length Matrix is performed. These characteristics are also used in classification using ANN. Examination results in a database of samples of about 600 fruit images. The accuracy of the classification techniques is found that both common and affected anthracnose fruits are having 84.65 percent and 76.6 percent accurately.

III PROLEM STATEMENTS

In the production of fruits India is ranked second place because India is the largest producer of pomegranate fruits. This contributes a significant part, and it also contributes lot for the growth of the nation. So, it is shortly called as the king of fruits. Due to improper cultivation, lack of preservation, very high post-harvest losses in handling and processing, manual inspection, lack of awareness on preservation and quick quality evaluation techniques it has been reduced in the production based on the good quality fruits. This impact also includes scarcity of skilled workers, inspection increasing on labour costs and with all these pressure and problems farmers had to improve and increase the production of fruits. So, in this scenario, farmers can be suggested at correct time with computer-based solution which helps them to increase the production by improved prediction of disease and pesticide. It is categorized based on the distributing types of pomegranates diseases such as: Alternia Rot, Crown Rot, Anthracnose, Bacterial blight, Cercospora fruit spot. To control the disease and to improve the production of Pomegranates in the next harvest this research helps in the efficiency of predicting diseases in the post-harvest.

IV.PROPOSED RESEARCH METHODOLOGY

Pomegranate is one of the most widely exported fruits in the world. Beautiful pomegranate pulp is an important export item from India. Kuwait, the UAE, and the Middle East countries are also major export destinations for Pomegranate. Excellent expectations are expected to improve the marketing and production of Pomegranate in India. It has great economic value in the field of marketing. The value of a fruit is determined by a number of factors, such as color, size, and taste. The healthy Pomegranate fruit contains 80 percent water in its composition. The size depends on the amount of water present in the fruit. Twenty different varieties of Pomegranate are produced, of which Red Delicious is one of the finest varieties of Pomegranate known for its taste and flavor. It is in great demand in the export market. Although it tastes good, it falls on the expensive side.

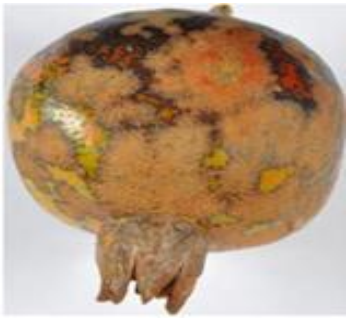
In response to a change in the color of the fruit, the cause of the disease may be identified. Personal identification of pneumonia costs time and effort. Fungal and bacterial diseases are the most serious diseases that are affecting pomegranates.

Early diagnosis helps prevent premature ejaculation and increases fruit production capacity. This approach is about using digital imaging techniques for early detection of diseases. For the disease to be cured earlier suffering, this approach helps to improve fruit sales. Timely diagnosis and treatment can reduce fruit diseases and improve fruit quality. Bacterial infections cannot be diagnosed and treated by hand. This proposed model is produced based on computerized vision diagnostic technique by automatic detection method. Diagnosis is made through digital imaging processing techniques. The main steps for image processing such as pre-processing, classification, and segmentation are used in this work.

This study developed new morphological algorithms to image pre-processing, image classification and segmentation, feature extraction and disease classifications. The stages involved in developing this research project that are shown in Figure 2.

The proposed study consists of four stages of achievement. The first step is image acquisition; digital camera captures a few areas of pomegranate image with the best resolution of the best quality. The results of the survey depend on the website. This database is responsible for the useful information that determines the efficiency of the algorithm.

1. Phase- I Image Pre-processing
2. Phase –II Segmentation of Disease affected region
3. Phase –III Feature extraction and Classification
4. Phase –IV Pesticide forecast

