A Review on Image Mining Techniques

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Abstract— In this paper, the overview of the Image Mining techniques are surveyed. Feature selection and extraction is the pre-processing step of Image Mining. Obviously this is a critical step in the entire scenario of Image Mining. Our approach to mine from Images –is to extract patterns and derive knowledge from large collection of images, deals mainly with identification and extraction of unique features for a particular domain. Though there are various features available, the aim is to identify the best features and thereby extract relevant information from the images using different image mining techniques. Various methods for extraction are used in this paper. Content Based Image Retrieval is the popular image retrieval method by which the target image is to be retrieved based on the useful features of the given image. In this paper, the concepts of Content Based Image Retrieval and Image mining have been combined and a new clustering technique has been introduced in order to increase the spe[...] [s]how that the features here used are sufficient to identify the patterns from the Imag[...] and are tested on the images. This paper presents a survey on various image minir[...]

Index Terms— Image Mining, Image Mining Techniques, Image Features,

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1 INTRODUCTION

Advances in image acquisition and storage technology have led to tremendous growth in significantly large and detailed image databases .The World Wide Web is regarded as the largest global image repository. An extremely large number of image data such as satellite images, medical images, and digital photographs are generated every day. These images, if analyzed, can reveal useful information to the human users. Unfortunately, there is a lack of effective tools for searching and finding useful patterns from these images. Image mining systems that can automatically extract semantically meaningful information (knowledge) from image data are increasingly in demand. The fundamental challenge in image mining is to determine how low-level, pixel representation contained in a raw image or image sequence can be efficiently and effectively processed to identify high level spatial objects and relationships. The popular amongst them are Features based on color, Features based on texture and Features based on shape.

2 IMAGE MINING PROCESS

Image Mining is an extended branch of data mining that is concerned with the process of knowledge discovery concerning images. Image retrieval is the fast growing and challenging research area with regard to both still and moving images. Many Content Based Image Retrieval (CBIR) system prototypes have been proposed and few are used as commercial systems. CBIR aims at searching image databases for specific images that are similar to a given query image. It also focuses at developing new techniques that support effective searching and browsing of large digital image libraries based on automatically derived image features. The features further can be classified as low-level and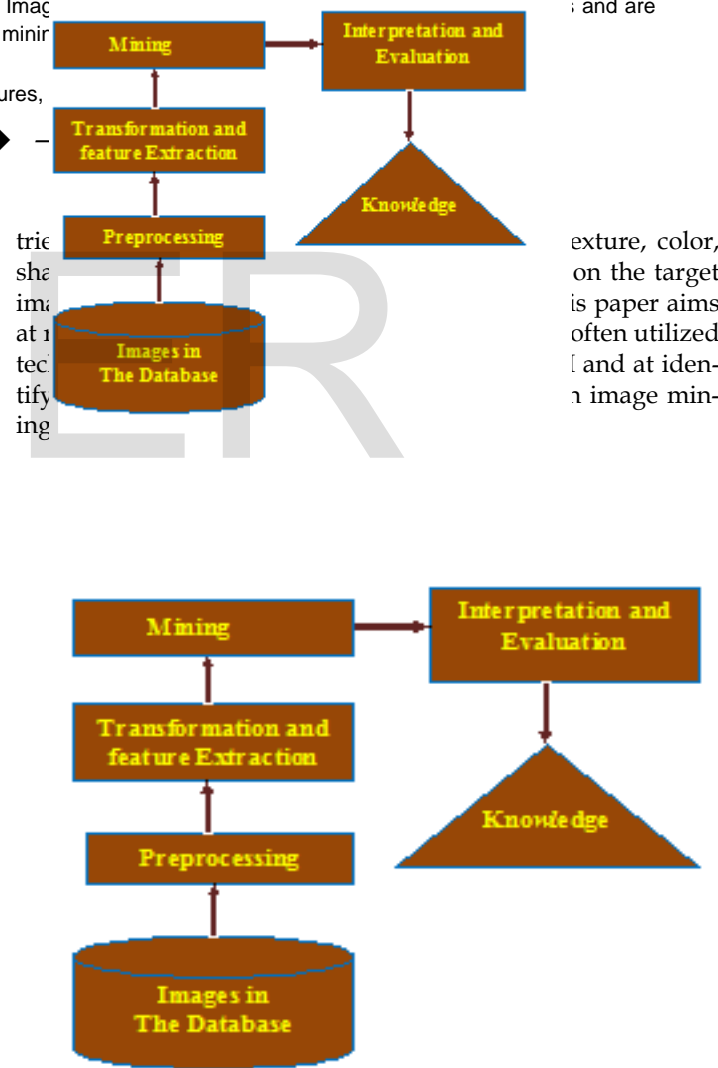 high-level features. Users can re-trie[...] [t]exture, color, sha[...] on the target ima[...] is paper aims at [...] often utilized tec[...] and at identify[...] n image min-ing[...]

Fig. 1 illustrates the typical image mining process.

2.1 Preprocessing

Image pre-processing is the name for an operation on images at the lowest level of abstraction whose aim is an improvement of the image data that suppress undesired distortions or enhances some image features important for further processing. It does not increase image information content. Its methods use the considerable redundancy in images. Image pre-processing tool, created in Mat Lab, realizes many brightness transformations and local pre-processing methods.

