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An efficient framework for image data retrieval

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ABSTRACT: Valuable information can be hidden in images, however, few research discuss data mining on them. Image retrieval means searching, browsing and retrieving images from image databases. There are two different methodologies for image retrieval i.e. text based image retrieval and content based image retrieval. Former one is obsolete. In latter one many visual features like texture, size, intensities, and frequency of pixels and color of image are extracted. In query-by-example search extracted featured are compared with stored ones. In this work an efficient for extracting image features is considered using intensity histogram of gray color image. Here in this general framework based on the decision tree for mining and processing image data. Pixel wised image features were extracted and transformed into a database-like table which allows various data mining algorithms to make explorations on it. Finally results of average gradient vectors are to be compared with previously stored one dimensional array of intensities to find similarities in image data.

Keywords: Convo-Detect, Hybrid Projection, EOAC, DC, EDH, DAC ImgDataRet, Hamming20, Keller6, Brock20.

1 Introduction

1.1 Image Extraction

Data Mining is termed as discovering hidden values in data warehouse, extracting hidden information from huge databases is a powerful new methodology which has helped many organizations nowadays to focus on significant information in their data warehouses. [1] Data mining techniques can be implemented rapidly on various platforms on high performance parallel processing computers or client/servers. Data mining tools can work with heavy databases to find answers to various business queries. [3] Many data mining operations are managed outside of data warehouse nowadays and thus require extra steps for extraction, import and to analyze preprocessed data. Also, when new things require operational data implementation, collaborations with the warehouse improves the application of outcomes from data mining. [14,23,29] The resulting analytic data warehouse can be applied to improve business processes throughout the organization, in areas such as substantial degree of relevance management, fraud detection, new product rollout, and so on.

The starting point of data mining process is a data warehouse having collaboration of its internal data with external market data from web about rival companies competing with them.[1,2] Previous raw information related to potential customers provides excellent basis for analyst software modules. An OLAP server favors more advanced flexible and fast data access to be applied when navigating data in some data mapping scheme for standardization. The data mining access server must be integrated with OLAP server and data warehouse. It is the job of data mining access server to advance process centric data that will give major data mining objectives like prospecting, promotional integration and campaign management.[3] Integration of newly arrived metadata with existing data warehouse allows operational decisions to be

directly focused and tracked. As a result when data warehouse grows with newly bindings in decisions, organization can mine continuously best results to be practiced for future decision making.

