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RESEARCH ARTICLE

IMAGE PROCESSING TECHNIQUES FOR THE RECOGNITON OF INDIAN SIGN LANGUAGE IN IMAGE MINING: A SURVEY

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ABSTRACT

Sign Language Recognition System is one of the most growing researches today. Many new Techniques are having been developed recently in the field of Sign Language Recognition. This system becomes popular because it is only one of the efficient way through which the deaf and dumb people can convey their message to other people. The main aim of this paper is to present a survey of the various techniques used for image mining techniques for the Indian Sign Language Recognition like Histogram equlization, Neural Networks, RGB color Segmentation techniques etc., given by different researchers.

INTRODUCTION

Image mining is an interdisciplinary endeavor that draws upon expertise in various fields like computer vision, image retrieval, matching and pattern recognition. Some methods allow image mining to have two different approaches. First method extracts images from image databases or collection of images. Second method mines a combination of associated alphanumeric data and collection of images. Research in Image mining can be broadly classified in two main directions (1) Domain specific applications (2) General applications. Both are used to extract most relevant image feature and later to generate image patterns. A vast amount of image data is generated in daily life and in various fields like medical, astronomy, sports and all kinds of photographic images. It is still at the experimental stage and growing field of research. Lack of understanding in the research issues of image mining is the obstacle to rapid progress (Gajjar *et al*., 2012). Image data plays vital role in every aspect of the systems like business, hospitals, engineering and so on. Image mining normally deals with the study and development of new technologies that allow easy analysis and interpretation of the images. Image mining is not only the simple fact of recovering relevant images but is the innovation of image patterns that are noteworthy in a given collection of images.

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The establishment of image mining system is frequently an complicated process because it implies joining diverse techniques ranging from image retrieval and indexing schemes up to data mining and pattern recognition. This paper presents many different views about retrieval, matching, pattern recognition which will be very useful while extracting features like shape, color, size, texture, imprint etc from large image databases. The number of features required to represent an image can be very huge. Using all available features to recognize objects can suffer from curse dimensionality. Feature selection and extraction is the pre-processing step of image mining. Main issues in analyzing images is the effective identification of features and another one is extracting them (Salam *et al*., 1996).

Shaikh Nikhat Fatma, 2012 describes the importance of Image mining in which images can be retrieved according to some requirement specifications. Image retrieval can have logical features like objects of a given type or individual objects or persons using edge detection techniques to retrieve the specified image. Continuing advancements in both hardware and software coupled with higher end image processing and image vision tools, have made it possible to store huge amount of images. This increase in number of images and image databases has necessitated the need for image mining techniques.

Image mining an important research area not only from engineering point of view but also for its impact on the society. Sign languages are non verbal visual languages, different from spoken languages, but they serve the same function. There are different sign languages all over the world such as American Sign. Language (ASL), British Sign Language (BSL), Japanese Sign Language family (Japanese, Taiwanese and Korean Sign Languages), French Sign Language family (French, Italian, Irish, Russian and Dutch Sign Languages), Australian Sign Language, etc. Similarly Indian Sign Language was also developed for Indian deaf community. It is different in the phonetics, grammar, hand gestures and syntax from other country's sign languages. Designing a hand gesture recognition system for ISL is more challenging than other sign languages due to the following reasons (Geetha *et al*., 2012):

- ISL uses both hands to make gestures to represent most of the alphabets.
- ISL uses static and dynamic hand gestures.
- Facial expressions are also included.
- One hand moves faster than the other at times in dynamic hand gestures.
- Many of the gestures result in obstruction.
- Complicated hand shapes.
- Locations of the hand with respect to body contribute to the Sign.
- Head/Body postures.
- ISL Involves both global and local hand motion.

