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Survey on Diseases of Citrus Plant Leaves and Detection Methods

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ABSTRACT
The citrus industry is an important part of Florida's agricultural economy. Citrus fruits, including oranges, grapefruit, tangelos, tangerines, limes, and other specialty fruits, are the state's largest agricultural commodities. The economic impact of citrus industry on the overall economy of the state of is substantial. The citrus industry is also one of the leading producers of jobs for people in or state and thus has huge potential for the overall economic balance of the state. These facts prove beyond doubt the importance of the citrus industry in the state's economy. As such, several important decisions regarding safe practices for the production and processing of citrus fruits have been made in the recent past. One of the main concerns is proper disease control.
Keywords: Citrus Fruit, Greasy Spot, Melanose

I. INTRODUCTION

Identification of the plant diseases is the key to prevent the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise to diagnose the plant diseases.

Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. Here we are mainly focusing on the methods used for the detection of plant diseases using their leaves images. Image analysis generally deals with the classification of diseases. Plant leaves can be classified based on their morphological features with the help of various classification techniques such as PCA, SVM, and Neural Network.

Figure 1. Bacterial Affected Citrus Leaf

Plant pathology (also phytopathology) is the scientific study of diseases in plants caused by pathogens (infectious organisms) and environmental conditions (physiological factors). Organisms that cause infectious disease include fungi, oomycetes, bacteria, viruses, viroids, virus like organisms, phytoplasmas, protozoa, nematodes and parasitic plants. Not included are ectoparasites like insects, mites, vertebrate, or other pests that affect plant health by consumption of plant tissues.

II. LITERATURE SURVEY

J.Senthil Murugan, R.Dhanaprabhu, R.Jayabalaji, C.Shinia Hephizibha has published a paper entitled "Lemon Tree Disease Detection by Analyzing Lemon Leaf"- The lemon leaf disease is detected by using the threshold based image segmentation and analyze the

features by using the gradient boost algorithm and apply the feature classification through SVM base.

ii. Peyman Moghadam, Daniel Ward, Ethan Goan has published a paper entitled "Plant Disease Detection Using Hyperspectral Imaging"- This paper proposes the use of hyper-spectral imaging (VNIR and SWIR) and machine learning techniques for the detection of the Tomato Spotted Wilt Virus (TSWV) in capsicum plants. Discriminatory features are extracted using the full spectrum, a variety of vegetation indices, and probabilistic topic models. The results show increasing classification performance as the dimensionality of the features increase.

iii. Sachin D Khirade and A B. Patil have published a paper named "Plant Disease Detection Using Image Processing" - Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases.

iv. Vijai Singh,A.K.Misra has published a paper entitled "Detection of plant leaf diseases using image segmentation and soft computing techniques" - This paper presents an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection.

v. Vidhya .K "Image Processing System for Plant Disease Identification by Using FCM-Clustering Technique"- Here research completely focused on providing information about plant diseases and prevention methods. Plants have become an important source of energy, and are a fundamental piece of the puzzle to solve the problem of global warming.

III. DIFFERENT TYPES OF CITRUS PLANT LEAF DISEASES

Citrus trees can exhibit a host of symptoms reflecting various disorders that can adversely influence their health, vigor and productivity to varying degrees. Identifying disease symptoms is essential as inappropriate actions may sometimes prove to be costly and detrimental to the yield.

1. **Greasy spot (Mycosphaerella citri).** Greasy spot is caused by Mycosphaerella citri. Management of this disease must be considered in groves intended for processing or for fresh fruit market. Greasy spot is usually more severe on leaves of grapefruit, pineapple, hamlins and tangelos than on valencias, temples, murcotts, and most tangerines and their hybrids. Infection by greasy spot produces a swelling on the lower leaf surface. A yellow mottle appears at the corresponding point on the upper leaf surface. The swollen tissue starts to collapse and turn brown and eventually the brown or black symptoms become clearly visible. Airborne ascopores produced in decomposing leaf litter on the grove floor are the primary source of inoculum for greasy spot. These spores germinate on the underside of the leaves and the fungus grows for a time on the surface before penetrating through the stomates (natural openings of the lower leaf surface). Internal growth is slow and

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does not appear for several months. Warm humid nights and high rainfall, typical of Florida summers, favor infections and disease development. Major ascopore release usually occurs from April to July, with favorable conditions for infection occurring from June through September. Leaves are susceptible once they are fully expanded and remain susceptible throughout their life.

