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Fruit Disease Detection Using Color, Texture Analysis and ANN

S. Heena[1], D. D. Raja Reddy[2] MCA

[1]Department Of Computer Science, Besant theosophical College, Madanapalli, Andhra Pradesh, India
[2]Assistant Professor, Head of Department of Computer Science, Besant Theosophical College, Madanapalli, Andhra Pradesh, India

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ABSTRACT

Efficient growth and increased fruit yield are required and significant now that prohibitive demand exists for agricultural industry. To this end, farmers need manual fruit monitoring from harvest to development. However, manual supervision will not always yield adequate results and specialist guidance is always needed. It therefore involves the proposal of a smart agriculture technique that contributes with less human effort to better yields and development. We are introducing a method for the diagnosis and classification of foreign diseases in fruit.The traditional scheme uses thousands of vocabulary leading to language boundaries. Whereas the framework we developed uses image processing techniques as a simple way to express the image. The proposed work is carried out using the OpenCV library. In the image segmentation, the K-means cluster approach is applied; the images are catalogued on four vectors of color, morphology, form, and hole configuration based on their respective disease categories. The framework uses two image libraries, one for query image execution and the other for the training of previously stored pictures.The definition for pattern matching and disease recognition is used by Artificial Neural Network (ANN).

Keywords :- OpenCV ,ANN ,Image ,K-means Clustering clustering.

I. INTRODUCTION

In fruit or plant experiments, measurable patterns of individual plants are used to assess and health controls and disease detection in a plant are important. By means of proper management techniques like pesticides, fungicides and chemical applications, the prevention of diseases that enhance productivity can be facilitated by interns. Different tools are used for the control and management of superior plant disease such as spectroscopic and imaging technologies. Today's smart farmers can use decision tools and integration strategies that combine products, skills and resources seamlessly for improved production, grading and surplus returns. The objective of this paper is to track fruit diseases and, with the aid of the Artificial Neural Network concept, propose better solutions to good production

and productivity. System uses two image libraries, one for the training of the infected region image already saved and another for query image execution. Three fruits were used for research in this article, namely grapes, apple and grenade. The following are the types of fruits and their diseases:

1. **Grapes:**

a) Black red: black red is the most common and serious disease of grapes. The pathogens in this disease target canes, tendrils, leaves and fruit, and in hot and damp areas they are most damaging. Nowadays, it is possible to control black rot by combining sound cultural traditions, fungicides and resistant varieties. The first symptom of black rot appears on the leaves as the black line forms along the base, then the spots are broadened. The lesions are reddish-brown even at the middle. A minute black dot appears to the furnishing structure of the spore and is arranged in a ring pattern within the boundary of the lesion. Lesion contour is oval, violet to black. After half growth of grapes, most symptoms occur.

b) Powderous mildew: is derived from the fungal uncinulanecator, also known as oidium. This fungus affects only grapes and other similar plants. Disease on grapes most often occurs. Powdery mildew is primarily symptomatic with white or greenish powdery patches occurring on the base of basement trees. It induces even a curling of the vine, withers and blocked or deformed branches. Ancient infections occur as reddish brown on dormant canes. If powdery mildew is premature, inflammation can lead to less sugar and less berries. Cracking and scarring berries can make fruit inappropriate in some way. Most winesmakers should be mindful that powdery mildew on the grapes is of poor tolerance.

c) Downy Mildew: The poisoning of grapevine is profoundly damaging. The cold weather of the grapes arise during the bloom, autumn, rainfall and whether the temperature reaches 10 μC (50 ±F). After 6 to 7 days the plant is poisoned, it will show the first sign of drowning mildew. Plasmoparaviticola is induced. Nearly any green section of the grape is suspicious. Oil spots, with an oily aspect occurring on the leaves (yellow circular spots). In favourable weather conditions, a greater number of oil spots can be observed. Young oil spots are enclosed in brownish-yellow halos in the young foliar. It is called Downy mildew because of its low growth.