2.2 Feature Extraction

Feature Extraction involves reducing the amount of resources required to describe a large set of data. When performing analysis of a complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power or a classification algorithm which over fits the training sample and generalizes poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. Feature transformation is a group of methods that create new features (predictor variables). The methods are useful for dimension reduction when the transformed features have a descriptive power that is more easily ordered than the original features. In this case, less descriptive features can be dropped when building models.

2.3 Mining

Image Mining is focused on extracting patterns, implicit knowledge and image data relationship or patterns which are explicitly found in the images from databases or collections of images. Some of the methods used to gather knowledge are: image retrieval, data mining, image processing and artificial intelligence. These methods allow Image mining to have two different approaches. First, is to extract only from databases or collections of images, and second, dig or mine a combination of associated alphanumeric data and collection of images.

2.4 Interpretation and Evaluation and Knowledge discovery

After mining, patterns are obtained and these patterns finally evaluate and interpret the knowledge that is required. The knowledge retrieved can be used by individual or organization for various purposes to make predictions and profitable output further.

3 IMAGE MINING TECHNIQUES

3.1 OBJECT RECOGNITION:

Object recognition has been an active research focus in field of image processing. Using object models that are known a priori, an object recognition system finds objects in the real world from an image. This is one of the major tasks in the domain of image mining. Automatic machine learning and meaningful information extraction can only be realized when some objects have been identified and recognized by the machine. The object recognition problem can be referred to as a supervised labeling problem based on models of known objects. Specifically, given a target image containing one or more interesting objects and a set of labels corresponding to a set of models known to the system, what object recognition does is to assign correct labels to regions, or a set of regions, in the image. Models of known objects are usually provided by human input a priority. In general, an object recognition module consists of four components, namely, model database, feature detector, hypothesizer and hypothesis verifier. The model database contains all the models known to the system. The models contain important features that describe the objects. The detected image primitive features in the Pixel Level are used to help the hypothesizer to assign likelihood to the objects in the image. The verifier uses the models to verify the hypothesis and refine the object likelihood. The system finally selects the object with the highest likelihood as the correct object.

3.2 IMAGE INDEXING AND RETRIEVAL:

In order to enable retrieving images from databases efficiently, a suitable indexing is required. Relational databases provide indexing based on primary and secondary keys. This approach is not applicable when mining image databases, as the image retrieval is most often similarity-based. K-D-B tree, R-tree, R*-tree, R+tree, SR-tree, TV-tree, X-tree and iMiniMax are the most utilized indexing methods.

The retrieval techniques as described by

- ✓ **Query by Associate Attributes** - Retrieving images based on the attributes stored as metadata.
- ✓ **Query by Description** - Description of the context stands for key words assigned to images (e.g. in file-names)
- ✓ **Query by Content** - Organizing pictures according to their visual content (according to the detected features, such as texture, shape, color; according to the similarity, etc.)

Many later applications are focused on combining the above mentioned methods in order to enable more specific and comfortable search for particular data. Multimodal retrieval was proposed for managing several kinds of unstructured data including image, video, audio and text simultaneously. The proposed algorithm enables both retrieving data based on visual features and text models. Framework deploying deep learning architecture was proposed by a tool for improving accuracy of image retrieval in medical image data management. Extracting accurate information from large amount of data is accomplished leaning on Bayesian Naïve Classifier.

3.3 IMAGE CLASSIFICATION AND CLUSTERING:

The objective of classification is to categorize objects detected in an image. Currently, classification objects are an extensively researched domain. Different approaches have been proposed and tested. Supervised classification is the original approach of categorizing images. The objective is to divide the detected objects into pre-defined categories. Methods of machine learning (decision tree, rule-based classification, support vector machines, neural networks) are applied on training the system based on the labeled (pre-classified) samples and flowingly,

on labeling new images using the obtained (trained) classifiers. Clustering represents unsupervised categorization of objects. The objects are grouped into clusters based on the similarity, not on the basis of predefined labels. Cluster analysis aims at searching for common characteristics without knowing the exact data types. It is oriented on decomposing images into groups of objects similar to each other and different from the other objects as much as possible. The similarity is evaluated based on the calculated features texture, shape, color...).Hierarchical clustering, partition based clustering, mixture resolving, nearest neighbor clustering, fuzzy clustering, evolutionary clustering are some of approaches used for unsupervised categorization. After accomplishing the clustering process (dividing the objects into clusters), an expert form the particular field is needed to identify the individual categories (clusters).

3.4 ASSOCIATION RULES MINING:

Association rule mining generates rules that have support and confidence greater than some user specific minimum support in addition to minimum confidence thresholds. A normal association rule mining algorithm works within two steps. The 1st step finds all substantial item sets that match the minimum support constraint. The second move generates rules from each of the large item sets that match the minimum confidence constraint.

3.5 NEURAL NETWORKS:

Neural Networks are computational systems made up of simple processing units called neurons which are usually organized into layers with fully or partially connections. The main task associated with a neuron is to receive the activation values from its neighbors (the output of other neurons), compute an output based on its weighted input parameters and send that output to its neighbors.

4 CONCLUSION

This paper presents a survey on various image mining techniques that was proposed earlier by researcher. This overview of image mining focuses on image mining implementations, usability and challenges. It also delivers conceptual overview of methodology. Image mining is an expansion of data mining in the field of image processing. Future investigations that are discussed may be implemented in the area of image mining.

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