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Smart Farming:
An Approach for Disease Detection Implementing IoT and Image Processing

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ABSTRACT

With the increasing demand on smart agriculture, the effective growth of a plant and increase its productivity are essential. To increase the yield and productivity, monitoring of a plant during its growth till its harvesting is a foremost requirement. In this article, an image processing-based algorithm is developed for the detection and monitoring of diseases in fruits from plantation to harvesting. The concept of artificial neural network is employed to achieve this task. Four diseases of tomato crop have been selected for the study. The proposed system uses two image databases. The first database is used for training of already infected images and second for the implementation of other query images. The weight adjustment for the training database is carried out by concept of back propagation. The experimental results present the classification and mapping of images to their respective categories. The images are categorized as color, texture, and morphology. The morphology gives 93% correct results which is more than the other two features. The designed algorithm is very effective in detecting the spread of disease. The practical implementation of the algorithm has been done using MATLAB.

KEYWORDS

Back Propagation, Color, Image Processing, Neural Network, Segmentation, Texture

1. INTRODUCTION

The advancement in Sensor nodes and evolution of 5G technologies has gained recent attention and the objective of this article is focused on considering the use of Internet of Things and smart sensor for the application of agriculture (Lin et al., 2018). The evolution of sensor networks and IoT has gained attention in agriculture domain and the deployment of sensor node in real time environment collects the field data at any time and collected data is analysed in real time basis through IoT analytics platform. The cloud platform provides the real time analysis of data for the detection of adversaries in data. The IoT is termed as the network of objects or smart devices, smart vehicles, smart home, buildings and each item which is embedded with electronics, smart sensors, network connection and software's as these advancement in technologies enables these smart devices to collect and exchange data among each other. The Internet of Things is addressed as the global organization towards information society and provides advanced solutions and services through connecting physical and virtual smart devices (things) on the basis of their evolution and existence of communication approaches. The objective of this article is then collaborated with the image processing for the confirmation and detection of

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diseases in crops along with the concept of cloud computing for meeting the requirement analysis of obtained data in real time. Majority of the smart farming application has adopted Internet of Things and presents the benefits of using the advanced sensing and analysis for crop production (Gayatri et al., 2015). The adaptability of IoT in majority of applications has proved the potential of the technology for various areas that includes tracking of assets, industrial management, security aspects, energy utility and monitoring based on conditions. IoT serves variety of other applications such as smart transportation, smart homes, lifestyle, smart building, smart agriculture, healthcare and environment monitoring. IoT is often named as thing of things or network of networks and because of this, IoT technology can perform different tasks at the same time with more accuracy and much efficiently. Image processing is the process in which the images are processed by implementing some mathematical expressions. Image processing uses signal processing at which the input is any image or multiple images or videos whereas the output of an image processing can either be any image or the extracted characteristics which are related to that image or series of images and output image is often termed as digital image (Sharma et al., 2017). Digital image processing requires various algorithms for the operation of performing image processing at digital images (Dogra et al., 2020). The prime operation of digital image processing involves classification (identification of the class at which the new extracted observation belongs), pattern recognition (recognition of known and discovering unknown patterns), feature extraction (derivations which are made using initial information), signal analysis (processing of signals) and at last projection (formation of planar surface by conversion of three dimensional object).

India is a country where most of its population for their living depends upon the agriculture. In India farmers can choose various different crops depending upon the productivity and selects particular pesticides as per the requirement. The economy of India is significantly relied upon farming. The improvement in this field will exceptionally add to the economic government assistance. Innovation is playing an important role in bringing the change and progress in numerous areas. The study of crop and plant diseases referred to as the study of visually analyzing the patterns of particular crop. Monitoring the growth of plant, crop, and fruit is critically important for sustainable agriculture (Rao and Sridhar, 2018). The early detection of plant disease can stop the cause or reduce it through proper management strategies and leads to the overall increase in productivity. The disease in crop affects the crop in terms of its quality degradation and quantity reduction. Image processing provides the capability of studying the visible observation patterns to study the plat diseases. The regular monitoring of particular crop results in analysing the health of plant and plays a significant role for the cultivation of crop. Initially, the operation of plant health monitoring and analysing the diseases is carried out manually by the experts. The disadvantage of manual prediction is that it consumes lot of time and there exist many wrong predictions. Moreover, manual prediction requires ample amount of efforts along with the intensive processing time. The detection of diseases in plats through image processing is an effective solution for early and accurate detection.

The symptoms of disease in most of the cases are observed on stems, fruits and on leaves. The detection of disease from the leaf of plant is considered as the symptoms of plant disease. Some of the common diseases in tomato are early blight, buck eye rot and late blight. These some of the diseases in tomato crop are the most common that can occur at any stage of plant and fruit growth (Mekala and Viswanathan, 2019). The disease of early blight is observed on tomato which appeared as a small black lesion. On the other hand the buck eye rot type of disease appears green in color and occurs mostly when the fruit touches the ground. The late blight is one of another kind of plant disease which happens because of high humid conditions. The overall purpose of this article is to monitor the plant disease specifically on the tomato leafs and to find the solution to reduce the cause in order to increase the health of plant and overall productivity. This process is achieved by adapting image processing and concept of neural network for the detection and analysis of diseases in plant. The database for the purpose of training is created for the diseased images. The features of each image are extracted by implementing morphology and texture analysis.