1.2 Image Mining Process

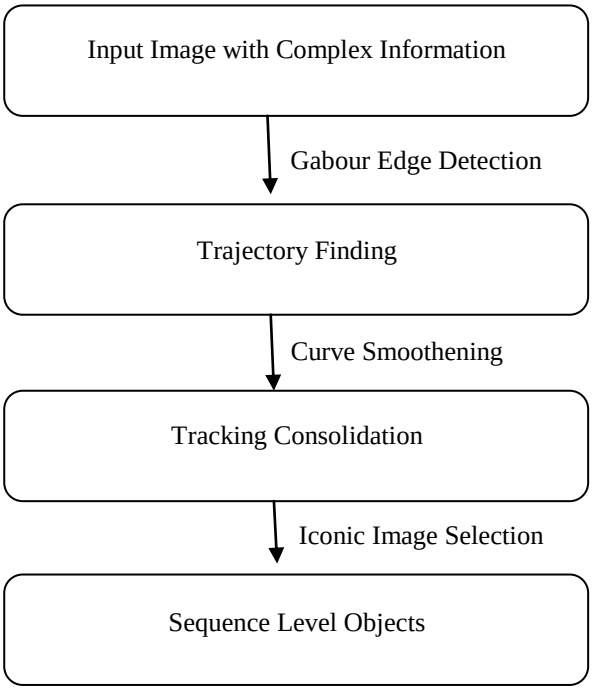


Figure 1.1: Data mining process interpreting mined

Data mining is the feature detection technique of image data and the use of software based techniques for finding image patterns and bitmap regularities in sets of image data. [38,41,43] The computer program is responsible for observing the image bit patterns by elucidating the pre-defined rules and image features in the image data. Data collected from different sources like databases or flat files or any other resources like web is made to be preprocessed. Various standardization techniques of data cleaning or formatting are to be used by data warehouse or mapping schemes. [4] Further preprocessed data is made to be reviewed by data analyst who is done nowadays by computers software. In earlier days it was manually done by data analysts. After reviewing preprocessed data analyst reports are to be made which is revised or refined if something is needed with hand on information to generate finally mined or interpreted results.

2 Image Data Retrieval

Recent progress of technology in hardware with large capacity of holding data from image, audio, video or textual data and/or combination of them has become more common these days. As a result the need of accessing contents of such data is growing with requirement of fast access database systems. [4] In case of conventional databases, retrieving contents of multimedia data is not enough facilitated. Because in conventional databases most of database systems are based on relational data models. [5] Following are three main reasons behind this lack in support:

a) In relational data models there is a lack of spatio-temporal relations. In linear system theory, it was in context of audition where an auditory data signal is represented as a function of single variable. [6, 19, 21, 29, 31, 39] But the same theory works on an image which is a function of two spatial dimensions x and y. also if temporal sensitivity is considered as well then a signal will be a function of three variables i.e. x, y and t which is in case of movie or sequence of images. In audition basic stimulus used in linear system theory is a sine wave grating. [7] Also temporal relation between audio and video data is a key thing that is needed to be taken care by database systems. In case when textual data is superimposed with video data which is stored separately from textual data, both temporal as well as spatial relations need to be managed in order to define relation between them.

b) Secondly semantics of data being retrieved is a crucial thing in recognition and/or data interpretation process in case of multimedia data, because representation of data and contents perceived are two different things in an image, video and audio data.

c) Third major concern in retrieving multimedia data is query representation. Retrieval of data in conventional databases is totally based on relational algebra with simple query conditions in the form of standard alphanumeric character representation. On the other hand multimedia data retrieval involves types of contents to be diverse and here query-by-example (QBE) would be better solution.

2.1 Spatial Relations

One of the most mandatory features in many multimedia documents is management of spatial coherence. Management of spatial relation of components of image data is done by considering its rectangular Cartesian coordinates. The spatial axis position of a component in object in image data is

represented by rectangular coordinates and the relations between components are calculated mathematically. [9, 13, 24, 48-50] A multimedia document which is composed of images, flowcharts, and other random graphics as well as image text is another example that proves the management of spatial coordinates for layout information in an image [6]. In other applications of image processing such as geographical information system (GIS), the image pattern representation and random indexing of abstract and finite spatial relations in some regions of image is studied. A 2D stream of bits [3], [9] is an image data indexing technique for representing a spatial pattern between different components of an image; 2D stream of bits represents few patterns in position of components in neighboring regions, which is composed of horizontal and vertical ordering of image components.

2.2 Temporal Relations

A recent study depends upon bit representation and image data management of temporal relation considers video based applications of image processing such as video information databases (VID). There are two basic techniques for representing time based relationship between objects in multimedia data of a moving image: One is a point-based image data representation containing time lag of various colors in a multimedia document, and the other is an interval-based image data representation which contains intervals of data shifts from neighboring regions of data. [21, 29, 34] The point based representation contains the Cartesian position of objects by points in the image data on timeline, whereas the interval-based representation contains the cohesion of image objects by means of their intervals of the occurrences of similar intensities in neighboring regions of an image.

techniques are considered to be the best techniques for the exact matching of the applications.