Literature Review

An image retrieval system is a Computer system for Searching, browsing and retrieving images from large databases. Chary *et al.* (2012) described the retrieval of images within a large image collection based on color projections and different mathematical approaches which are introduced and applied for retrieval of images. Images are sub grouping using threshold values, they considered R,G,B color combinations for retrieval of images, which are implemented and results are included, and through results it is observed that it obtaining efficient results comparatively to the previous one and existing. This method provides the best solution in large image set compared with total of 10000 images with different categories. All suggested methods are helpful to perform the good results and based on query images required images retrieved from the database. So best one is to select the combinations of colors mean with median and standard deviation, expect best performs and good results.

Daniele Cerra and Mihai Datcu (2012) explains that almost ten seconds would be needed to process five RGB images of size 256x256, in the case of images datasets but cause a major drawback for compression-based analysis in real applications, where usually medium-tolarge datasets are involved. To avoid that problem another author Vamsidhar Enireddy *et al*. (2012) says that the digital medical images are stored in large databases for easy accessibility and Content based image retrieval (CBIR) is used to retrieve diagnostic cases similar to the query medical image. Haar wavelet is used for image compression without losses. Edge and texture features are extracted from the medical compressed medical images using Sobel edge detector and Gabor transforms respectively. The classification accuracy of retrieval is evaluated using Naïve Bayes and Support Vector Machine. The digital medical images are stored in large databases for easy accessibility and Content based image retrieval (CBIR) is used to retrieve diagnostic cases similar to the query medical image. CBIR uses algorithms to extract relevant features from the image, on presenting a query image. CBIR retrieves images from the database based on the features such as color, texture, edge and shape in the images which are automatically extracted by CBIR systems. Stanchev (2003), using image mining in image retrieval, described a new method for image retrieval using high level semantic features. It is based on extraction of low level color, shape and texture characteristics and their conversion into high level semantic features using fuzzy production rules, derived with the help of an image mining technique. Dempster-Shafer theory of evidence is applied to obtain a list of structures containing information for the image high level semantic features.

Johannes Itten theory is adopted for acquiring high level color features. The main advantage of this method is the possibility of retrieval using high level image semantic features. After the full system realization it will be able to obtain statistic characteristics about the usefulness of the suggested method. Aswini kumar mohanty *et al*. (2010) says that, before proceeding to the first stage preprocessing it is necessary to improve the quality of image and make the feature extraction phase as an easier and reliable one. Feature extraction methodologies analyze objects and images to extract the most prominent features that are representative of the various classes of objects. Features are used as inputs to classifiers that assign them to the class that they represent. Janani *et al*. (2012), proves that Image mining is a vital technique which is used to mine knowledge from image. The function of image mining is to retrieve similar image from huge database. The development of the Image Mining technique is based on the Content Based Image Retrieval system. Color, texture, pattern, shape of objects and their layouts and locations within the image, etc are the basis of the Visual Content of the Image and they are indexed. Especially for the image retrieval, it is not a single image but a list of images ranked by their similarities with the query image. Many similarity measures have been developed for image retrieval based on empirical estimates of the distribution of features in recent years. Different similarity measures will affect retrieval performances of an image retrieval system significantly.

Matching is the technique to find existence of a pattern within a given description. Image matching is an important application requirement in the field of image mining. A lot of matching techniques have been developed till today and still research for developing an optimized matching technique is going on. Most commonly used matching technique is nearest neighborhood technique which is an important technique used in applications where objects to be matched are represented as n-dimensional vectors. Other matching techniques used are least square method, coefficient of correlation technique, relational graph isomorphism technique, approximate nearest neighbor technique and matching using simulated annealing

etc. all of these matching techniques have their own advantages and disadvantages. So, the matching technique should be chosen depending upon the application area in which it is to be applied. (Ruen, 1984) says that The Adaptive Least Squares Correlation is a very potent and flexible technique for all kinds of data matching problems. Here its application to image matching is outlined. It allows for simultaneous radiometric corrections and local geometrical image shaping, whereby the system parameters are automatically assessed, corrected, and thus optimized during the least squares iterations. The various tools of least squares estimation can be favourably utilized for the assessment of the correlation quality. Furthermore, the system allows for stabilization and improvement of the correlation procedure through the simultaneous consideration of geometrical constraints, e.g. the collinearity condition. Finally, the adaptive least squares correlation can be applied to a great variety of data matching problem, which focuses mainly on its utilization for image matching. The technique shows a number of attractive features, such as, high matching accuracy, monitoring of quality, precision and reliability measures are readily available.

