Digital Image Processing

Documentation of Fruit Recognition System

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1. Introduction:

The area of digital image processing signifies to process digital images using a digital computer. In this project, we have made the **Fruit Recognition System** to enhance the recognition of different fruits by using the modern technology. As everything is becoming more digitized, advancement in Digital Image Processing has also helped us to solve many real world problems more easily. We can easily process images using different image processing techniques to obtain various useful results. Fruit recognition is one of the interesting topics in this regard. In fruit recognition. Unrecognized fruit images are caused by variety of factors which may include different illuminations, specular reflections, and different poses of each fruit, variability on the number of elements, and maybe due to cropping or occlusions.

2. Objective:

There are almost 2000 different types of fruits in the world and most of them are very difficult to differentiate from each other. So the main aim of this project is to build an efficient and effective system that can distinguish between variety of fruits just through images and calculating various features using different image processing techniques.

3. Use:

This system will result in ease to the market persons in the markets to recognize the fruits more easily as this system is able to detect fruits by its size, shape, color and other features. As these features are results in utmost prevalent methods used for fruit image analysis.

4. Dataset:

Our project includes 14 different fruits identification. This dataset is taken from Kaggle and preprocessing is done before features extraction.

5. Platform Used:

For making this system, Jupyter Notebook is the platform we have used and implemented in python which has a lot of open source libraries that can be used in this regard.

Explanation:

We have used different libraries like numpy, matplotlib pyplot, matplotlib, glob, pandas, skimage.color, rgb2gray, rescale, resize, downscale_local_mean, train_test_split, feature, color, hog, seed, randint, KNeighnorsClassifier, accuracy_score and cv2. The library openCV is not

present in the Jupyter Notebook, so we have installed that library to the Jupyter Notebook. This library is designed to solve the computer vision problems. The other libraries that are used in the system helps to resize, provide colors and for other purposes. The technique we have used in this system is KNN.

6. K- NEAREST NEIGHBOR ALGORITHM:

KNN is a simple algorithm that stores all available cases and classifies all new cases based on a similarity measure. KNN is used in statistical analysis and patterns recognition that's why we have used this algorithm. Its purpose is to use a database in which the data points are separated into several classes to predict the classification of a new sample point.

Explanation:

KNN is a supervised learning algorithm that can be used for both classification and regression problems. This algorithm is based on the principle that **'similar things exist in close proximity'**. It mainly captures the idea of closeness and similarity which is measured using distance matrix.

Working:

The whole algorithm is based on the value of K which determines how many closest neighbors should be taken to label the test data. Different values of K yields different results and hence different accuracy.

The distance is measured between every test point to every trained data point and the results are stored and then measured for accuracy.

7. Accuracy:

After using this algorithm, we have used different values of K to check for better accuracy:

K=3, Accuracy is given as 93.20585842148088 %

K=5, Accuracy is given as 93.24654190398698 %

K=9, Accuracy is given as 92.47355573637104 %

8. STEPS OF RECOGNITION:

Following are the steps to recognize the fruits on the basis of different features.

Import Libraries:

In first step, different libraries are imported to perform the variety of functions. These libraries include cv2, numpy, pandas, matplotlib, globe, skimage, sklearn and random.

Import Dataset:

In this step, we have imported the training and testing dataset which consists of 15 different fruits given as:

Apple
Banana
Guava
Kiwi
Lychee
Mango
Orange
Papaya
Peach
Pear
Pineapple
Plum
Pomegranate
Strawberry

Load Dataset:

In this step, firstly testing and training datasets are loaded and stored and give them a label on the basis of the fruit images.

Train Dataset:

We have made a training function through which we train the images on the basis of color and shape features and then store the training images along with labels.

Preprocessing:

Preprocessing is divided into two portions:

Preprocessing Part 1 (Features Extraction):

In this part, we convert the images into gray scale also resized them.

Preprocessing Part 2 (Histogram):

In preprocessing part 2, we extracted the histogram and adjusted the shape of the images.

