Classification of Fruits using Gabor and Sift Feature

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Abstract- The goal of this paper is to implement a fruit classification technique using an image processing algorithm for efficient feature extraction. Morphological features like Gabor and SIFT features are extracted from the fruit images and these are subject to threshold-based technique to classify the fruits from the images. An overall 77.14% recognition rate has been achieved. Like many other methodologies different fruit images may have similar or identical color and shape values. Hence, using color features and shape features analysis methods are still not effective enough to identify and distinguish fruit images.

I. INTRODUCTION

The fruit industry plays a vital role in a country's economic growth. They account for a fraction of the agricultural output produced by a country. It forms a part of the food processing industry. Fruits are a major source of energy, vitamins, minerals, fiber and other nutrients. They contribute to an essential part of our diet. Fruits come in varying shapes, color and sizes. Some of them are exported, thereby yielding profit to the industry. In agricultural science, images are the important source of data and information. To reproduce and report such data, photography was the only method used in recent years. It is difficult to process or quantify the photographic data mathematically. Several applications of image processing technology have been developed for the agricultural operations. These applications involve implementation of the camera-based hardware systems or color scanners for inputting the images. The computer-based image processing is undergoing rapid evolution with ever changing computing systems. The dedicated imaging systems available in the market, where the user can press a few keys and get the results, are not very versatile and more important, they have a high price tag on them. Additionally, it is hard to understand as to how the results are being produced. We have attempted to investigate the solutions through published literature which presents classification problems in a most realistic way possible. Consumption of fruits is important for human health because these foods are primary sources of some essential nutrients and contain photochemical that may lower risk of chronic disease. Because of many fruits available, classification of fruits is important to researchers who attempt tosses relationships among diet, health, and disease. For example, researchers who develop food frequency questionnaires often need to gauge their fruit questions to assess intakes of specific food components. Classification of fruits is also needed for dietary guidance materials to help people select appropriate types of these foods to meet their nutrient and health needs. Many countries have food guides with graphic depictions of the food groups and subgroups along with recommendations for consumption.

The fruit groups and subgroups vary from country to country because the focus of food guides is not only on the important components in fruits but also on which fruits are commonly available to and consumed by population groups. Gabor feature and SIFT feature, have been particularly successful in many computer vision and image processing applications. This system also serves as a useful tool in a variety fields such as educational, image retrieval and plantation science. Several fruit recognition techniques are developed based upon color and shape attributes. However, different fruit images may have similar or identical color and shape values. Hence, using color features and shape features analysis methods are still not robust and effective enough to identify and distinguish fruits images. A new Fruit classification system has been proposed. Proposed method classifies and recognizes fruit images based on obtained features values. This system also serves as useful tool in a variety fields such as educational, image retrieval and plantation science.

SIFT feature is a technique for detecting salient, stable feature points in an image. For every such point, it also provides a set of "features" that "characterize/describe" a small image region around the point. These features are invariant to rotation and scale. Gabor features is a technique to extract local pieces of information which are then combined to recognize an object or region of interest.

Recently, different features of color, size, shape, and texture are combined together for their applications in the food industry. Normally, by increasing the features used, the performance of the methods proposed can be increased. Moreover, both surface information (color and texture) and geometry information (size and shape) of food products in images play a significant part in defect detection and class discrimination. Thereby, to capture more proper information about the quality of food products from images, multiple kinds of features corresponding to the grading system of the food products should be proposed.

II. PROPOSED METHODOLOGY

We proposed a new methodology for the fruit classification. Fruits plays an important role in a human life and provide required information for the development of human society. Fruit classification is a challenging problem. The main goal of our proposed method is to classify the different kinds of fruits. We have used Gabor texture method to extract the feature of apple fruit and SIFT shape feature to extract the feature of banana fruit and instead of classifier we have used threshold technique.

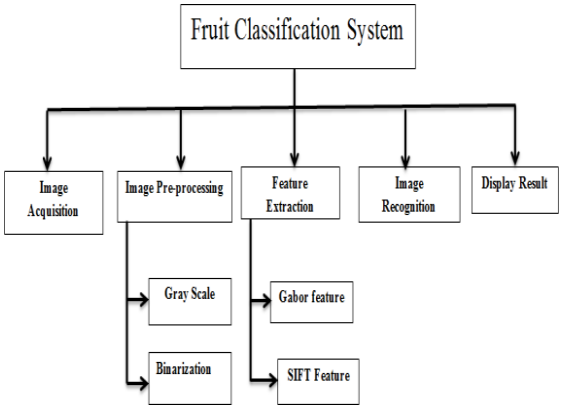


Fig.1: Proposed Architecture

FEATURE EXTRACTION

In image processing feature extraction is one of the important steps, it is a type of dimensionality reduction. When the input data is too large to be processed and suspected to be redundant then the data is transformed into a reduced set of feature representations. The process of transforming the input data into a set of feature is called feature extraction, feature contain information relative to color, shape, texture or context.