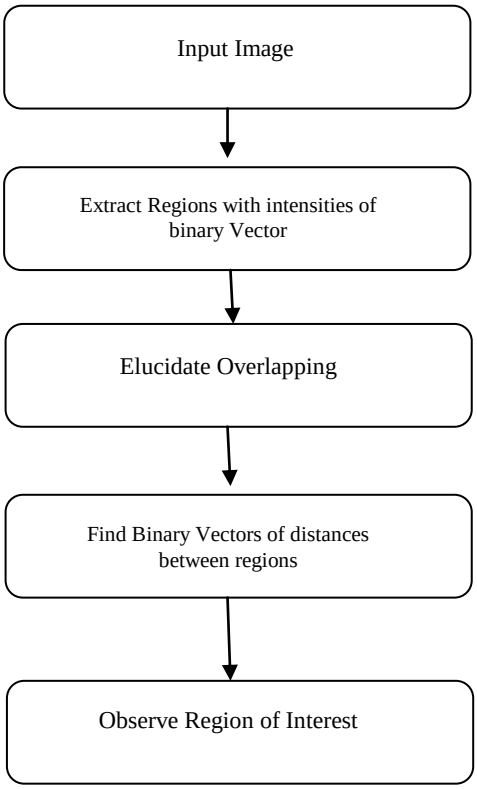


Figure 3.1 Region of interest Finding Model

3 Data Retrieval in Conventional Databases

Earlier database systems were designed to manage and retrieve the textual data and their related keyword based retrieval techniques which are not suitable for retrieving the data which comprises of text, video and audio data. Adding to this, in earlier times lot of human effort was required for the manual annotation because as the data which was stored in binary form was of no meaning to the human. Similarity comparison

3.1 Image Extraction through Mining

The technique of handling the association of image data and its patterns which are not stored in its images is known as image mining. Different methods of image processing and retrieval are used by this technique. There are two approaches to mining, firstly to mine from a large database of images and the other one performed on different collections of images and the data. The co-ordination of structures and the human brain can be deteriorated by this technique. The actual meaning of image mining is the production of different patterns with no knowledge of the image content. There can be different kinds of patterns like description, temporal, spatial etc. [41-43] All huge image databases are being handled but the image mining. This system includes different image retrieval as well as indexing technique for pattern matching. This method is considered as if user friendly for data patterns and can generate in depth knowledge of image representation. The different patterns are grouped together .The sample of different images is taken to extract the content. But during this process different type of distortions and disturbances are being met. The results of mining can only be obtained after the matching of the model description with the symbolic prescription.

3.2 Object Moment Finding

Image with dimensions M X N having moment represented by its classification in view plane of having object particles inclined towards moment of highly dense populated regions of image objects. Image moment Mi is the constituent operator giving differentiation to image object particles in the Gaussian favored dense intensity regions. According to morphological image processing a gateway of image dilation of its corner points identifies presence of an object in the image under sophisticatedly designed frame of reference about a locus point. Moment Mi will be introduced as:

$$M_i = \sum (x_i y_i * Px_i y_i)$$

Where $Px_i y_i$ denotes pixel count of MxN image about first two moments m_{10} and m_{01}

First two moments about bright intensity regions captured in the surroundings of an object are:

$$X_1 = m_{10} / m_{00}$$

$$X_2 = m_{01} / m_{00}$$

Centralized normal moment about locus point under consideration will be given by summation of p power differences of all moments from centralized moment and its product with pixel count in that region surrounding the object space about centralized moment. It is taken as:

$$\mu = \sum (x - x_i)^p * Px_i y_i$$

Object retrieved from image through these distance comparisons made once Euclidian Distance is calculated for observed image object particle under its tolerable attained threshold value of distance vector c_i.

$$c_i = a_i - b_i$$

$$d = \text{sq. root} (\sum c_i^2)$$

Scale balanced moment is observed by dividing normalized moment with invariant initial moment about image object particle locus under the effect of same transformation.

