INFORMATION RETRIEVAL FOR IMAGE MINING

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ABSTRACT

Many areas of commerce, government, academia, and hospitals create large collections of digital images. Through digitization of data and developments in technology it is very easy to acquire and store large quantities of data, mainly multimedia data. This data will be suitable to analyse in an efficient and fast manner by the different kinds of agencies of commercial to Military. Currently, tools for mining images are insufficient and require human involvement. Feature selection and extraction is the pre-processing step of Image Mining. Obviously this is a serious step in the whole scenario of Image Mining. Our method to mine from Images – to extract patterns and derive knowledge from large collections of images, deals chiefly with identification and extraction of unique features for a specific domain.

Experimental results display that the features used are sufficient to identify the patterns from the Images. An interactive system was established which allows the user to define new features and to resolve unclear regions. This paper presented a new method for image retrieval using high level semantic features. It is based on extraction of low level colour, shape and texture features 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 covering information for the image high level semantic features. Johannes Itten theory is helpful for obtaining high level colour features.

KEYWORDS

Image mining, Semantic features, Multimedia databases.

1. INTRODUCTION

The progressive computer industry has seen a huge growth in technology – access, storage and processing fields. This combined with the fact that there are a lot of data to be processed has covered the way for analyzing and mining data to derive possibly useful information. Various fields ranging from Commercial to Military want to analyze data in an efficient and fast manner. Particularly in the area of Multimedia data, images have the stronghold. However there is a general agreement that sufficient tools are not available for analysis of images. One of the issues is the effective identification of features in the images and the other one is extracting them. One of the difficult tasks knows the image domain and obtaining a priori knowledge of what information is required from the image. This is one of the reasons the Image Mining process cannot be completely automated.

Current techniques in image retrieval and classification (two of the dominant tasks in Image Mining) concentrates on content-based techniques [6]. Various systems like the QBIC[1], Retrieval Ware [2] and Photo Book [7] extra have a variety of features, but are still used in particular domains. Jain et al [3] use colour features combined with shape for classification.

Ma et al [4] use colour and texture for retrieval. Smith and Chang [7] use colour and the spatial arrangements of these colour regions. Since perception is subjective, there is no single feature which is sufficient [5,8]; and, moreover, a single representation of a feature is also not sufficient. Hence multiple representations and a combination of features are necessary.
Image mining is nothing but a study of different patterns stored in the image as well as data extraction from the image and its relationship with the image. In this paper a method for image retrieval, based on high level image semantic features is presented. In section 2 we explain the image feature extraction mechanism. In section 3 we describe Evaluation of features in Image Mining. In section 4 we detail our experiments, and finally in section 5 the conclusions of this paper are presented.

2. IMAGE FEATURE EXTRACTION MECHANISM

In the proposed method the low level image characteristics are transferred into high level features using fuzzy logic rules and image interpretation. Low level image characteristics in the sense the color, texture and edge features are analysed.

I. Color: Egeria occurs in 2 colors – pink (rusty rose) and black. Hence the picture elements can be compared to these spectra.

II. Texture: Texture is defined as a neighbourhood feature [6] – as a region or a block. The variation of each pixel with respect to its neighbouring pixels defines texture. In our case, Egeria occurs in open water or in water at the shoreline. Hence the textural details of similar regions can be compared with a texture template.

III. Edge: Edge is simply a large change in frequency. This is particularly important here, as the distinction between the dark Egeria and the lighter water bodies or land can be considered as an edge.

Image Retrieval from the image collections involved with the following steps

- Pre-processing
- Image Classification based on some true factor
- RGB processing
- Pre clustering
- Texture feature extraction
- Similarity comparison
- Target image selection

Fig 1 Image mining process

Fig 2 block diagram for image retrieval system

### Table-1, extraction of image

<table>
<thead>
<tr>
<th>Color</th>
<th>Texture</th>
<th>Edge</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

3. EVALUATION OF FEATURES IN IMAGE MINING
All these features were extracted for this particular domain. We used the features extracted from the training image, on the testing images. Hence in essence, we have developed a system, which is trained once and then applies the same technique to other images. The goodness of these features can be judged by certain evaluation criteria. The second set of images (with the manually interpreted Egeria) was used for comparison and validation. The validation images have the same size and hence can be compared with the extracted images in terms of blocks.

