

# Image Recognition using Texture and Color

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## ABSTRACT

Content-Based Image Retrieval (CBIR) technique uses visual contents to search images in a large scale image databases according to the users' choice. The recognition accuracy depends on the training data set, the potentiality of features and the classifier used. The visual contents of an image such as color, shape, texture etc. are used in CBIR to retrieve the image. Texture is one of the important feature used in CBIR system. It is semi-repetitive arrangements of pixels. Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image. In this paper color and texture feature entropy are combined to form a feature vector for kNN classifier. The algorithm is tested on a database of 2732 images from 6 different fruit classes. The higher recognition and retrieval accuracy is 97.85% for the proposed algorithm.

## General Terms

Your general terms must be any term which can be used for general classification of the submitted material such as Pattern Recognition, Security, Algorithms et. al.

## Keywords

CBIR, kNN, Entropy, RGB, Image Retrieval, Entropy

## 1. INTRODUCTION

CBIR has been an active and fast advancing area of research due to its diversified applications like recognition of fruits, books, medicines etc. from the respective images database. The distinguishing primitive characteristics of images are the features. Some natural features that correspond to visual appearance are luminance, shape descriptor and gray scale texture and are used by Gary et al [1], Gric et al [2], Mente et al [3]. The process of color classification involves extraction of useful information concerning the spectral properties of object surfaces and discovering the best match from a set of known descriptions or class models to implement the recognition task is carried out by Sahin et al [4]. Mente et al [3] have considered only the color features in different regions of an image and used the kNN classifier to retrieve input image from database and achieved an image retrieval accuracy of 93.53%.

According to Kartikeyan et al [5] and Harlick et al [6] texture analysis is one of the most active research in machine intelligence and pattern analysis which tries to discriminate

different patterns of images by extracting the dependency of intensity between pixels and their neighboring pixels or by obtaining the variance of intensity across pixels. Galloway et al [7] suggested that texture is the main feature utilized in image processing and computer vision to characterize the surface and structure of a given object or region. Since an image is made up of pixels, texture can be defined as an entity consisting of mutually related pixels and group of pixels. This group of pixels is called as texture primitives or texture elements (texels). As the texture is a quantitative measure of the arrangement of intensities in a region, the methods to characterize texture fall into two major categories: Statistical and Structural. Statistical methods characterize texture by the statistical distribution of the image intensity. Spatial distribution of gray values is one of the defining qualities of texture. Statistical methods analyze the spatial distribution of gray values, by computing local features at each point in the image, and deriving a set of statistics from the distributions of the local features. According to Chu et al [8] structural methods describe texture by identifying structural primitives and their placement rules. They are suitable for textures where their spatial sizes can be described using a large variety of properties. Gabor Filters and Wavelet Transforms are widely used for describing structural primitives.

For achieving efficient and effective retrieval performance and to increase the accuracy in the image retrieval, a method is proposed in this paper that uses the entropy a statistical measure of randomness to characterize the texture of the input image [9] and mean of pixel values in the red, green and blue color space.

## 2. FEATURE EXTRACTION METHOD

Entropy is one of the statistical measure used for characterizing the texture of the input image. Hence, entropy and three mean intensity values of the red, green and blue color space are considered as the features for identification and retrieval of the input image. In the following an algorithm is designed to extract these features.

### Algorithm 2.1 : FeatureExtract(input\_image)

Step 1 : Start

Step 2 : Input the color training / test image.

Step 3 : Calculate the entropy value of the image.

Step 4 : Calculate mean of each red, green and blue color space.

- Step 5 : Label the image.
- Step 6 : Store entropy and mean of the three color spaces as vector in the feature matrix.
- Step 7 : Store image labels and their index as vector in the other matrix.
- Step 8 : Repeat step 2 to step 7 for each training / test image.
- Step 9 : Stop

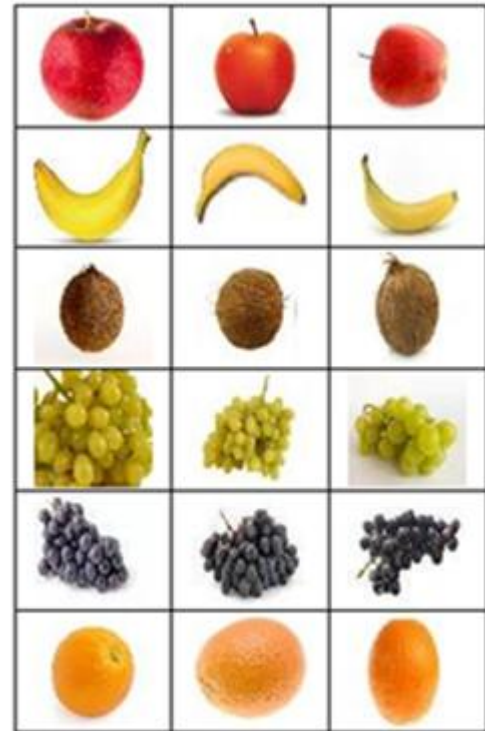
### 3. EXPERIMENTAL RESULTS AND ANALYSIS

The algorithm 2.1 is executed on a database consisting of 2732 different single fruit images downloaded from the internet. The details of the types of images and number of images are presented in Table 3.1 and sample images downloaded from standard database is presented in Table 3.2.