2. **Melanose (Diaporthe citri).** Control of melanose, caused by Diaporthe citri, is often necessary on mature groves where fruit is intended for fresh market, particularly if recently killed twigs and wood are present as a result of freezes or other causes. Grapefruit is very susceptible to melanose, but the disease may damage all other citrus. On foliage, melanose first appears on the young leaves as minute, dark circular depressions with yellowish margins. Later they become raised, are rough, brown in color, and the yellow margins disappear. Leaves infected when very young may become distorted. Infested leaves do not serve as an inoculum source. Young green twigs can also be infected.
3. **Star Melanose**. Star melanose occurs when copper is applied late during hot, dry weather, and is due to copper damage to leaves. It has no relationship to melanose but may resemble symptoms of that disease. Copper causes the developing tissues to become more corky and darker than normal and the shape of the lesion often resembles a star.
4. **Citrus scab (Elsinoe fawsettii).** Citrus scab caused by elsinoe fawsettii affects grapefruit, temples, murcotts, tangelos, and some other tangerine hybrids. Small, pale orange, somewhat circular, elevated spots on leaves and fruit are the first evidence of the disease. As the leaves develop, the infection becomes well defined, with wart-like structures or protuberances on one side of the leaf, often with a conical depression on the opposite side. The crests of the wart-like growths usually become covered with a corky pale tissue and become somewhat flattened as the fruit matures especially on grapefruit. The pustules may run together, covering large areas of the fruit or leaves. Badly infected leaves become very crinkled, distorted, and stunted. Fruit severely attacked when very small often become misshapen. Scab can be particularly severe on temples and lemons, and is often troublesome on murcotts, minneola tangelos and grapefruit.

IV. IMAGE PROCESSING AND COMPUTER VISION TECHNIQUES

Computer vision techniques are used for agricultural applications, such as detection of weeds in a field, sorting of fruit on a conveyer belt in fruit processing industry, etc. The underlying approach for all of these techniques is the same. First, 6 digital images are acquired from environment around the sensor using a digital camera. Then image-processing techniques are applied to extract useful features that are necessary for further analysis of these images. After that, several analytical discriminant techniques, such as statistical, bayesian or neural networks will be used to classify the images according to the specific problem at hand. This constitutes the overall concept that is the framework for any vision related algorithm.

In the past decade, agricultural applications using image processing and pattern recognition techniques have been attempted by various researchers. Object shape matching functions, color-based classifiers, reflectance-based classifiers and texturebased classifiers are some of the common methods that have been tried in the past. The following sections will discuss some past work done using these methods.

1. **Object Shape Matching Methods**

Tian et al. (2000) developed a machine vision system to detect and locate tomato seedlings and weed plants in a commercial agricultural environment. Images acquired in agricultural tomato fields under natural illumination were studied extensively and an environmentally adaptive segmentation algorithm, which could adapt to changes in natural light illumination, was developed. The method used four semantic shape features to distinguish tomato cotyledons from weed leaves and a whole plant syntactic algorithm was used to predict stem location of whole plant. Using these techniques, accuracies of 65% for detection of tomato plants were reported.

2. **Color Based Techniques**

Woebbecke et al. (1995b) developed a vision system using color indices for weed identification under various soil, residue and lighting conditions. Color slide images of weeds among various soils and residues were digitized and analyzed for red, green and blue (RGB) color content. It was observed that red, green and blue chromatic coordinates of plants were very different from those of background soils and residue. For distinguishing living plant material from a non-plant background, several indices of chromatic coordinates were tried and were found to be successful in identifying weeds. A weed detection system for Kansas wheat was developed using color filters by Zhang and Chaisattapagon (1995). Gray scale ratios were used to discriminate between weed species common to wheat fields.

3. **Reflectance Based Methods**

A method to assess damage due to citrus blight disease on citrus plants, using reflectance spectra of entire tree, was developed by Edwards et al. (1986). Since the spectral quality of light reflected from affected trees is modified as the disease progresses, spectra from trees in different health states were analyzed using a least squares technique to determine if the health class could be assessed by a computer. The spectrum of a given tree was compared with a set of library spectra representing trees of different health states. The computed solutions were in close agreement with the field observations.

4. **Texture Based Methods**

In many machine vision and image processing algorithms, simplifying assumptions are made about the uniformity of intensities in local image regions. However, images of real objects often do not exhibit regions of uniform intensities. For example, the image of a wooden surface is not uniform, but contains variations of intensities which form certain repeated patterns called visual texture. The patterns can be the result of physical surface properties such as roughness or oriented strands, which often have a tactile quality, or they could be the result of reflectance differences such as the color on a surface.

V. CONCLUSION

The survey on different diseases classification techniques used for plant leaf disease detection and an algorithm for image segmentation technique that can be used for automatic detection as well as classification of plant leaf diseases are presented in this work. Banana, beans, jackfruit, lemon, mango, potato,

tomato, and sapota are some of those ten species on which proposed algorithm is tested. Therefore, related diseases for these plants were taken for identification. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases.

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