For a two-class problem, there can be 4 possible outcomes of a prediction. The outcomes are True Positives (TP), True Negatives (TN), False Positives (FP) and False Negatives (FN), where TP are those extracted regions that are correct, TN are the regions that are incorrect and are not retrieved, FP are regions that are actually incorrect, but have been extracted (these correspond to false alarms), and FN are regions which were supposed to be extracted but were missed.

- **Precision**: Defined as the fraction of the retrieved information, which is relevant.

\[
\text{Precision} = \frac{TP}{TP + FP}
\]

- **Recall**: Defined as the fraction of the relevant retrieved information versus all relevant information.

\[
\text{Recall} = \frac{TP}{TP + FN}
\]

<table>
<thead>
<tr>
<th>Method</th>
<th>Precision</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray scale</td>
<td>0.7530</td>
<td>0.6349</td>
</tr>
<tr>
<td>RGB</td>
<td>0.7668</td>
<td>0.8600</td>
</tr>
<tr>
<td>YCbCr</td>
<td>0.7306</td>
<td>0.8927</td>
</tr>
<tr>
<td><strong>Texture:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Histo bins</td>
<td>0.6880</td>
<td>0.6732</td>
</tr>
<tr>
<td>Norma Histo</td>
<td>0.5851</td>
<td>0.6547</td>
</tr>
<tr>
<td>- bins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCT</td>
<td>0.7465</td>
<td>0.5006</td>
</tr>
<tr>
<td><strong>Edge:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.3220</td>
<td>0.4675</td>
</tr>
<tr>
<td><strong>Edge and Color:</strong></td>
<td>0.5724</td>
<td>0.4707</td>
</tr>
</tbody>
</table>

In the above table, the methods used (in bold face) are better than their counterparts. Precision and Recall are used below for performance evaluation.

4. EXPERIMENTAL RESULTS

In this application, the user implementing three stages of image retrieval one is Histogram, Decomposition and the last one is Edge detection technique. Histogram is done in the form of Graph and for Decomposition the user using wavelet decomposition technique and the other one is edge detection, in the edge detection the user implementing two techniques one is sobel edge detection and the other one is canny edge detection. Finally, based on these three techniques the precision and recall rate will be calculated.

4.1. Screens

Above figure shows the screen that allows the user to select a query image from the provided list and retrieve images similar to the query image. For this Retrieve Images button is used. Feature Extracted button answers the question of how the images are retrieved i.e. Retrieval at every step and how it is done.
Figure 4.2: Images Retrieved for the given query

Above figure shows, the retrieved images for the query image, after extracting the features of a glass image from the database the user will get these images as output.

Figure 4.3: Features extracted and Images Retrieved at each step

Above figure gives the options of viewing the extracted colour, texture and shape features and images retrieved after each step.

Figure 4.4: Select image to view its histogram

Figure 4.5: Histogram of the Image selected

Above figures shows that, the application called histogram shows that color values of a selected image in the form of graph and it is based on the color features of the database images. And also there is a home button where the user can go back to the Main Page.

Figure 4.6: Images Retrieved after Colour Feature Extraction

Above figure shows, after applying histogram method to a selected image is it compares the query image color values with database image color values, after comparison it displays the desired images which are having same color values.
5. CONCLUSION

The prototype system tries to improve the detection process and also tries to reduce human intervention. High recall values obtained are necessary so that the instances retrieved are comparable to the actual (relevant) instances. The algorithm labels instances from the knowledge obtained from the training data. We found that the tested images required less human interaction for resolving the uncertain regions. The next prototype will be more automatic by requiring less expert interaction and also is expected to be better in terms of accuracy rates.

The main advantage of the proposed method is the possibility of retrieval using high level image semantic features. After the full system realization we will be able to obtain statistic characteristics about the usefulness of the suggested method.

REFERENCES


AUTHORS

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