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Retrieval of Images Using Data Mining Techniques

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***Abstract* -** This paper presents the Content Based Image Retrieval System .The Content Based Image retrieval (CBIR) is up-and-coming exploring area that deals with image retrieval using visual feature extraction, multidimensional indexing, and retrieval system design. Color, Texture and Shape information have been the primitive image descriptors in content based image retrieval systems. The goal is to retrieve the images from the database. Database contains lot of images which belongs to different categories. There are several methods to retrieve the images from large dataset, but they have some drawbacks. In this paper, techniques like clustering, association rules mining are used to mine the data. This paper also uses the fusion of multimodal features like visual and textual features. The proposed approach is simple and shows good results in term of efficiency.

***Keywords* -** Content based image retrieval, k-clustering, Association rule mining

I. INTRODUCTION

In today's world data mining plays an important role in every field. So a large volume of electronic data is created in each second. Most of the data are converted and stored in digital form. The data may be in the form of text, images, audio and video. An image retrieval system is a system for browsing, searching and retrieving images from a large database of digital images [2].

The traditional image retrieval systems are text based. It uses the manual annotation of images. As images are always considered better than the text because it conveys more information than the text. But there are some limitations also. One of them is image annotation. The large volume of the databases makes this process very difficult. Moreover the annotation is valid only for one language. Second problem arises in the human perception. Individual personal impressions and opinions about an image are different. So it is subjective to human perception. Third problem is with the deeper needs. That means the queries that cannot be described at all.

The solution to solve these problems is CBIR (content based image retrieval) systems. CBIR is also known as query by image content (QBIC) and content-based visual information retrieval [7]. CBVIR is popular application of computer vision techniques to solve image retrieval problems i.e. the problem of searching for digital images in large databases.
Here, "Content-based" means the search analyzes the contents of the image rather than the metadata (such as keywords, tags, or descriptions) associated with the image. The term "content" in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. If a user wants to search for car images, then he can submit an existing car image or his own sketch of car as a query. The system will extract image features for this query. It will compare these features with other features of images in database. Then system will return the relevant images to the user. In CBIR system the visual features like color, shape etc are used. It leads to "semantic gap" problem. To solve this problem, it is proposed to use amalgam of multimodal features i.e to use visual as well textual features for image retrieval. This concept helps in increasing the system efficiency. The objective of the work is to provide efficient technique for image retrieval as compared to existing techniques. For this purpose, the concept of image mining is adopted.

The paper is organized as follows: Section II covers the related work in the area of image processing. Section III covers the detail discussion on image mining. The proposed architecture is given in section IV. The experimental results are included in section V. Section VI concludes the research work**.**

II. RELATED WORK

Raniah A. Alghamdi [3] proposed a method in which it uses the multimodal feature of the images. Multimodal feature includes both the textual and visual features. It uses association rule mining in its method. Its main focus is on generating rules at online and offline phase. The semantic

association rules mining is constructed at the offline phase where the association rules are discovered between the text semantic clusters and the visual clusters of the images to use it. Later at the online phase achieved the precision score among different query categories.

A. Kannan [6], proposed the new concept of CBIR and image mining. It combines clustering techniques with other methods to speed up CBIR system. The main objective of the image mining is to remove the data loss and extracting the meaningful information to the human expected needs.

J. Priya , Dr. R. Manicka Chezian[1] argued that Image mining is an expansion of data mining in the field of image processing. It presents a survey on various image mining techniques.Image mining focuses on image mining implementations, usability and challenges in various fields.

Ruhan He , Naixue Xiong , Laurence T. Yang and Jong Hyuk Park [10], proposed a method based on the semantic rules. It fuses the two modalities of web images automatically, and improves the retrieval precision remarkably and demonstrates the benefit of multi-source information fusion technology.

The next section covers the detail discussion on image mining.

III. IMAGE MINING

Image mining is the new turn of data mining. Image mining deals with the extraction of images that follow some pattern from a large collection of image database. Image mining is different from low-level computer vision and image processing techniques because the focus of image mining is to extract the patterns from large collection of images, where as the focus of computer vision and image processing techniques is to understand and/or extract specific features of a single image. The goal is to discover image patterns that are significant in a given collection of images .Image mining is concerned with the knowledge discovery in image databases as it remove the data loss and extract the meaningful information like its color, shape, size etc [1]. The working of image mining process is as follows:

The image mining processes are shown in Figure 1. In image mining process, there are several steps as in the knowledge discovery. It includes data cleaning, data integration, data selection etc. The figure 1 also depicts image database that contain lot of images. First it needs to preprocess the images. Then perform feature extraction (color, shape, size) of that image. Then interpretation and evaluation of the information is carried out.. At last knowledge is obtained.