Gabor Texture Feature

The proposed project involves Gabor texture feature, it is one of the transform-based texture feature. Gabor filters are also popular as the Gabor wavelets, it is widely used signals processing method. The Gabor filters consists of parameters such as the radial center frequency, orientation and standard deviation. It can be used by defining a set of radial center frequencies and orientations. Although orientation may vary. As signal processing methods produces large feature size, the Gabor filters requires to be downsized for the prevention of the dimensionality issues Gabor filters provide means for better spatial localization. Texture based retrieval is to find images or regions with similar texture, it contains homogeneous features.

SIFT (Scale Invariant Feature Transforms)

For any object there are many features, interesting points on the object, that can be extracted to provide a "feature" description of the object. This description can then be used when attempting to locate the object in an image containing many other objects. There are many considerations when extracting these features and how to record them. SIFT image features provide a set of features of an object that are not affected by many of the complications experienced in other methods, such as object scaling and rotation.

The SIFT approach, for image feature generation, takes an image and transforms it into a "large collection of local feature vectors". Each of these feature vectors is invariant to any scaling, rotation or translation of the image. This approach shares many features with neuron responses in primate vision.

III. CLASSIFICATION

Instead of classifier we have used threshold based technique.

Threshold Technique

This project involves Threshold based technique instead of classifiers. This technique is one of the most successful technique that have been used in image recognition. Thresholding is a great way to extract useful information encoded into pixels.

The process is as follows,

1) Select initial threshold value, typically the mean 8-bit value of the original image.

2) Divide the original image into three portions;

- Pixel values less than the threshold.
- Pixel values greater than the threshold.
- Pixel values equal to the threshold.

3) Find the average mean values of the new images

4) Calculate the new threshold by averaging the means.

There are 2 conditions,

- If the obtained threshold value is below a specified limit, it indicates fruit is present.
- If the obtained threshold value is above the specified limit, it indicates fruit is absent.

IV. EXPERIMENTAL RESULTS AND OBSERVATION

DATA SET: We have used standard dataset, it has large number of collection of fruits. It consists of different kinds of fruit images like apple, banana and mixed fruits, which helps to our project.

Table1: Dataset of apple

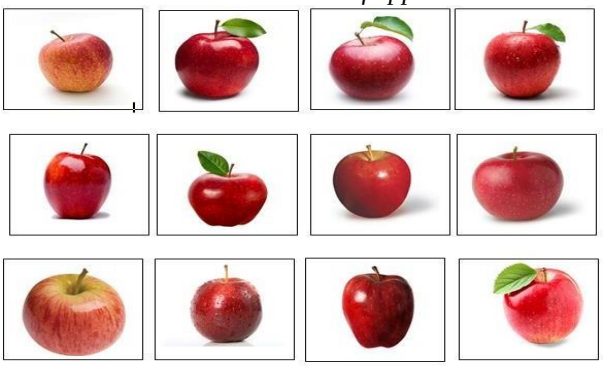


Table2: Dataset of banana

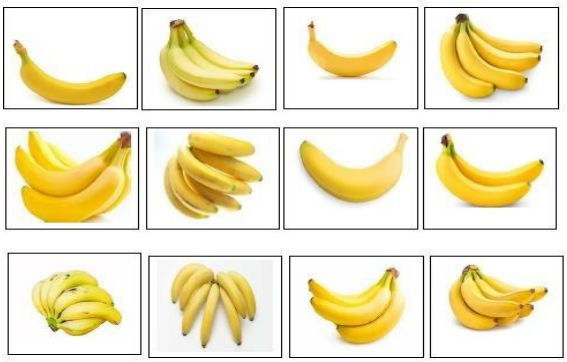
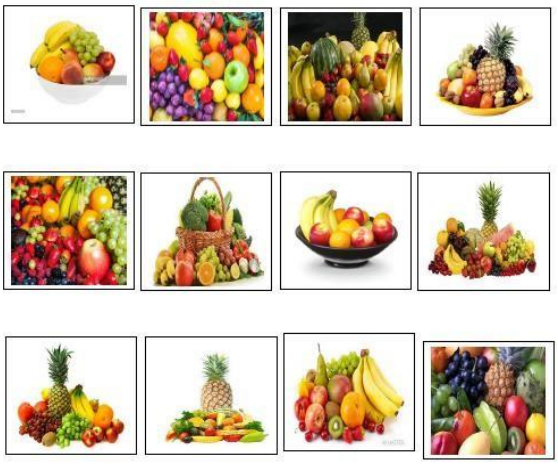