Walia and Suneja (2010) describes an efficient matching technique should find similarity or dissimilarity in lesser time period. On the other hand, Salam and Rodrigues (1996) explains that research progress in image mining still has a big room for improvement, particularly in multimedia images. One of the greatest challenges is devising an effective automatic recognition and categorization. Peaks measureare essential for recognizing objects of different shapes, as the shape outline itself is insufficient. A larger number of peaks or higher readings occur where there is a significant change in shape, such as a sharp corner or a curve. Different shapes will be grouped accordingly. The system is capable of grouping new objects, that are objects that do not belong to any existing category by putting it into a new category. The research was carried out to test the capability of producing an automatic shape recognition system by mining relevant image features. From the experiments and the results it showed that the method is capable of producing a generic automatic shape recognition system that is invariant to rotation, translation, size and to a certain degree of distortion.

Balan and Devi (2012) explains that the retrieval process represents a visual query to the system and extracts the images based on the user request such mechanism referred to as query-by-example and used to compare some similarity metrics to compare query and target images. The greater demand for retrieval and management tools for visual data and visual information is a more capable medium of conveying ideas and is more closely related to human percept ion of the real world. In Text based Image Retrieval images are indexed and retrieved based on the descriptions such as their size, type, date and time of capture, identify of owner, keywords or some text description of the image. This is often called description based or text based image retrieval process. In Query Based Image Retrieval query image can be extracting the visual features and can be compared to find matches with the indices of the images stored in the database. These features are used to retrieve the similar images from the image database.

Mining Color Images-ISL Dataset

Fig.1. Indian Sign Language (ISL) Dataset

Aura Conci., Everest Mathias M. M. Castro (Aura *et al*., 2004) proposed a framework for mining images by colour content. Their framework provides the possibility of use 5 distance function for evaluation of similarity among images and 2 type of quantization. Androutsos *et al*. (1999) presented a scheme which implements a recursive *HSV*-space segmentation technique to identify perceptually prominent color areas. The average color vector of these extracted areas is then used to build the image indices, requiring very little storage.

Sanjay Silakari *et al*. (2009) proposed a framework focuses on color as feature using Color Moment and Block Truncation Coding (BTC) to extract features for image dataset (Fig.1). Then K-Means clustering algorithm is conducted to group the image dataset into various clusters. Lukasz Kobylinski and Krzysztof Walczak (2007) proposed an application of Binary Thresholded Histogram (BTH), a color feature description method, to the creation of a metadatabase index of multiple image databases. Rajshree S. Dubey *et al*. (2010) described about an Image mining techniques which is based on the Color Histogram, texture of that Image. The query image is taken then the Color Histogram and Texture is produced and based on this the resultant Image is found. They have investigated a histogram-based search methods and color texture methods in two different color spaces, RGB and HSV. Histogram search differentiate an image by its color distribution. It is shown that images retrieved by using the global color histogram may not be semantically associated even though they share similar color distribution in some results (Fig.2). Carlos Ordonez and Edward Omiecinski *et al*. (1998) presented a data mining algorithm to find association rules in 2-dimensional color images. The algorithm has four main steps: feature extraction, object identification, auxiliary image creation and object mining and it does not rely on any type of domain knowledge. This resembles the CBIR system architecture shown in Fig 2. (Lakshmi Devasena *et al*., 2011).