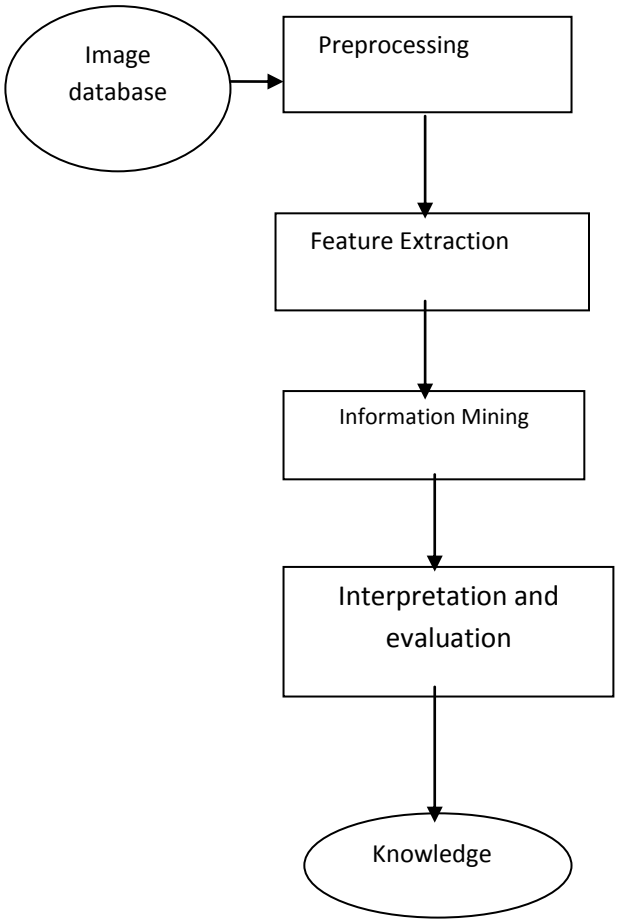

Figure 1. Image mining

Image mining has an important application in the area of medical imagery and patient records [4]. To develop an accurate diagnosis both image data like x-rays and patient data such as weight, family data etc are examined together to get interesting associations.

IV. PROPOSED SYSTEM

The various functional components of proposed system are shown in figure 2. The image database contains number of images with their extracted features. The features include both visual and textual features. First of all, the visual features of image are extracted followed by textual features. Next, clustering of both the extracted features are performed resulting in two clusters namely: visual features cluster and textual features cluster. To discover the hidden association between these features, association rules mining algorithm is applied on both clusters.

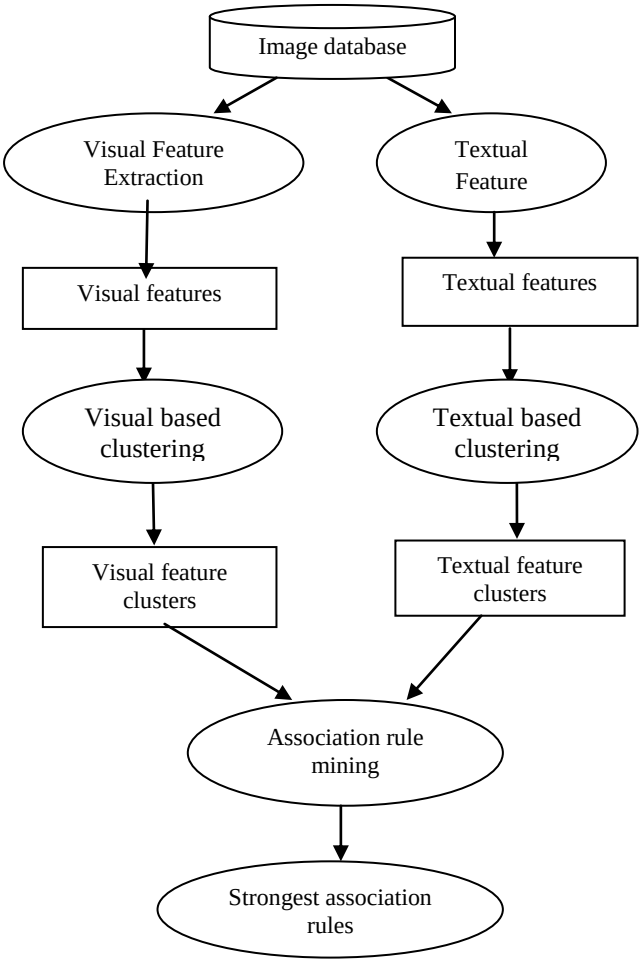

Figure 2. Architecture of image retrieval system

The detail discussion of each sub process is given in following subsections.

4.1 Features Extraction

Features are divided into two categories - text based and visual based. Textual features are keywords, tags, annotations etc. Visual features are color, space and texture etc. Visual features are the important features of an image for pattern recognition.

Visual Features:- The visual descriptors describes the basic features of image like shape , color ,texture etc . The use of visual features makes the image retrieval process more efficient because these features can be further classified and also because of perception subjectivity and the complex composition of visual data.

Textual Features:- It is an important factor in case of images . Now a day's most of the images are text based. The texts in the images are human submitted annotations or it is already surrounded by text.