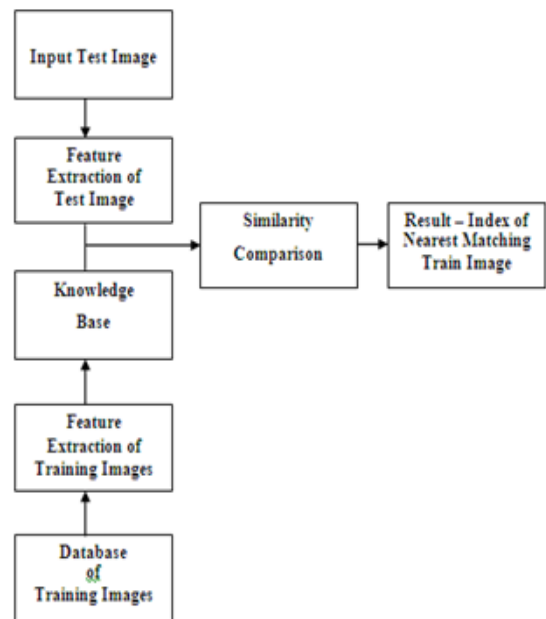
**Table 3.1 : Image Classes**

Image Classes	Class Name	No. of Images
1	Apple	627
2	Banana	405
3	Coconut	316
4	Grapes	387
5	Black Grapes	538
6	Orange	459
Total Number of Images		2732

Figure 3.1 presents the flow of the proposed algorithm. K-nearest neighbor algorithm is a part of supervised learning algorithm used for classification of objects. In this experiment the similarity comparison is performed with respect to the Euclidean distance and kNN classifier. The optimal value of k is found to be 1 for this experiment. The experimental results obtained from the proposed algorithm are presented in Table 3.3 and Table 3.4.



**Table 3.2 : Sample Images from Various Classes**



**Figure 3.1: Flow of Comparing Test Image and Training Images**

**Table 3.3: Percentage of retrieval accuracy for 50% training images and 50% test images**

Image Class Name	No. of Training Images	No. of Test Images	No. of Matches (k=1)	Percentage of Accuracy
Apple	314	314	296	94.27
Banana	203	203	193	95.07
Coconut	148	148	144	97.30
Grapes	194	194	179	92.27
Black Grapes	269	269	266	98.88
Orange	230	230	217	94.35
<b>Total</b>	<b>1358</b>	<b>1358</b>	<b>1295</b>	<b>95.36</b>

Here the isolated fruit images are considered for input image in the experiment. The average percentage of accuracy is 95.36 and which is reasonably high. The maximum recognition accuracy is 98.88% and minimum is 92.27% this leads to the smaller variation and confirming the consistency of the results.

**Table 3.4: Percentage of retrieval accuracy for 75% training images and 25% test images**

Image Class Name	No. of Training Images	No. of Test Images	No. of Matches (k=1)	Percentage of Accuracy
Apple	470	157	156	99.36
Banana	303	102	99	97.06
Coconut	222	94	94	100.00
Grapes	290	97	92	94.85
Black Grapes	403	135	135	100.00
Orange	345	114	108	94.74
<b>Total</b>	<b>2033</b>	<b>699</b>	<b>684</b>	<b>97.67</b>

The maximum recognition accuracy is 100% and minimum is 94.74% and exhibits the consistency of the proposed algorithm. Further, the average accuracy obtained for 50% training and 50% testing sample is smaller than the average accuracy obtained for 75% training and 25% testing sample images. This is obvious because as the training sample images increases the characterization of underlying image also increases.

#### 4. CONCLUSION

In this paper an image retrieval system is presented based on the entropy and three mean values of intensity values in red, green and blue color space. The percentage of accuracy in retrieval of query images is 97.67%. The combination of the color and texture features provides a robust feature set for image retrieval. The retrieval time is faster and at the same time, more accurate. Efforts are on to achieve the 100% accuracy or nearer to 100% by using shape descriptor features.

#### 5. REFERENCES

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