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# Recognition of Fruits Using Neural Classification Methods

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***Abstract***— Object recognition is emerging technology to detect and classify objects based in their characteristics. Fruit it is also a domain of object recognition and it is still a complicated task due to the various properties of numerous types of fruits. Different fruits have different shapes, sizes, color, textures and other properties. Tangerines and Madarin oranges have the same characteristics such as color, texture size, etc. Multi-feature extraction methods are based on supervised machine learning algorithms and image processing mechanisms. These algorithms are used to find a better fruit classification.

Firstly, we pre-process the training sample of fruits images. The preprocessing is included a separating foreground and background, scaling and cropping and it reduce the dimension. So the processing is fast then, we extract features the fruit's image, which includes color, texture and shape of the fruit image. Extracted features are then fitted into the neural classifier machine learning algorithm. This paper is obtained the results from the test sample is cross validated using machine learning network. The output obtained will give us the fruit that it has acknowledged.

***Keywords***— Classification, Feature Extraction, Neural Classifier, Object Recognition Fruit Classification.

## I.INTRODUCTION

Object Recognition implements pattern recognition of different objects. Pattern recognition builds up from different areas such as statistics and machine learning. To achieve good object detection, classification and recognition, different machine learning algorithms, it is not a guarantee that every algorithm gives accurate result. The achievement of accuracy. Also, while training the system, proper learning rate also plays a vital role.

For fruit classification and detection this project implements a portion of computer vision and object recognition with machine learning model. The rapid development of computer vision, image processing and recognition, advancement in computer technology provides the possibility of fruit classification through computer vision. In recent years fruit recognition using computer vision is being gradually applied in agriculture sector, education sector and supermarkets. Computer vision has been widely used in industries to aid automatic checking process. The important problem in computer vision and pattern recognition is shape matching. Shape comparison and shape matching can be carried out by using computer vision and image processing algorithms. Shape matching applications contain image registration, object detection recognition, and image content based retrieval. Many agricultural applications use image processing to automate their duty. Detecting crop diseases are one of these applications in which the crop images are analyzed in order to discover the affected diseases.

## II.METHODOLOGY

For this project, the ensemble machine learning algorithm is used to train the system. And three image processing algorithm for image feature extraction is used for feature extraction. These feature extraction algorithms are: Hue Histogram Feature Extraction, Haar-Like Feature Extraction and Edge Histogram Feature Extraction algorithm. For machine learning, Neural ensemble algorithm is used in this project for classification of fruits. Neural algorithm was used because it can be employed to advance the function of any machine learning algorithm. It is best used with weak learners. Weak learners are the models that have achieved accuracy just above random chance on a classification problem.

### *A. Algorithms*

There are two different types of algorithms followed by:
1. Feature Extraction Algorithm
2. Support Vector Machine

*1). Feature Extraction Algorithm:*

Feature extraction algorithms are listed and described below:

- Haar – Like Feature Extraction.
- Hue Histogram Feature Extraction.
- Edge Histogram Feature Extraction.

*(a) Haar - Like Feature Extraction:*

This is used to generate Haar – Like features from an image. These Haar – Like features are used by the classifier of

machine learning to help identify objects or things in the picture.

*(b) Hue Histogram Feature Extraction:*
This feature extractor takes an image to get the hue channel bins the number of pixels with a particular hue and the result is returned. This feature extractor takes in a color image and returns a normalized color histogram the pixel counts of each hue.

(c) *Edge Histogram Feature Extraction:*
This edge histogram method takes an image, to applies an edge-detector and the length and direction of lines are to be calculated in the image. It extracts the line orientation and length histogram.

*2). Support Vector Machine:*
SVM use an implicit mapping if the input data into a high-dimensional feature space defined by a kernel function, i.e a function returning the inner product h_(x),(x0) i between the image of two data points x,x0 in the space. The learning then takes place in the feature space, and the data points only appear inside dot products with other points. This is referred to as the "Kernel trick". Eqn(1) is followed by, if a projection X -> H is used, the dot product h_(x), _(x0) i can be represented by a kernel function k

$$K(x,(x0)=h\_(x),(x0)I \quad (1)$$

This is computationally simpler than explicitly projecting x and x0 into the feature space H. Select a valid kernel function, one can practically work in any dimension without any additional computational cost, feature mapping is never effectively performed. In fact, one does not need to know which features are used. Another advantage of SVMs and kernel methods is that one can design and use a kernel for a particular problem that could be applied directly to the data without the need for a feature extraction process. A lot of structure of the data is lost by the feature extraction process is the one important problem (e.g., text processing).