4.2. Fusion of multimodal features

The fusion of multimodal consists of fusion of textual features and visual features. It can be done in different levels like early fusion, late fusion and transmedia fusion. The fusion of multimodal features has a potential to improve the retrieval performance because it include both the textual and visual features.

4.3 Clustering

Cluster is a group of objects that belongs to the same class. Clustering helps in distinguish the similar and dissimilar objects. Similar objects are in the one cluster and dissimilar objects are in another cluster. It generally finds out the similarities between the data of the same qualities. This is based on the unsupervised learning. Clustering are of different types like k-mean and k-medoid clustering. Here k-means clustering is used.

K-means clustering is a method commonly used to automatically partition a data set into k groups. It proceeds by selecting k initial cluster centers and then iteratively refining the results. The algorithm converges when there is no further change in assignment of instances to clusters. The runtime complexity of the algorithm is O(n). The algorithm for K-means clustering is outlined in figure 3.

4.4 Generate Strongest Association rules

Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a transactional database , relational database or other information repository. For example find all items which are frequently purchased with milk . Using association rules mining algorithm generate association rules from the textual clusters and visual

K-means clustering algorithm:

Repeat for all feature vectors

1. Identify clusters with same target category and predictions. New data items are identified by assuming that they are of the same type as nearest cluster center.

2. Suppose the given feature vectors (a1, a2… am) all belong to same class "C" and there exist a cluster "z" clusters such that z<m.

3. If clusters are well separated, The minimum distance classifier is used to separate them.

4. Initialize the means of "z" clusters that are µ1 µ2… µz. One of the ways to do this is to assign random numbers to them.

5. Determine the membership of "a" by taking the | |a-µi| |, where (i= 0,..,1…..z).. The minimum distance determines as membership in a respective cluster.

Figure 3 Steps of K-means clustering

clusters. Association rules can be generated by constructing transaction database, mining frequent itemset or calculate support and confidence. Here it is generated by finding support and confidence.
The association rules which is equal to or greater than minimum confidence and support consider as strong association rules.

The rule X U Y holds with support s if s% of transactions in domain D contains X U Y. Rules that have a s greater than a user- specified support is said to have minimum support. The rule X -> Y holds with confidence c if c% of the transactions in D contain X also contain Y. Rules that have a c
greater than a user-specified confidence is said to have minimum confidence.

4.5 Similarity checking

The retrieval process starts with feature extraction for a query image. The feature of the images in the database are pre-computed and stored. Using these predefined features the resemblance between the query images and other images are evaluated and stored. Here similarity checking, is done on the basis of the images in the training dataset or databases that have similar strongest association rules as query(input) images.

V. EXPERIMENT

5.1 Dataset and Tools

The experiment is done on the dataset of 700 images. Dataset is taken from the Image CLEF 2011 Wikipedia collection. The images belong to the different categories like vehicles, monumental, entertainment etc. Images have user provided annotation in three different languages. The tool used to perform this experiment is Mat lab. Mat lab is a high level language. It has many specialized toolboxes for making things easier for us. A very large database of built in algorithms for image processing and computer vision applications are encoded with it. It also supports data mining techniques like clustering, association rules etc.

5.2 Experimental Setup

This experiment is repeated for 5, 6 times. After analyzing the results set the minimum support as 2% and minimum confidence as 70%.

5.3 Experimental Results

To evaluate the performance of the system, two measures "precision and recall" are used.

$$Precision = \frac{Number\ of\ relevant\ images\ retrieved}{Total\ number\ of\ images\ retrieved}$$

$$Recall = \frac{Number\ of\ relevant\ images\ retrieved}{Total\ number\ of\ relevant\ images\ in\ the\ database}$$

Comparing to other image retrieval methods, this system produces good result. The performance measures are higher than the existing methods The plot of precision and recall is given in figure 4.

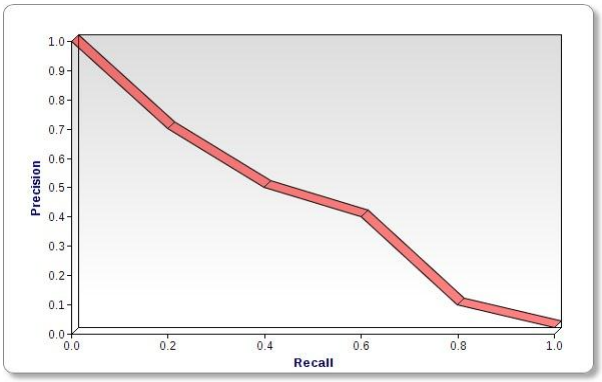

Figure 4. Precision –Recall graph

VI. CONCLUSION

Image Mining is used to extract the meaningful potential information to the human expected needs. Retrieving useful image from the database becomes a challenge. There are several Content Based Image Retrieval systems existing in this present scenario. The proposed method uses k-means clustering and similarity matching. The method uses both textual and visual features followed by clusters and generate association rules. The proposed image retrieval system obtained significant values of precision and recall.

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