Table3: Dataset of Mixed fruits



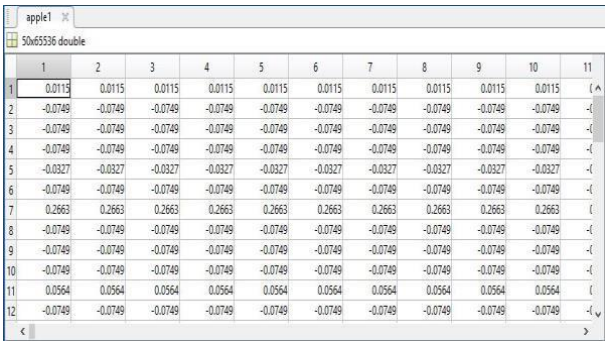


Fig2: Gabor feature matrix database

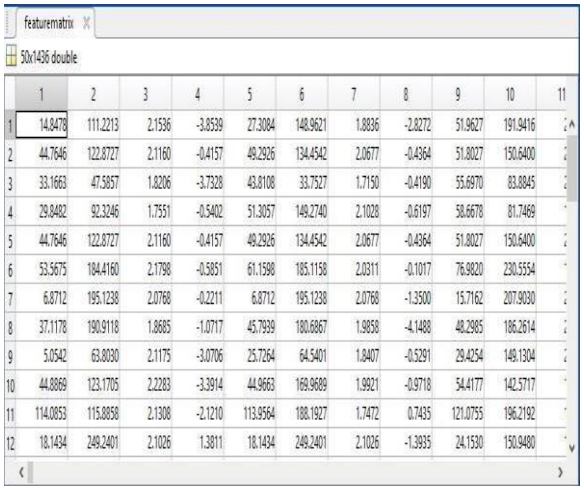


Fig3: SIFT feature matrix database

V. RESULT AND ANALYSIS

Here we are calculated using threshold- based technique, Firstly, threshold value is applied for both Gabor and SIFT features then if the mean value of the tested or taken images is less than the respective threshold value, then it belongs to the respective fruit image and it recognizes the presence of the fruit. Otherwise, it recognizes that the respective fruit image is absent(or not present).

There are 4 cases as output will obtain,

- Presence of only apple.
- Presence of only banana.
- Both apple and banana are present.
- Both apple and banana are absent.

These are the 4 cases which we will get as a result(output). Checking the accuracy has the formula as mentioned below, A =Total number of fruits recognized / Total number of dataset collected*100 Where A is the accuracy

VI. CONCLUSION

In this project automated fruit classification system is proposed. Oftentimes, when tackling complex classification problems, just one feature descriptor is not enough to capture the classes' reparability. Therefore, efficient and effective feature fusion policies may become necessary. Although normal feature fusion is quite effective for some problems, it can yield unexpected classification results when not properly normalized and preprocessed. Additionally, it has the drawback of increasing the dimensionality which might require more training data.

The proposed classifications for fruits and vegetables are offered to nutrition professionals as a means to more accurately group fruits and vegetables based on food components of public health significance; they may be useful for instructors to teach students about food composition; and they may help dietitians provide dietary guidance to patients and clients. This proposed work describes the various techniques implemented and used. The proposed work is an attempt to make a simple and effective tool for classification of fruits using image processing. This system also serves as a useful tool in a variety of fields such as education, image retrieval and plantation science with 77.14% accuracy.

VII. FUTURE WORK

In our project we have worked on the limited feature which we have concentrated only on Gabor texture feature and SIFT shape feature. And those extracted features are fed in to the threshold-based technique instead of classifiers. But it can also implement on the other features like shape, color, or different types of texture features like GLCM, LBP etc. These extracted features can be fed in to the ANN (Artificial Neural Network), KNN (K-Nearest Neighbor), SVM (Support Vector Machine). Fusion of classifiers can be done in the future.

VIII. REFERENCES

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