## III. FRUIT CLASSIFICATION USING SYSTEM:

We have implemented fruit classification in their "Classification of Fruits Using Computer vision and a Multiclass Support Vector Machine". In their project, first the fruit images were acquired by the digital camera. Second pre-processing of the image was carried out by removing the background of each image by split and merge algorithm. The input was a database of 1.653 images with 17 categories of fruits and each image size was 256 X 256. Texture and shape features of each pre-processed image were extracted to compose feature space.

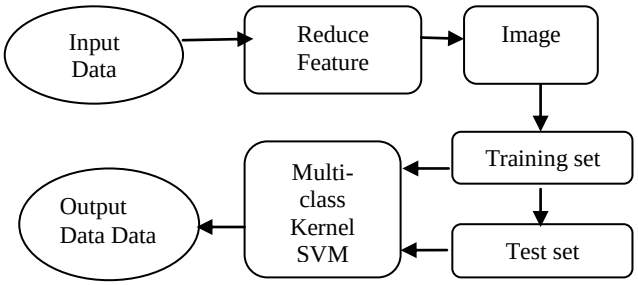


Fig. 1

The SVM algorithm for the fruits recognition steps as follows:

- The input is a database of 1,653 images consisting of 17 categories of fruits and each image size is 256 X 256.
- The feature extracted from each image size is 256 X 256. These features contain 64 color features seven texture, and eight shape features.
- The images are divided into training set and test set in the proportion of treated by 5 fold cross validation.
- The features are reduced to only 3 features selection standard is to SVM.
- Multi-class SVM is used to training set. The weight of the SVM are adjusted to make minimal the average error.
- The test data set is constructed by randomly sampling each group, and is used to analyze.

*A.SVM PROCESS:*

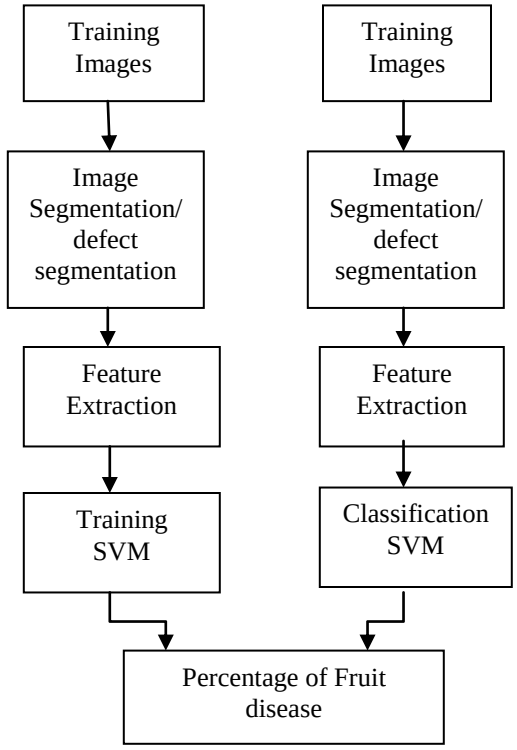


Fig. 2

## IV. IMPLEMENTATION OF RGB VALUES:

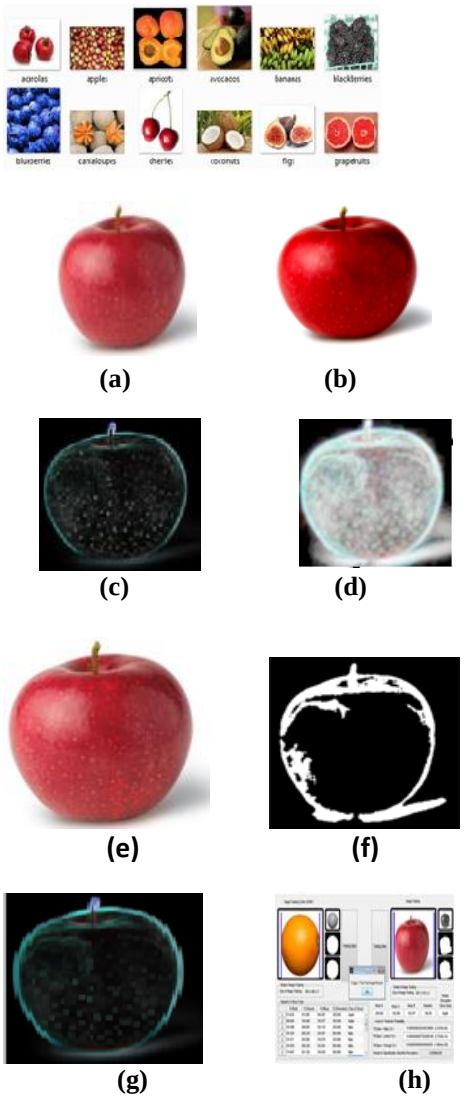
In RGB color model, each color appears in its primary spectral components of red, greed, and blue. The color of a pixel is having three components: Red, Green, and Blue (RGB), described by their corresponding intensities. Color components are color channels or color planes (components). In this process, the intensity function used by the color image. Eqn(2) as followed:

$$I\ RGB = (FR, FG, FB) \quad (2)$$

Where FR(x, y) is the red channel, FG(x, y) is the green channel and FB(x, y) is the blue channel.

The intensity of each color channel is usually stored eight bits which indicated that the quantization level is 256. Color image of a pixel is requires a total storage of 24 bits. A 24 bit memory can express as 224 = 256x256x256= 16777216 distinct colors. The number of colors should adequately meet the display effect of most images.

*A. Figures:*



(a) Input Image (b) Contrast Image
(c) Outer Layer (d) Inner Layer
(e) Classification Image
(f) Segmentation Image
(g) Output Image (h) Thin Layer

This images are using of my project from fruit diseases. In this paper, are followed by the fruit diseases using the machine learning algorithm.

The SVM results of their proposed algorithm are as follows:

For the experiment, three kinds of multi-class SVMs were constructed. Which were Winner-Takes- All SVM (WTA-SVM), Max-Wins-Voting SVM(MWV-SVM), and Directed Acyclic Graph SVM(DAG-SVM). In addition to that three kinds of kernels were chosen, i.e., Liner kernel(LIN). Homogeneous Polynomial kernel(HPOL), and Gaussian Radial Basis kernel(GRB). The experimental result were as follows:

*B. Tables:*

Table 1: Classification accuracy of SVMs

| Fruits | SVM | LIN | HPOL | GRB |
|---|---|---|---|---|
| Apple | ***WTA_SVM*** | 48.1% | 49.5% | 49.9% |
| | ***MWV_SVM*** | 46.3% | 45.2% | 47.3% |
| | ***DAG_SVM*** | 48.7% | 48.4% | 49.1% |
| Orange | ***WTA_SVM*** | 51.7% | 54.5% | 53.9% |
| | ***MWV_SVM*** | 57.1% | 53.1% | 52.4% |
| | ***DAG_SVM*** | 56.2% | 58.3% | 58.4% |
| Lemon | ***WTA_SVM*** | 61.4% | 67.3% | 63.5% |
| | ***MWV_SVM*** | 60.9% | 64.2% | 67.9% |
| | ***DAG_SVM*** | 69.2% | 64.9% | 62.8% |
| Mango | ***WTA_SVM*** | 78.1% | 73.3% | 75.5% |
| | ***MWV_SVM*** | 76.8% | 71.4% | 74.2% |
| | ***DAG_SVM*** | 73.3% | 76.6% | 78.9% |
| Grapes | ***WTA_SVM*** | 80.9% | 84.4% | 81.5% |
| | ***MWV_SVM*** | 85.2% | 84.9% | 87.3% |
| | ***DAG_SVM*** | 89.3% | 83.1% | 82.6% |

Table 2: Computation time of SVMs(in Seconds)

| | LIN | HPOL | GRB |
|---|---|---|---|
| WTA_SVM | 8.439 | 9.248 | 11.522 |
| MWV_SVM | 1.680 | 1.732 | 1.917 |
| DAG_SVM | 0.849 | 0.403 | 0.563 |

The experiment conclusion was that, using of Max-Wins-Voting SVM(MWV-SVM) with Gaussian Radial

Basis(GRB) kernel performed better in terms of classification but considering the computation speed, Directed Acyclic Graph(DAG-SVM) with GRB kernel performed better.

## V. CONCLUSION

This project aims to classify the percentage of disease in fruit images based on neural classifier. The project is designed in such way that it reads image, extracts features, preprocesses it, implements machine learning algorithm and generate output based on the input provided. The project has been able to classify the percentage of disease in fruit images based on the fruits features. The cross validation score obtained is with learning and the prediction accuracy of the system.

This result is satisfactory since the cross validation score and probability of prediction accuracy is very less than what was expected. In some cases, system doesn't predict the fruit images even the provided input falls under the training category. This problem of the fruit classification is also segmentation. In this paper, classify the percentage of disease in fruit images based on neural classifier. With this result, it can be concluded that the chosen ensemble machine learning algorithm is suitable for the fruit classification problem.

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