OBJECT RECOGNITION FROM IMAGE USING GRID BASED COLOR MOMENTS FEATURE EXTRACTION METHOD

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Abstract

Image processing is a mechanism to convert an image into digital form and perform various operations on it, in order to get an enhanced image or to extract some useful information from it. In Image processing system, it treats images as two dimensional signals while applying number of image processing methods to them. This leads to an increasing number of generated digital images. Therefore it is required automatic systems to recognize the objects from the images. These systems may collect the number of features of a image and specification of image and consequently the different features of an object will identify the object from the image. Image processing is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too. Its most common and effective method is retrieve the textual features from various methods. But most of the methods do not yield the more accurate features form the image. So there is a requirement of an effective and efficient method for features extraction from the image. Moreover, images are rich in content, so some approaches are proposed based on various features derived directly from the content of the image: these are the grid-based-color-moments (GBCM) approaches. They allow users to search the desired object from image by specifying visual features (e.g., colour, texture and shape). Once the features have been defined and extracted, the retrieval becomes a task of measuring similarity between image features. In this paper, we have proposed a number of existing methods for GBCM applications.

Keywords- *object, grid-based-color-moments (gbcm), features, feature extraction, textual features, Image Processing, Digital form, Object Identification*

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1. INTRODUCTION

Object Recognition is the task of finding a given desired object in an image sequence or video sequence [1]. Thus object recognition is a problem of matching features from a database with extracted representations from the image dataset. So Object recognition is concerned with determining the identity of an object being observed in the image from a set of known labels [7]. Oftentimes, it is assumed that the object being observed has been detected or there is a single Object in the image [5].

Object recognition is one of the most fascinating abilities that humans easily possess since childhood. With a simple glance of an object, humans are able to tell its identity or category despite of the appearance variation due to change in pose, illumination, texture, deformation, and under occlusion. Furthermore, humans can easily generalize from observing a set of objects to recognizing objects that have never been seen before. For example, kids are able to generalize the concept of “chair" or “cup" after seeing just a few examples [3].

Color moments analysis (CMA) is a very popular and effective for color-based image analysis [1]. It is especially important for classification of images based on color, texture properties, face recognition, image retrieval, and identification of Image angle at various degrees. Here we will discuss the basic methodology to calculate CMs of a given image and sample code. Color moments to be calculated are in fact statistical moments.

An image has to be partitioned into sub-blocks. Deciding optimal number of sub-blocks is a qualitative question and has to be decided as per the type of the application. In general, at least 7*7 and not more than 9*9 is a good choice. Here we partition an image using 9*9 sub-blocks. This gives total of 81 blocks [8].

Since any color distribution can be characterized by its moments and most information is concentrated on the low-order moments, only the first moment (mean), the second moment (variance) and the third moment (skewness) are taken as the feature vectors [2]. The similarity between two color moments is measured by the Euclidean distance. Two similar images will have high similarity [6]. However, if two images have only a similar sub-region, their corresponding moments will be different and the similarity measure will be low.

Color moments are measures that can be used differentiate images based on their features of color. Once calculated, these moments provide a measurement for color similarity between images [4].These values of similarity can then be compared to the values of images indexed in a database for tasks like image retrieval [1]. The basis of color moments lays in the assumption that the distribution of color in an image can be interpreted as a probability distribution [8].Probability distributions are characterized by a number of unique moments (e.g. Normal distributions are differentiated by their mean and variance). It therefore follows that if the color in an image follows a certain probability distribution, the moments of that distribution can then be used as features to identify that image based on color [9].Moments are calculated for each of these channels in an image. An image therefore is characterized by 9 moments- 3 moments for each 3 color channels.

Section 1 throws lights on the introduction of image processing and object recognition. Section 2 explains about the related researches that have been done in the field of object identification. Section 3 covers the problem statement that has been proposed. Many papers and researches have been put in front for object recognition. Section 4 details with the experimental set up and result. And at last section, it focuses on the conclusion and future scope.