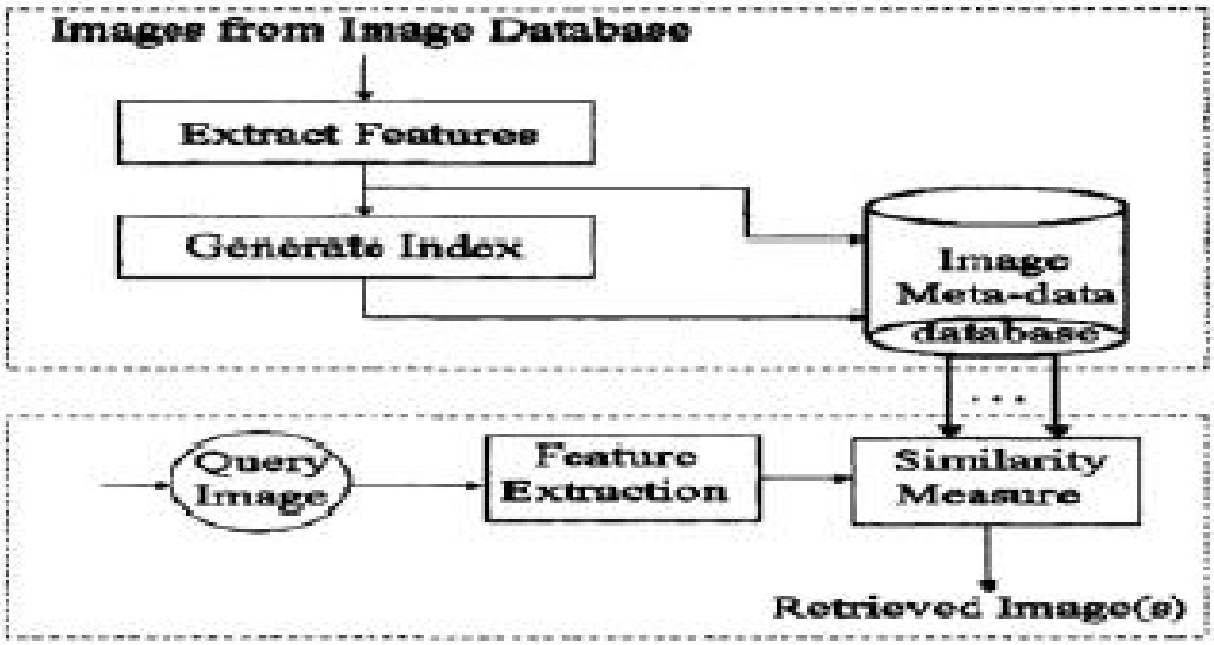

Fig. 2. Content Based Image Retrieval (CBIR) System Architecture

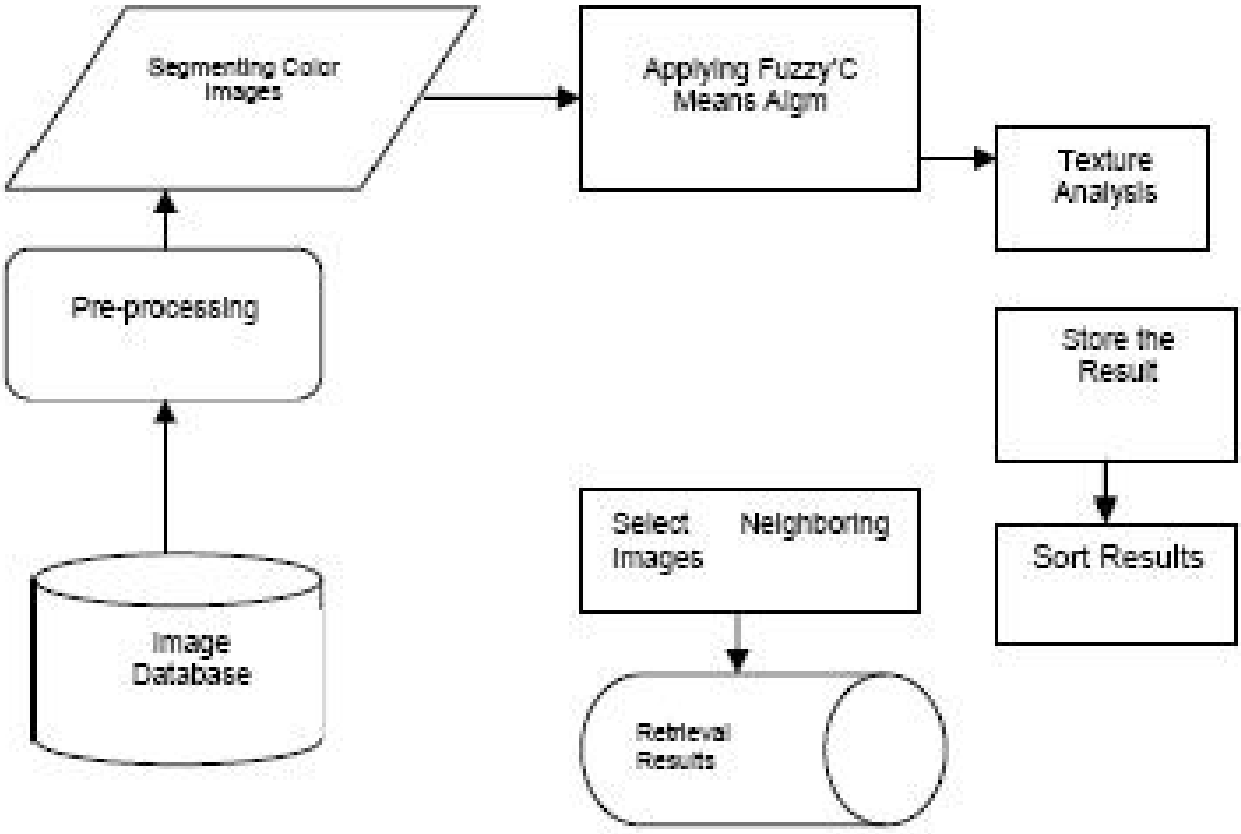