KNN Classification:

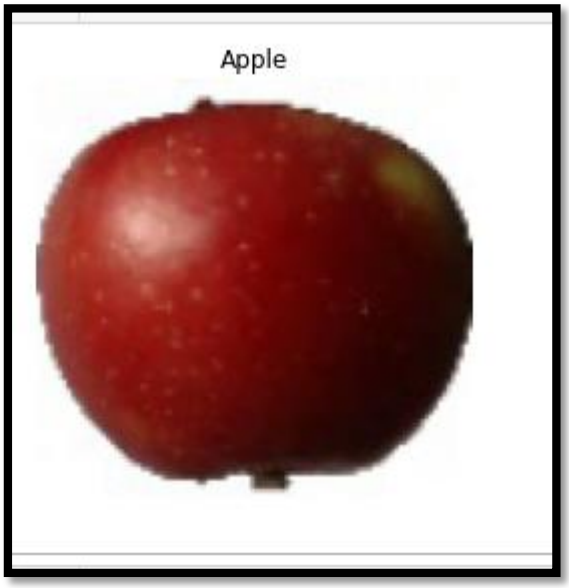
In this step, we applied the KNN algorithm to classify the different features by processing the data.

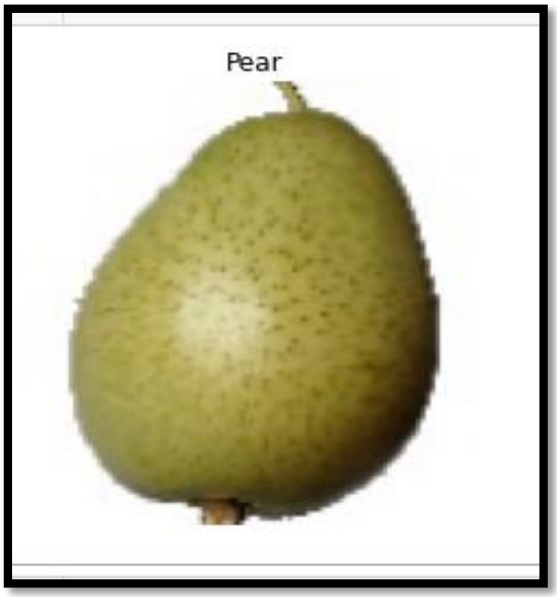
Accuracy:

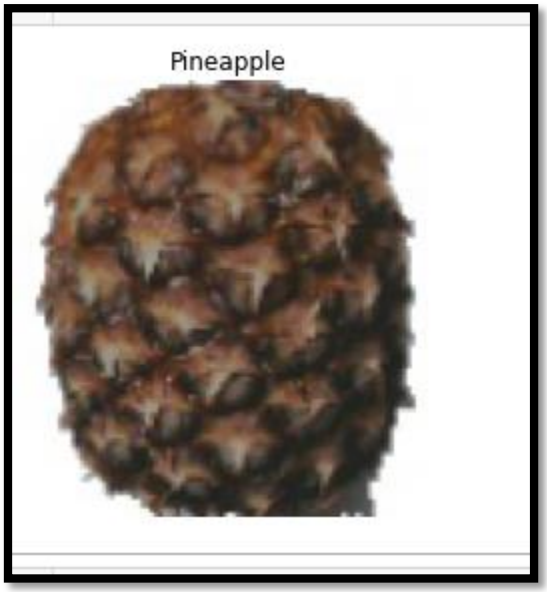
In this step, we find the accuracy rate of the applied algorithm which is KNN as mentioned above. It has given me the accuracy of 93%, which is a good technique.

Result:

In this step, we used the randint built-in function to find the results of the classification given as follow:







9. Conclusion:

An effective method to identify different fruits have been invented using KNN which have been proved to be efficient and reasonably accurate. It has also been concluded that combining features for prediction show better accuracy.

10. References:

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