4 Genetic Algorithm For Image Retrieval

Step1. Input Image (Binary matrix (Sparse) of bitmap)

Step2. Apply BCN filter to the input image

Step3. Extract largest bounding region surrounding object space

Step4. Find edges using Harris Edge Detection Technique

Step5. Find Centralized Moment

Step6. Find COG (Center of Gravity) of image

Step7. Normalize (m_{01} / m_{00} and m_{10} / m_{00})

Step8. Find invariant moment factor μ_{00}

Step9. Apply G.A. (Selection of initial Binary Vectors)

Step10. Check Fitness (F = (1 - R(A)) / P.E * log(M))

Step11. Apply Crossover (Two Point Inverse crossover)

Step12. Repeat **Step10**. and **Step11**. Until (P.E > = 0.00001)

Step13. An object with least Euclidean Distance is retrieved.

Here at step 12 Euclidean distances of binary vectors taken from previous population are considered and their processing error is observed if it is lying in an observed range. Otherwise the object may be discarded. Retrieved object undergoes inverse Fourier transformation and is accepted while in comparison with below dark intensity ranges. Here scope of least processing errors is completely dependent on image under consideration. Its viable processing effort always is objectionable for the wrong choice of initial population. [12,

14] BCN filter applied after selection of also cutting sharp peaks of pixel intensities in the object particles.

5 Outcome Results

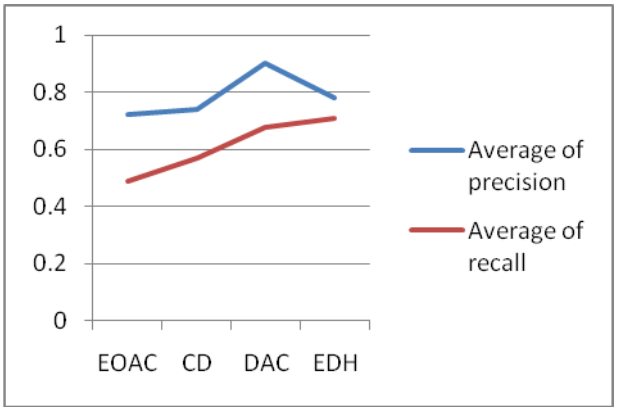
Color and texture of image data patterns are observed through sobel-edge detection mechanism. Semantics of similarity between observed image patterns is the matter of distance between images to measure their similarity. This distance is given by Minkowsky and known as Minkowsky-distance. It is expected that this distance will provide us similarity measure between images. Sobel-edge detection mechanism will help greatly to correlate two images with their appropriate distance.

$$L_P(X,Y) = [\sum |x_i - y_i|^P]^{\frac{1}{P}}$$

Here results of various image retrieval methods are given along with their Minkowsky-distances. EOAC (Edge Oriented Auto Correlation), CD (Coherence Distance), DAC (Distance Auto Correlation) and EDH (Edge Detection Histogram).

	EOAC	CD	DAC	EDH
Average of precision	0.72	0.74	0.9	0.78
Average of recall	0.49	0.57	0.68	0.71

5.1 Performance comparison of different Image Retrieval Methods.



6 Conclusion And Future Scope

Method ImgDataRet has performed well only on standard images like brock-26, keller-5 and quickie-12. The main feature which is taken with serious attention is image preprocessing. In image preprocessing loaded input image undergoes segmentation, finding bright intensity values of pixels and their belongingness to particular region is noted in the form of feature. Out of which extracted 2x1 matrix is maintained. This matrix shows presence of image object particles in an image. This algorithm is tested on light background images of courtesy standard benchmark images; this has found its moderate performance with these images as compared to other allied approaches like Convolution Based Detection, Hybrid Projection, Neural based and Multi-View Approach. It has also tested over complex image like hamming-200 and MANN-400; it has performed relatively poorer on these kinds of complex images.

Future work could consider changing the termination condition in ImgDataRet method. If the method reaches stagnancy, then it can reallocate vectors for exploration of new object particles that can be extended from already calculated ones. For exploration of maximum number of object particles in input image ImgDataRet can drop existing vectors and restart new search for more object particles in the new start. In this way the algorithm has a chance to escape from local optimization and explore more of search space. However one needs to find a good reallocation method.

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