Fig. 3. Block Diagram of Color Image Classification and Retrieval System

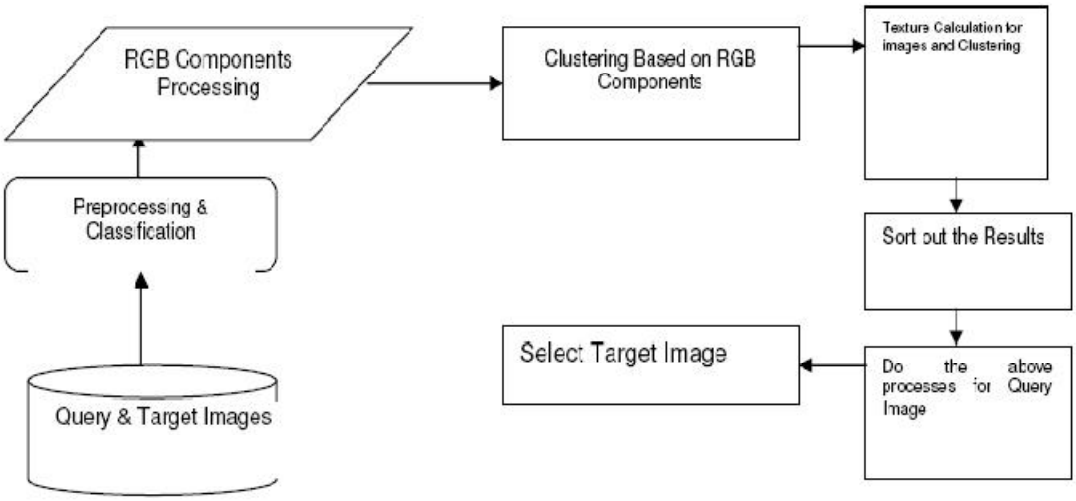

Fig. 4. Block Diagram: Image Retrieval System