2. **Apple:**

a) Apple Scab: It causes most devastating apple infection. It occurs throughout in the apple-growing areas. During the bloom in cool and wet weather apple scab is more severe but it is not reasonably significant in dry or warm climates. Signs of apple scab are visible on leaves, petals, flowers, husk, fruit, young shoots and bud scales of apple tree. Mostly infection on the fruit and leaves are common and obvious.

b) Apple Rot: is a Botryosphaeriaobtusa-caused disease. The leaves, bark and apple tree fruits are attacked. On the outer surface of leaves, the first signs of apple red are seen 1 to 3 weeks after the fall as a thin, purple blotch. For some weeks, the second phase of apple red happens. In this second phase, leaf spots are enlarged. The heavily infected leaf drops out of the forest.
Apple rot disease occur in three forms: 1) leaf blotch on apple trees 2) fruit rot on apple trees 3) limb canker on apple tree.

c) Fruit Blotch: the most frequent northwesterly "summer plague" of apples. Two different organisms are caused by Apple Blotch. Any of the harsh results of this epidemic are economic losses and trade damage of quality. Signs of illness appear on the surface of contaminated fruit as dark greenish-blue spots. One or several

almost circular colonies grow separately. These symptoms appear after the leaflet is fallen 3-4 weeks later. The fruit is covered by larger and shapeless colonies are increasingly focusing on the human/computer interaction framework for automated face recognition or facial sentiment analysis. Computer-aided facial and gestures processing is an emerging field today. Analysis of sentiment involves associate an emotion with the face picture. The aim is therefore to assess an individual's inner feelings

3. Pomegranate:

a) Bacterial Blight: first noted in 1952 in Delhi, India. Bacterial Blight was seen as a lesser economic threat until 1998. until 1998. However, this disease now occurs very often in all countries and has been registered. In all granny-growing countries such as Maharashtra, Karnataka and Andhra Pradesh, the disease occurs. Bacterial blight affects sepals, twigs and pomegranates. Blue spots covered by bacterial slime can be preliminary signs of the disease. Bacterial bite yields of 90 percent of pomegranate depletes. Because of this epidemic, fruits snap.

b) Aspergillus Outflow Red: Alternatively red fruit aliases. It appears as the flora starts to open after the precipitation and the inside of the grenade infects. Minor off-color and less weight on the skin because of internal decay are some of the external symptoms of illness. Typically, however, this issue is not visible until harvesting or selection. Fungus can develop inside the fruit without any outward signs. In certain cases, infected fruit shows a certain degradation from yellow to brownish-red and slightly colourless, such as pale red.

c) Gray Mold: the grey mould is sometimes referred to as cinetea botrytis. It's more active and widespread during washing and spreading at room temperature after harvest. This disease is most common. Gray Mold degrade part of the grenade which impacts the fruit before it matures. Once the fruit is washed or deposited in high moisture, the fungal mycelium starts developing by condensation or water in flower tissues. The normal greyish layer of spores and pathogen sporulates is produced on the flower sections. Finally, the virus extends into the tissue of the fruit, and colonises the crown tissue. Low humidity of the infected fruit

II. RELATED WORKS

The objective of the proposed scheme is to monitor fruit diseases and recommend an alternative approach to good yield and productivity. By segmentation of images this can be accomplished by KMeans clustering strategy, the labelling of boundary pixels can be achieved. The Neural Network has developed a trained database of infected image. For obtaining the characteristics of each image and for the diagnosis of disease morphology the feature vectors, such as image colour, morphology, hole configuration and texture are applicable. SURF algorithm for removing the features used as locator and descriptor. Use of functionality extracted Scope of interest can be estimated and the first step after extraction can be taken after refining and analysis. Use of functionality extracted Scope of interest can be estimated and the first step after extraction can be taken after refining and analysis.