2. RELATED RESEARCH

Many scholars have published tons of research work on object recognition techniques and methods. Mas Rina Mustaffa, Fatimah Ahmad, Rahmita Wirza O.K. Rahmat, Ramlan Mahmod presented context baesd image retrieval based on color spatial features [2]. Jau-Ling Shih and Ling-Hwei Chen gave a way of Color Image Retrieval Based on Primitives of Color Moments [3]. They have concluded and proposed a new color image retrieval method based on primitives of color moments.David G. Lowe introduced Object Recognition from Local Scale-Invariant Features [4]. J F Dale Addison, Stefan Wermter, and Garen Z Arevian presented texts upon the comparison of various feature extraction techniques and selection techniques [5]. Noah Keen focused upon the color moments of am Image [6].

3. PROBLEM STATEMENT

The problem statement is to classify the image's object into certain classes using the rich set of datasets of various features of image. Till now the datasets of object's features are not clearly identified [1].We have identified more than 15 properties to extract the features of object. This will help to increase the possibilities and efficiency for identifying the objects from an image. The relationship among the various models is illustrated in Fig. 1.

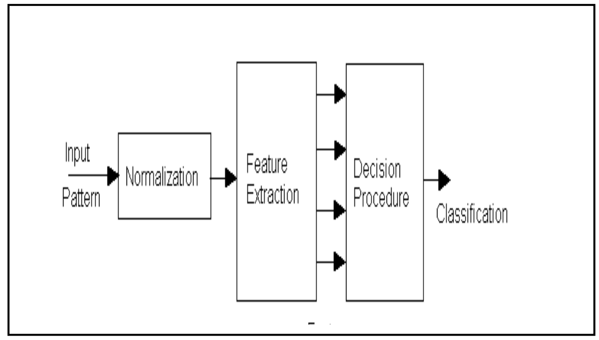

Fig 1: Feature Extraction Process

Proposed systems collect the number of features of a image and specification of image and consequently the different features of an object will identify the object from the image. As the number of properties increase lead to increase in the efficiency and correctness in object identification. The main task is to choose the highly matched data sets and hence the object in the image.

4. PROBLEM SOLVING USING GBCM METHOD

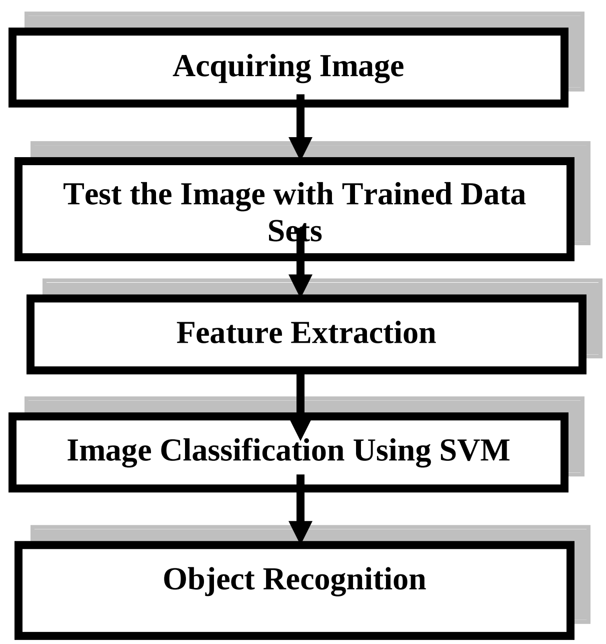

Fig 2: Various stages of object recognition process

4.1 FEATURE EXTRACTION

In this paper, we have proposed a new method for solving object recognition problem. We will define the i-th color channel at the j-th image pixel as Pij

The three color moments can then be defined as:
Mean :

$$E_i = \sum_{N}^{j=1} \frac{1}{N} p_{ij}$$

Mean can be understood as the average color value in the image
.
Standard Deviation:

$$\sigma_i = \sqrt{\left(\frac{1}{N}\sum_{N}^{j=1}(p_{ij} - E_i)^2\right)}$$

The standard deviation is the square root of the variance of the distribution.
Skewness :

$$s_i = \sqrt[3]{\left(\frac{1}{N}\sum_{N}^{j=1}(p_{ij} - E_i)^3\right)}$$

Skewness can be understood as a measure of the degree of asy mmetry in the distribution.

