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IRNAIT-031.
A COMPREHENSIVE STUDY ON GUAVA PLANT LEAF DISEASE CLASSIFICATION USING MACHINE LEARNING APPROACHES

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Abstract:

Now a days, agribusiness is the primary force behind the development of foods, raising a human's life, and developing critters by supplying desired plant products. India is one of the major players in the harvesting of crops like guava and rice. The best strategy to prevent the tragedies in the production and quantity of the item is to identify any visible signs of plant illnesses. For sustainable agriculture, disease detection and plant health monitoring are absolutely essential. Physical screening for plant diseases is challenging. It demands a significant amount of effort, knowledge of plant diseases, and extensive preparation time. The most prevalent guava diseases include algal, fruit rot, guava wilt, and others. These diseases stunt fruit growth and render the fruits unfit for sale. It causes significant loss to the guava farmers and is a highly severe disease. These diseases cause the fruit to get hard, develop dark spots, and have insects lay eggs inside the fruit, become sore, and split. Based on photos of diseased guava plants, this paper gives a survey of various machine learning algorithms employed in the diagnosis of guava plant leaf diseases.

Keywords: Leaf disease, Machine Learning, Identification, Classification

I. Introduction

Agriculture is the main source of the income in India. Almost 70 percent of the population in India depends on farming [1]. Over 58 percent of the rural people depend on farming as it is an essential mean of livelihood [2]. In current developing world, technologies are emerging day by day but still we are utilizing few ancient methods in agriculture. If a plant affected by any disease is identified by existing methodologies consumes more time, work and cost. Guava is a fast growing evergreen shrub or small tree that can grow to a height of 3-10 m. It has a shallow root system. Guava produces low drooping branches from the base and suckers from the roots. The trunk is slender, 20 cm in diameter, covered with a smooth green to red brown bark that peels off in thin flakes.

Guava is one of the most familiar fruit and it is the poor man's apple. The production of guava is decreasing day by day because of affecting different types of diseases. Most common diseases of guava are Algal, Fruit rot, Guava Wilt These kinds of diseases spoil the fruit growth and due to unworthiness, the fruits are not marketable. It is very harmful problem for the guava farmers and it does heavy loss. Due to these diseases the fruit becomes hard, erupts brown spots, insects lay on eggs inside the fruit, sore and split the fruit. These problems are solved by using the Machine Learning techniques and it provides the best solution of leaf disease.

II. Machine Learning

Machine Learning Is a Form of Artificial Intelligence that Makes Predictions from Data. The role of Machine learning refers to the current technology which is benefiting farmers to minimize the losses in the farming by providing rich recommendations and insights about the crops. Application of machine learning in agriculture allows more efficient and precise farming with less human manpower with high quality production. To identify the recent advancements in the development of plant disease detection and classification system based on Machine Learning (ML) models. In this paper, we have conducted a systematic literature study on the applications of the state-of-the-art ML and DL algorithms such as Support Vector Machine (SVM), Neural Network (NN), K-Nearest Neighbor (KNN), Naïve Bayes (NB), other few popular ML algorithms for plant disease categorization.

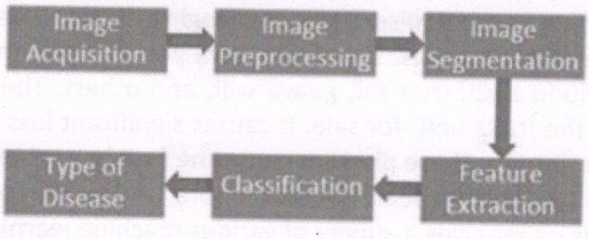
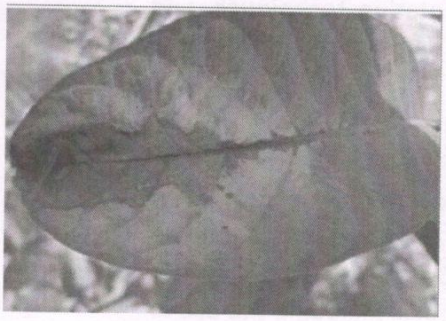


Figure 1: Work Flow

III. Guava Diseases

Guava Wilt

Guava wilt starts with the onset of monsoon. Appearance of light yellow foliage with loss of turgidity and epinasty. Some of the twigs become bare and fail to bring forth new leaves or flowers and eventually dry up. Fruits of all the affected branches remain underdeveloped, hard and stony. It is shown in Fig. 2a.



(a) Guava Wilt

(b) Algal

(c) Fruit rot

Figure 2: Leaf diseases.

Algal

Alga infects immature guava leaves during early spring flush. Minute, shallow brown velvety lesions appear on leaves especially on leaf tips, margins or areas near the mid vein and as the disease progresses, the lesions enlarge to 2-3 mm in diameter. It is is shown in Fig. 2b.

Fruit rot

This disease is starts at calyx disc of the fruit during rainy season. Affected area is covered with whitish cotton like growth which develops very fast as the fruit matures and pathogen is able to cover almost the entire surface within a period of 3-4 days during humid weather. It is shown in Fig. 2c.

IV. Related works

Research into the automated detection of plant diseases has been of interest to researchers for many years. Gavhale and Gawande built a model for the identification of different diseases in plants using images of plant leaves. Their approach involved five stages. In step one, they used a camera to capture initial image sets, and preprocessed these images to enhance the images and color space. For segmentation, the infected regions were identified using edge, region, and threshold-based segmentation techniques, and then texture, color features, and shape were calculated. Finally, a neural network classifier was used to create texture feature taxonomy [3].

Deshpande et al. presented an established graded method for automated disease recognition in guava fruit. They processed the images and identified the disease after resizing, enhancing, correcting, and removing shadow from the images. The K-means algorithm was used for the detection of the affected parts of the leaves. Their approach provided good accuracy of identification of the diseases [4]. Thilagavathi et al. [5] proposed a system for guava plant leaf disease detection using image processing techniques, including the use of color transformation to facilitate the detection of diseased areas, followed by classification using SVM and KNN.

Gavhale et al. developed a framework for the identification of disease affected parts of citrus leaves. They recognized the disease using image preprocessing techniques including image enhancement, RGB color vector transformation, and K-means. They focused on feature extraction and recognition to recognize diseases of the leaf. Texture and color feature extraction was done using Gray Level Co-occurrence Matrix (GLCM) methods and an SVM classifier was used for disease detection [6]. Ali et al. [7] presented a technique using color features and histogram of oriented gradients (HOG) features, and achieved significant results for citrus disease. Sannakki et al. [8] presented a model for the diagnosis of grape leaf diseases using machine learning methods. Images of leaves from a digital camera were passed to thresholding, where green pixels were masked.

Author	Method	Accuracy
S.Sladojevic et al [16]	SV/M	82%
Habib et al [11]	SVM	95.54
Singh et al [17]	Neural Network	High Accuracy
Rauf et al [12]	K-Means	87.5
Khan et al [10]	SVM	High Accuracy
Almadhor,	HSV	99

Table 1: Summary of reviewed article

Conclusion

The method for identifying leaf diseases on guava plants is discussed in this review paper. According to the review papers, the approaches had accuracy rates for anthracnose, algal spot, styler end rot, and fruit flies of 95.7%, 95.9%, 94%, 95.7%, and 100%, respectively. The focus of the upcoming work will be hybrid machine learning categorization.

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