Assessment functions that are dependent and usually unknown on large number of inputs. They are interdependent networks of "neurons" which computer input utilities and provide the ability to learn from the machine and to recognise the pattern in an adaptive manner. This methodology decreases human initiative and produces an effective outcome of 90 percent.

Initially, uniform weights are set for the start of this phase and then the preparation starts. Two methodologies for teaching are supervised and

unattended. The network is supplied with a supervised testing mechanism, either by manually "scoring" network results or supplying the necessary outputs by inputs, while individual training can be done through a network that takes inputs without external assistance. P. Most networks use the supervised approach to programming, while unattended training is used to implement some initial features inputs. The database server is used primarily for comparison with the qualified database of extracted images which diagnose and classifies fruit disease.

III. METHODOLOGY

Picture Acquisition - The acquisition of images may also be represented as the operation in which an image from some sources is restored, typically a hardware dependent source which can be used along with subsequent processes. The initial state of the workflow sequence of image processing is continuously image acquisition because processing can only be done with an image. The obtained picture is completely normal and is the product of all hardware used to create it.

Image Segmentation - It is the method for segregation of digital image into several segments. The primary aim of segmentation is to clarify and/or convert the rendering of an image into something that is further relevant and easier for analyses. Objects and bounding line of images are located by using image segmentation. Pixels with similar label portion share distinguishing features for allocating a label to each pixel in an image. For this we are using K-Means Clustering methodology.

Function extraction - The colour, form, morphology and composition of the fruit holes are known to be four characteristics vectors. Often enormous resources are needed to describe large data sets.

The following is the algorithm used to retrieve the features:

For extracting the functions, the SURF algorithm is used. Used as local blob detector descriptor and SURF algorithm.

$$s(x,y) = \sum_{i}^{x} \sum_{j}^{y} I(i,j)$$

A rectangle that can be determined easily by means of the integral image in the sum of the primitive image, involving four measurements at the cross-section.

The key division of the algorithm is -

1. Point of scope Detector Detector
2. Local Descriptor Surrounding
3. Matching. 3. Matching.

The aim of blob analysis is to detect the scope of interest around the digital image that differs in features, such as a contrast of colour or brightness with its nearby areas. A picture region with roughly constant properties can be called Blob.

Blob Analysis' basic scenario includes the following phases:

1. Extraction: It is primary step of image thresholding technique which inspects a region corresponding to single object or objects.
2. Refinement: Extracted region contain various kind of loud sound due to degraded quality of image. Region transformation techniques are used in refinement step.
3. Analysis: It is ultimate stage for refined region to evaluate & compute the outcome. If the region shows multiple objects then divide it into separate blobs for inspection.

Blob Analysis - Blob detection methods are intended at detecting scope of interest surrounded by digital image that varies in properties, such as color or brightness comparison with its vicinity regions. Region of an image in which some properties are approximately constant can be called as Blob. The basic scenario of the Blob Analysis solution consists of the successive stages:

1. Extraction: It is primary step of image thresholding technique which inspects a region

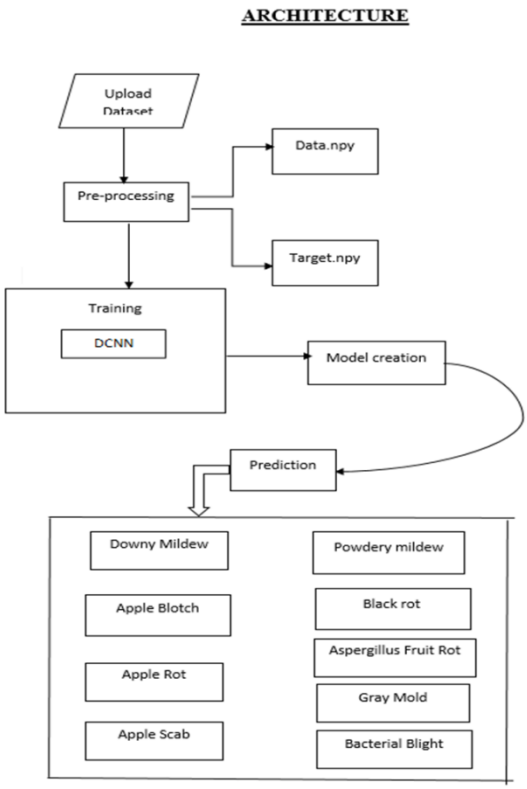
corresponding to single object or objects.