Many other image properties have been introduced for better performance of the system. Those are listed as below:

- **Auto Correlation**
- **Contrast**
- **Energy**
- **Entropy**
- **Homogeneity**
- **Sum Variance**
- **Sum Average**
- **Difference Entropy**
- **Maximum Probability**
- **Dissimilarity**
- **Cluster Prominence**

GBCM():
Here GBCM() function has been using to extract the three features i.e. Mean, Standard Deviation and Skewness of an image. Here variable 'i' is used for loop iteration.

```
GBCM((i-1)*9+1) = mean(reshape(block(:,:,1), 1, []));
GBCM((i-1)*9+2) = std(reshape(block(:,:,1), 1, []))^2;
GBCM((i-1)*9+3) = skewness(reshape(block(:,:,1), 1, []));
```

reshape():
B = reshape(A,m,n) returns the m-by-n matrix B whose elements are taken column-wise from A. An error results if A does not have m*n elements.

4.2 CLASSIFICATION USING SVM

Support vector machine are supervised learning models with associated learning algorithms that analyse data and recognize patterns, used for classification and regression analysis [7].

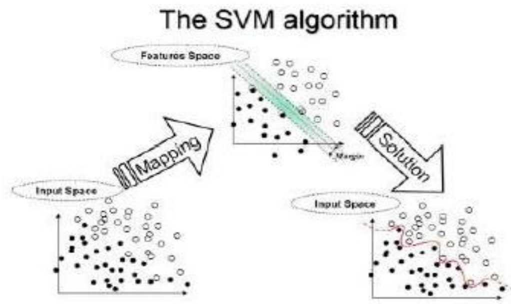

Fig 3: The SVM Algorithm

SVM object can be created in one of two ways - an existing SVM can be loaded from a file, or a new SVM can be created a trained on a dataset. Support Vector Machines (SVM) has recently gained prominence in the field of machine learning and pattern classification [8].Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.

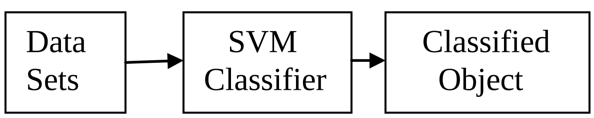

Fig 4: Block Diagram of SVM

The datasets are provided to the SVM Classifier as an input and consequently the classified objects are produced as an output.

5. EXPERIMENTAL SET UP AND RESULT

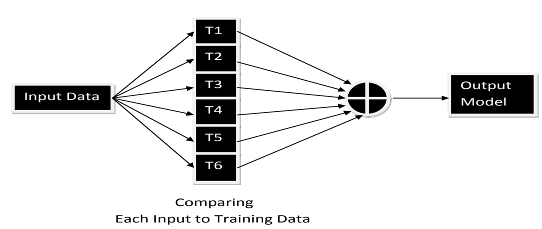

Fig 5: Comparing testing data with trained data

First of all Input data are considered, each input data are compared with training data that can be up to 'n' numbers. Now the result obtained from training data set that is the maximum match found is passed into a next stage where collaboration of data sets are done and finally the result obtained from collaboration are passed into next stage which is called as output model. Finally output model is created.

In our system, number of images has been through to the MATLAB programs. We have prepared training data sets for images of different types and 18 features have been extracted. In our project around 50 training data images have been tested with trained data sets and for testing 20 images have been inputted to SVM program in order to test the final result and at last output efficiency has been observed in percentage as 81%.

CONCLUSION AND FUTURE WORK

In this paper we have focused on the different type of Feature Extraction Techniques and applied to the input training data sets. In future more techniques can be involved for better efficiency and result. There are many more complex modifications we can make to the images. For example, you can apply a variety of filters to the image. The filters use mathematical algorithms to modify the image. Some filters are easy to use, while others require a great deal of technical knowledge. There are lots of possibilities in the fields of image processing. There are number of algorithms in pre-processing of images.

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