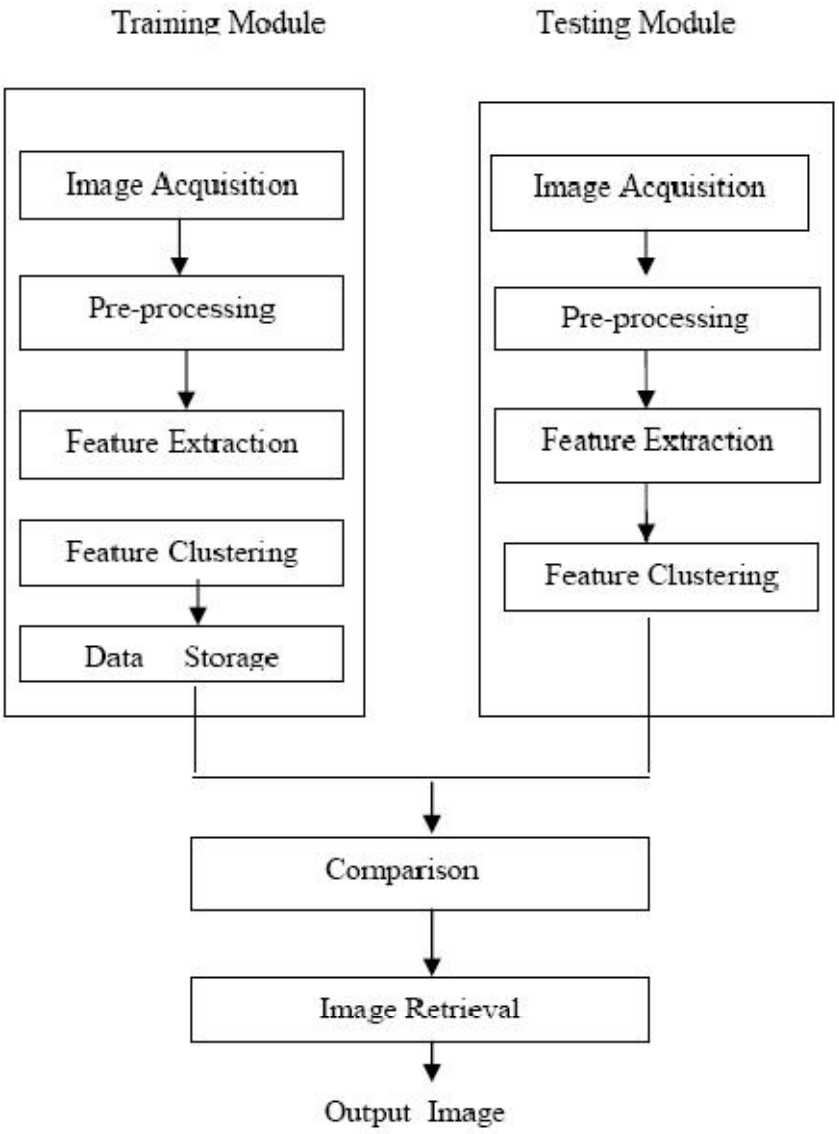

Fig.5. Framework of Image Mining System based on concept lattice and cloud model theory