2. Refinement: Extracted region contain various kind of loud sound due to degraded quality of image. Region transformation techniques are used in refinement step.
3. Analysis: It is ultimate stage for refined region to evaluate & compute the outcome. If the region shows multiple objects then divide it into separate blobs for inspection.

Template matching - this is the way the tokens have been examined for the presence in the components in such patterns. For the pattern matching which the interns are classified as illness, the proposed ANN, an artificial neural network concept, is applied.

Using an artificial neural network, comparison between patterns may be acknowledged. ANNs may be assessed as the neural network system of Artificial Intelligence (AI).

Architecture



The input of 48x48 to converting layers followed a pooling layer and ended with density layers with dropout layer between them. Our design is very straightforward. The result gives the seven groups odds and the limit is chosen.

IV. ALGORITHM

ARTIFICIAL NEURAL NETWORK:

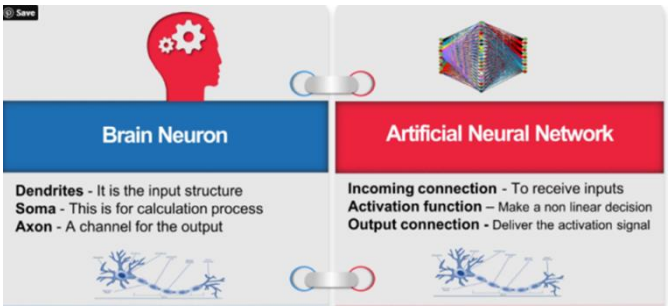
Algorithms for the Neural Network – Neural Artificial Networks probably works almost the human brain. Conceptually, artificial neural networks are influenced by the brain's neural networks, but modern machine learning is far from experience. ANN takes several inputs and generates one output. The ANN is influenced by the animal brain, but is not near biological neural networks.

In this article we discuss a simple understanding of artificial neural networks and neural network algorithms, working behind the scenes and a short look at their work (Algorithms). Part 2 of the previous article – profound education – introduction to artificial Neural networks.

NeuralNetworks

Multi-Layer Perceptron
Radial Basis Network
Recurrent Neural Networks
Generative Adversarial Networks
Convolutional Neural Networks.

Neural Network algorithms can be used for strategic purposes depending on radial function. Including the latter, there are several other neural network models. Continue reading this article to introduce the neural network and its operating model. You'll get an insight into how they work and how they work on actual math problems.



ANN reads, gets conditioned and adapts like we humans do instinctively. While ANN is inspired by the human brain, they are on a far simplified level for a fact. The neuron structure is now used as deep intelligence for computer learning. This development has helped to solve many problems, especially where layering is necessary for refining and granular data.

Neural Network Architecture

Neural networks are made up of opaque layers of input and output layers. The key task is to transform the entry into a valuable production device. Examples of mathematical models are excellent. Neural network information flows are two-way.

Feedforward Networks — Only the output layer will pass in these signals in one direction without a single loop. Used extensively in pattern identification. However, there are zero or more opaque layers on this network with one single input layer and one output layer. This approach has two general concepts as follows

When it's being learned or "trained"

During daily operation or "after training"

Feedback networks – their internal state (memory) may be used to process input sequences in this persistent or interactive network. With loops on the network, signals will flow in both directions. From now on only sequence / sequential activities are available. Typical brain paradigm for human beings.