		
Cercospora	Anthracnose	Bacterial Blight

		
Scab	Fruit Rot	Botryosphaeria

Figure 1 Types of Common Pomegranate Fruit Diseases

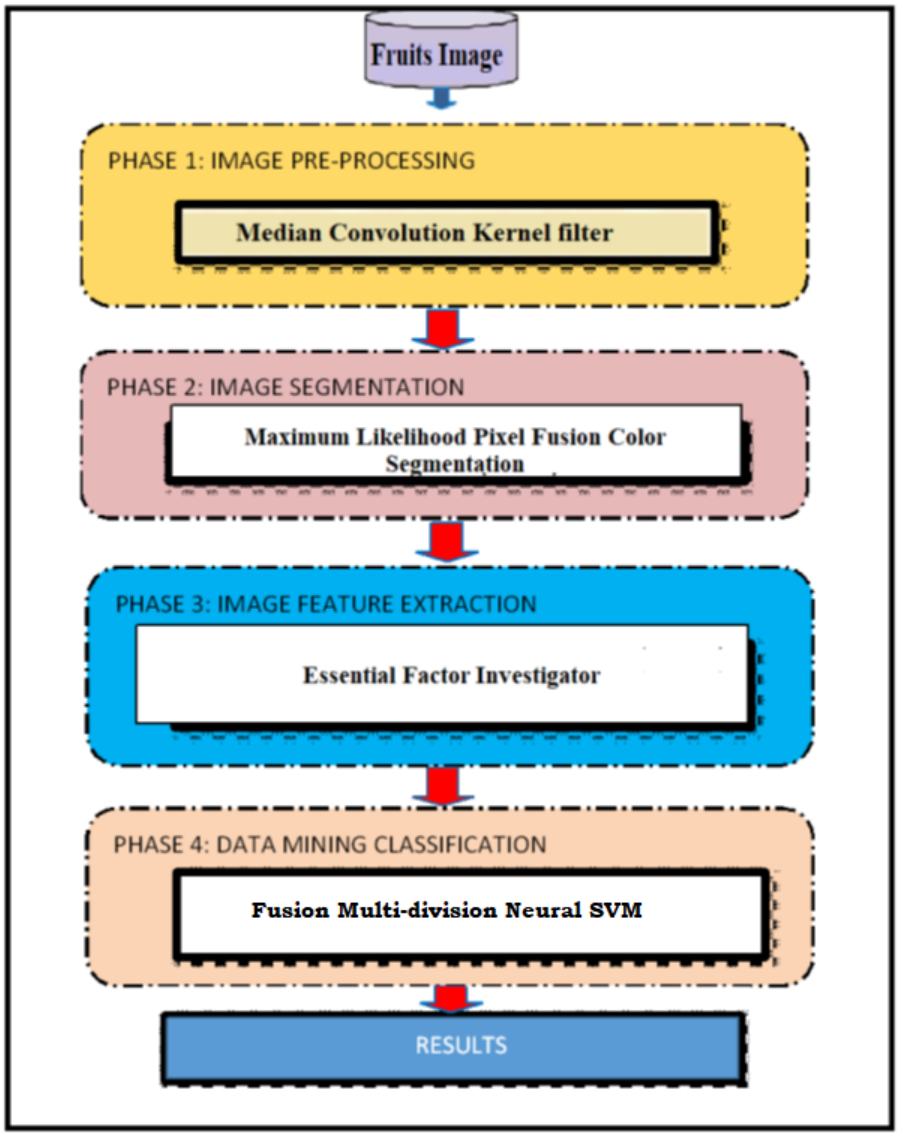


Figure 2: Framework of Research Work on Pomegranate Disease Prediction

- **Image Acquisition and Dataset Preparation**

A high-resolution digital camera with a resolution of 1024 by 768 pixels is used to capture pomegranate fruit and a 20-megapixel camera. The digital camera has a focal length of 15mm to 18 mm. Such digital camera will be suitable for capturing all the possible combinations of pomegranate pictures. These photos were captured at an standard distance. So various types of diseases affected pomegranate pictures of various pixels are captured. Figure 3.3 shows a data sample of Pomegranate fruit diseases.

Figure 3.Sample Pomegranate fruit disease from Dataset

- **Phase I- Image Pre-processing using Median Convolution Kernel filter** (MCKF).

This study used the Mean Convolution Kernel Filter (MCKF) to enrich the quality and to reduce the calculation time. Proposed effectively compresses all types of sound during image time, preserving image edge information, lower processing time, and improving image quality. The proposed filter is compared to the Mean, Median, Gaussian and variable filters. The execution of this algorithm is measured by PSNR and MSE (Mean Square Error). The result shows that the proposed filter increases the PSNR value and lowers the MSE (Mean Square Error) metric values and produces better results. The PSNR value of the image at the audio level is used to assess the image quality. Comparisons made between median, mean Gaussian and Adaptive filter with the help of MCKF filter.

- **Phase II-Disease affected Region segmented by Maximum Likelihood Pixel Fusion Color Segmentation**

After consideration of pre-processing, the image is presented as an input to the segmentation process. Segmentation algorithms are used for image fragmentation. This section reads the pomegranate fruit from the dataset and the image is resized to 256 × 256. Front images can be distinguished from the dynamic background of featured images with the help of using various effective image classification techniques. Background information with a defective image can be removed from the previous image using the background removal process. The efficiency of the proposed system is influenced by important factors such as Secular reflections, background clutter, shading and shadows. Therefore, it is very small that in order to reduce the background dynamics of the image it is necessary to make the image segmentation in the images, which helps to focus only on the narrative phase. At last, we separate the diseased area from the fruit. The proposed method was used and tested with pomegranate database. The proposed method accurately removes and separates the affected region from pomegranate images. Segmentation accuracy is measured using parameters such as sensitivity, specificity, Dice Coefficient (DC) and Jaccard Similarity (JS).