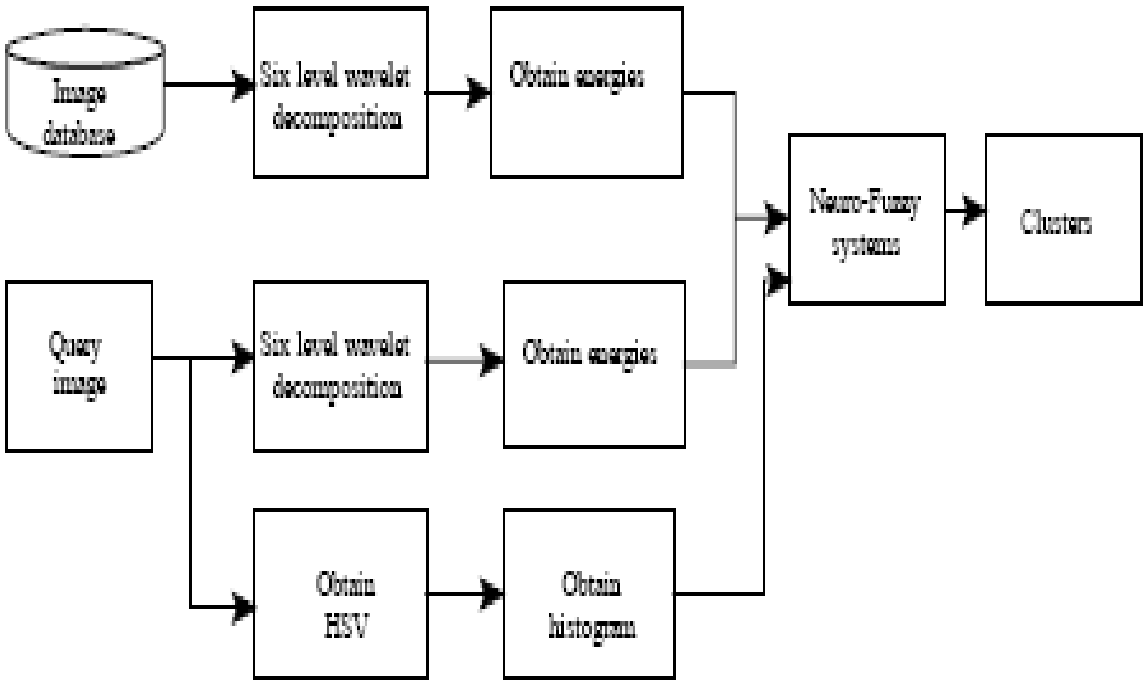

Fig. 6. Neuro-Fuzzy based clustering approach for image retrieval using 2D- WT

Vitorino Ramos *et al.* (2000) formulated the segmentation problem upon images as an optimization problem and espouses evolutionary strategy of Genetic Algorithms for the grouping of small regions in colour feature space. The approach uses k-Means unsupervised clustering methods into Genetic Algorithms, for guiding Evolutionary Algorithm in the search for finding the finest or best data partition, task that as we know, requires a non-trivial search because of its intrinsic NP-complete nature. To solve this, the appropriate genetic coding is also discussed. Mohan *et al*. (2010) proposed a new technique Color Image Classification and Retrieval using a Image (Figure 3) for improving user interaction with image retrieval systems by fully exploiting the similarity information. In that technique retrieving the images from the image collection involves the steps like Preprocessing, Color image classification, Preclustering, Texture feature extraction, Similarity comparison and Neighboring target image selection.

Techniques in Image Mining

R. Brown, B. Pham (R.Brown *et al.,* 2005) described in detail a general hierarchical image classifier approach, and illustrated the ease with which it can be trained to find objects in a scene using support vector machine concept. Ji Zhang *et al*. (2001) proposing new representation schemes for visual patterns and to facilitate fast and effective access we need to frame efficient content-based image indexing and retrieval techniques. Victor *et al*. (2010) proposed an efficient retrieval technique for images using enhanced univariate transformation approach. In this method they have treated images as a compilation of the representative prototypes selected from the training image corpus, and then used the resulted distribution in the descriptor space as a characterization of the image.

The words in the images, called visual words, are calculated to form a vocabulary of N words. Then each image was represented by a word histogram. The construction of visual words is evaluated in two steps: 1) Computation of local descriptors for a set of images 2) Cluster the previous descriptors by K-means. SIFT algorithm is then employed to extract the features due to its impressive performance in image recognition. Peter Stanchev (2003) proposed a new method for image retrieval using high level semantic features is proposed. It is based on removal of low level color, shape and texture characteristics and their translation into high level semantic features using fuzzy production rules derived using an image mining technique. One of the leading frameworks for image object mining is the bag-of-words (BOW) approach. The idea is to encode an image as a collection of visual words of the quantized local patches. Objects in the image can then be retrieved through inferring the semantic topics associated with the set of visual words. However, the visual BOW mining framework is apt to suffer from the so-called term-mismatch problem.