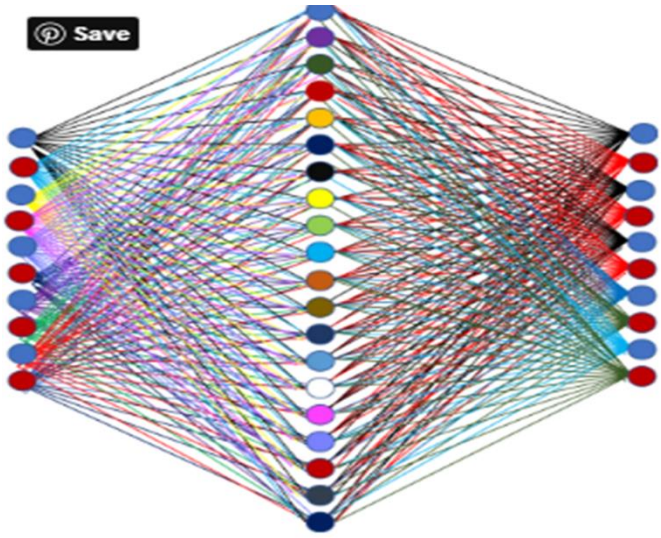
Neural Network algorithms run on three major layers of its architecture, i.e. the input layer, secret layer, and the output layer.

Components of architecture.

Input Layers, Neurons, and Weights –

It is called the neuron or node as the fundamental unit within a neural network. The inputs from the outside source or from any other nodes are given. The idea is to calculate the related weight based on the output. Based on its relative value compared with other inputs the neuron is allocated weights. This function is now finally extended to calculations.

Let's presume our job in making tea so that our ingredients are "neurons" or input neurons because they are building blocks or points of departure. The ingredient quantity is referred to as the "weight." Sugar, species, milk and water would be dumped in a tub, and then mixed into a new colour. This transition process can be referred to as "activation"



Hidden layers and output layers—The hidden layer is still separated from the outside world. The key task of the hidden layer is for collecting data from the input layer and for carrying out its work, that is, calculating the output nodes. A secret layer may be referred to as bunch of hidden nodes.

To follow the same example above – The solution begins to change color after heating (computation process) in our tea making job, which now uses the blend of our material coming out of the input sheet. The intermediate layers are referred to as "cached layers." At the end, we get the final tea as production, which can be contrasted with heating.

Compared to what you'll see in real life, the network mentioned here is much easier to comprehend. In the forward propagation and in the backpropagation stage, all calculations are carried out as previously discussed (at each node). Algorithms of the neural network

Neural Network Work Flow – Layers of Learning.

Neural networks are not so different from humans, people learn from life experience while neural networks need data to obtain experience and to learn. Over time the volume of data improves accuracy. About the same way, people even better and better do the same role by doing any job you do.

The base of neural network algorithms is a layer and layers of connections. A new layered architecture is built into the whole neural network concept. The obligation of each layer lies with itself. These networks are designed to use "neuron" layers to process raw data, to locate patterns and artefacts normally concealed from naked eyes. Data scientists have three separate baskets to train a neural network.

Training data set – This helps networks to understand and know the various weights between nodes.

Validation data set – To fine-tune the data sets.

Test data set – To evaluate the accuracy and records margin of error.

Layer enters, extracts the functionality and enters the next layer, i.e. each layer works as an input layer in another layer. This is to obtain information and the final work layer is to give output. All the information within hidden layers or key layers is processed.

K-NEAREST NEIGHBORS (KNN):

Introduction:

KNN is a type of supervised ML algorithm that can be used for predictive problems in both classification and regression. It is however used primarily for the predictive problems of classification in the industry. The two following characteristics characterize well KNN -

Lazy learning algorithm – KNN is a lazy learning algorithm since there is no advanced testing and uses all the data during classification for training.

Non-parametric learning algorithm – KNN is also a non-parametrical learning algorithm since the underlying data is not assumed.