- **Phase -III Feature Extraction using Essential Factor Investigator (ESI)**

In this feature, the extraction process is divided into categories such as Feature selection and Classification. In between these two stages, selecting a feature is the most tedious process. If the selected features are not visible, then the classifiers in the classification phase cannot work by joining with the patterns. Selecting a feature is the first and most important step in making any pattern classification. Also, the selected features should display relevant data from each class. Feature vectors are made up of relevant elements extracted from trained data. The following features are extracted from this classified image: Mean, Standard Deviation (SD), Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM, Contrast, Correlation, Energy, Homogeneity, color, size, shape and dimensions.

Phase IV: Classification of the Disease using Fusion Multi-division Neural SVM

Proposed classifier algorithm on fusion multi-division neural SVM with an entirely connected feed-forward Neural Networks functioned with sigmoid activation is used for classification of disease found in the fruit. Training the algorithm is done with Momentum Backpropagation, Resilient Gradient Descent and Decrease Learning Rate. Once the maximum predefined limit of epochs reaches or the Mean Square Error drops to zero, the training is completed. This research classifies the disease, such as using hybrid classifier such as Anthracnose, Backterial Blight, Scab, Black Spot, Alternaria Rot. This classifier is minimising the training time over the conventional classifiers. The accuracy of the proposed method compared with several other existing methods such as Fuzzy logic, k-NN and Naive Bayes, it yields good result than other.

V. RESULT AND DISCUSSION

The existing classifiers such as Fuzzy logic, Naïve Bayes, K-NN are compared with the proposed Fusion MD-NSVM Classifier. The accuracy of the overall performance is calculated for each classifier. For the result obtained by each classifier, the accuracy is measured in

percentage. Fusion MD-NSVM is found to have better performance with 98.2% of accuracy and K-NN with 92.38 % of Accuracy and Fuzzy logic with 90.48 per cent and Naïve Bayes with 85.71 per cent.

Table 1. Prediction Accuracy of Existing and Proposed Classifiers

S. No.	Classification Technique	Accuracy (%)
1	**Fuzzy Logic**	90.48
2	**Naïve Bayes**	85.71
3	**K-NN**	92.38
4	**Fusion MD-NSVM**	98.37

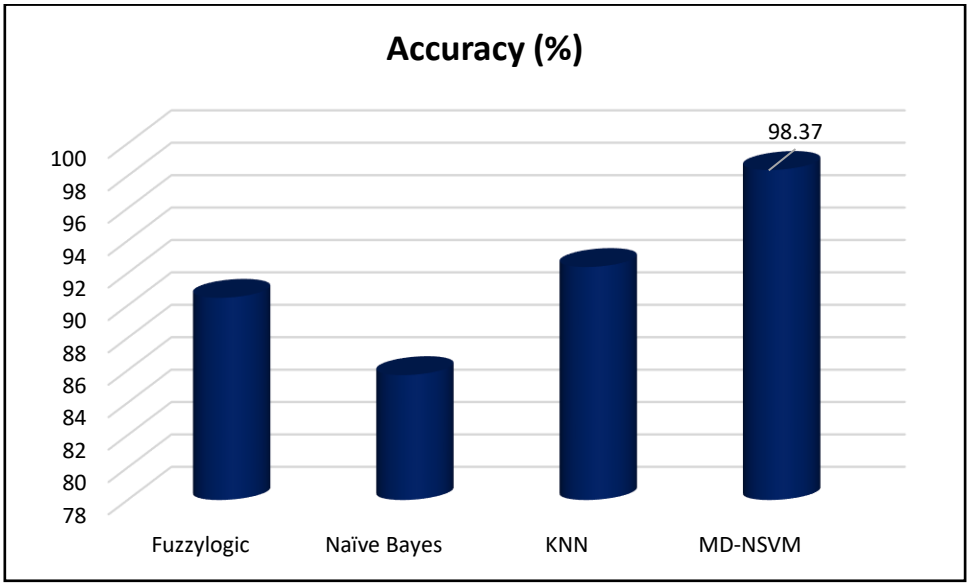


Figure 4. Graph Representing Accuracy Result of Classifiers

VI. CONCLUSION

Pomegranates are one of the healthiest fruits which have a wide range of beneficial plant compounds while it cannot be compared with other foods. According to the research studies which found that they have incredible advantage for human body and reduces the risk of all sorts of diseases. Pomegranates are enjoyed by the human beings by getting the benefits of pomegranates by consuming it as a syrup or by eating seeds, juice, paste etc. Pomegranates are beneficial for cartilage related problems and at the time of baby's birth brain damage problem. To improve the prediction of diseases in pomegranates, computer aided technology was more helpful.

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