Jen-Hao Hsio *et al*. (2008) proposed a novel language model-based approach with pseudo-relevance feedback for tackling the vocabulary problem in visual BOW mining. Due to improvements in image acquisition and storage technology, terabyte-sized of image databases leads to two basic problems: how to exploit images (image mining)? how to make it accessible to human beings (image retrieval)? The specificity of image mining /retrieval techniques operates on the whole collection of images, not a single one. Under these circumstances, it is natural that the time complexity of related algorithms plays an important role. Iwaszko *et al*. (2010) suggested a novel general approach applicable to image mining

and retrieval, using compact geometric structures which can be precomputed from a database. Rosalina Abdul Salam and Abdullah Zawawi Hj. Talib (2004) proposed a technique to test the capability of producing an automatic shape recognition system by mining relevant image features. The method has the capability to be extended to three-dimensional objects, which is currently under investigation. Color, depth and texture can be grouped together to form a set of new features. Mohan *et al*. (2010) formulated a new technique called Image retrieval based on optimal clusters is proposed for improving user interaction with image retrieval systems by fully exploiting the similarity information. The technique involves steps as shown in Figure 4. Dipesh Dugar *et al*. (2010) proposed a novel discriminative learning framework based on canonical correlations for object recognition with image sets.

Anthony *et al*. (2007) proposed a novel spatial mining algorithm, 9DLT-Miner. This is used to mine the spatial association rules from an image database. In the image database e every image is stored in 9DLT representation. Two phases are there in this method. First phase finds all lengthier frequent patterns. Second phase generates all candidate (k + 1)-patterns using frequent k-patterns (k P1). For each candidate pattern generated, the frequent supporting patterns in the database were counted. The steps are repeated until no more frequent patterns can be found. Kun-Che Lu and Don-Lin Yang (2009) adopted the decision tree induction to recognize relationships between attributes and the target label from image pixels, and constructed a model for pixel-wised image processing according to a given training image dataset. And it is proved that the proposed model can be very competent and effectual for image processing and mining. Victor *et al.* (2010) propose minimum spanning tree based clustering algorithm using weighted Euclidean distance for edges to segment the image.

John Peter *et al.* (2010) propose a novel algorithm, Minimum Spanning Tree based Structural Similarity Clustering for Image Mining with Local Region Outliers (MSTSSCIMLRO) to segment the given image and to detect anomalous pattern (outliers). In that he used weighted Euclidean distance for edges, which is key element in building the graph from image. The algorithm uses a cluster validation criterion based on the geometric properties of data partition of the data set in order to find the proper number of segments. Two phased involved in this algorithm. First phase creates optimal number of clusters/segments, Second phase segments the optimal number of clusters/segments and detect local region outliers. Ashok *et al*. (2004) presented a methodology for automatic knowledge driven image mining using the theory of Mercer Kernels. Mercer Kernels are extremely nonlinear symmetric positive definite mappings from the original image space to a very high, probably infinite dimensional feature space. Rupali Sawant (2010) presented a framework of image mining based on concept lattice and cloud model theory shown in Figure 5. The methods of image mining from image texture and shape features are introduced here, which include the basic steps: pre-processing the images, using cloud model to extract concepts, and then using concept lattice to extract a series of image knowledge.

Balamurugan and Anandhakumar (2009) introduced a neuro-fuzzy based clustering approach for content based image retrieval using 2D-wavelet transform (2D-DWT) as shown in Figure 6.

Conclusion

This paper compared many of the proposed techniques in image mining used by the earlier researchers in the image retrieval, matching, pattern recognition etc, which is used while extracting features of the images like shape, color, size, texture, imprint etc for Indian sign language recognition. Because, Image mining presents special characteristics due to the richness of the data that an image can show. Effective evaluation of the results of image mining by content requires that the user point of view is used on the performance parameters. The query image is compared to each of database images to determine whether they are equivalent or not by comparing with all features. Some of the proposed techniques produced good results and some may not. However, to identify, the entire features the images are to be evaluated, in various views. The Main goal of image mining is the discovery of image patterns that are significant in a given collection of images for deaf languages. New techniques are being generated and many area left for the future enhancement and this study of review is found that still few more methods needed to identify the imprint which is one of the important notable feature of the image.

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