Working of KNN Algorithm.

KNN uses 'feature-similarity' algorithm to predict new datapoint values, which also ensures the new data point can be given a value depending on how exactly the points in the training set align. It can be understood by the following steps –

Step 1 - For implementing any algorithm, we need dataset. So during the first step of KNN, we must load the training as well as test data.

Step 2 - Next, we need to choose the value of K i.e. the nearest data points. K can be any integer.

Step 3 - For each point in the test data do the following –

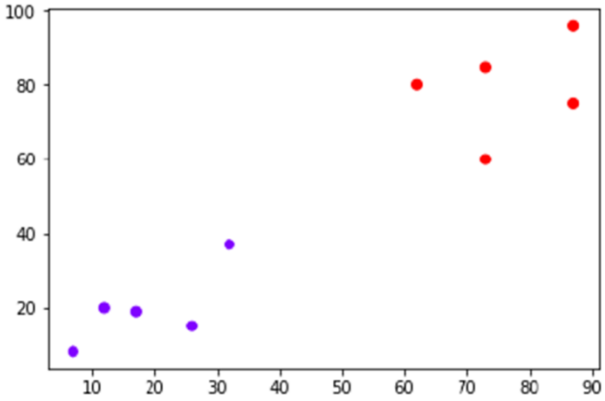
- 3.1 – Calculate the distance between test data and each row of training data with the help of any of the method namely: Euclidean, Manhattan or Hamming distance. The most commonly used method to calculate distance is Euclidean.
- 3.2 – Now, based on the distance value, sort them in ascending order.
- 3.3 – Next, it will choose the top K rows from the sorted array.
- 3.4 – Now, it will assign a class to the test point based on most frequent class of these rows.

Step 4 - End

Example

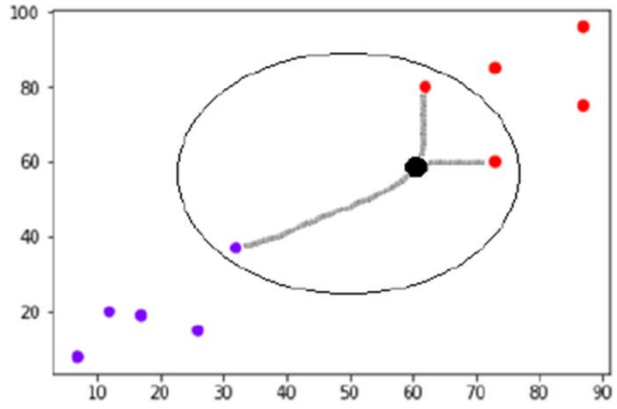
The following is an example to understand the concept of K and working ofKNN algorithm –

Suppose we have a dataset which can be plotted as follows –



Now, we need to classify new data point with black dot (at point 60,60) into blue or red class. We are

assuming K = 3 i.e. it would find three nearest data points. It is shown in the next diagram –



We can see in the above diagram the three nearest neighbors of the data point with black dot. Among those three, two of them lies in Red class hence the black dot will also be assigned in red class.software of the machine, though. Deep

V. CONCLUSION

The groundbreaking result shows that this sophisticated technique is valuable, which in a small computational effort will clearly promote correct diagnoses of fruit diseases. It also focuses on prospective research on the automated assessment of the disease's seriousness.

For vine, apple and grenade diseases, an image processing approach is suggested. Apple Scab, Apple Rot, Apple Blotch; Pomegranate-Bacterial Blight, Aspergillus Fruit Rot, Gray Mold diseases have been observed and graded for Grape-Black Rot and Downy Mildiv, Powdery Mildew, Gray Mold, Apple Scab. Proper therapies are recommended after infections are identified.

It would also promote Indian Farmers to do smart farming which helps to take time to time decisions which also save time and reduce loss of fruit due to diseases. The leading objective of our paper is to enhance the value of automatic fruit disease detection

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