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Bio-Medical Image Retrieval Using SVM

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***Abstract*—This paper presents an image retrieval system in a computer system for browsing, searching and retrieving images from a large database of digital images. The support vector machine (SVM) is a concept based on learning methods that evaluate data and identify patterns, used for classification and regression analysis. In this work, the prediction of database and query image depends on the outputs of a multiclass support vectormachine (SVM) classifier. The irrelevant images are first to filter out, for similarity matching. The different low-level featuresmodalities are used in this framework. When compare to the query image, the main difficulty is to find unique feature. So an adaptive linear combination of similarity matching and user's feedback information is used here. The predicted output of classifier may be inexact in some cases. Hence, the feature weights are calculated by considering both precision and rank order information based on users feedback. As a result, using SVM classifier with the retrieval performance clearly shows the advantageof searching images based on similarity fusion and filtering in terms of competent and success.**

***Index Terms*—Bio-Medical images, Low Level Features, Relevance Feedback (RF), SupportVector Machine (SVM) Classifier.**

I. INTRODUCTION

Now a days the important play of medical imaging in the field of improved patient care, cost efficient healthcare and socio-economic benefits. In this framework, we are choosing three different bio-medical images such as magnetic resonance imaging (MRI), computer tomography (CT) scan images and Ultrasonography(US) images. Image retrieval systems attempt to search through adatabase to find images that are perceptually similar to aquery image. Here the feature extraction depends on low level features such as color,shape and texture. The support vector machine is a classifier specially using multiclass SVM in this technique for improved performances. The new technique of SVM classifier is suitable for binary classification tasks. The main advantages of the SVM classifier is a tool for insolvency analysis, in the case of non-regularity in the data, gain flexibility,and then operate on the kernel matrix without reference to the underlying feature space. In image retrieval system the technique is content based image retrieval system (CBIR). The Content based image retrieval system seek out the image via automatically derived image features, such as color, texture and shape. The main drawback for CBIR technique, there is semantic gap between high level and low level features, next the problem involves entering an image as a query into a software application that is designed to employ CBIR techniques in extracting visual properties and matching them. The goal of our work is to developa retrieval systemthat implements recent developments in feature representation, efficient indexing and similarity matching; supports. Here the retrieve images in the databaseare visually similar to the query image. The Relevance feedback (RF) is an interactive process to incorporate human perception subjectivity into the query process and provide users with the opportunity to evaluate the retrieval result.

II. PROPOSED ARCHITECTURE

The proposed method is based on low level features such as color,shape and texture using SVM classification and similarity matching is done using Relevance feedback.

INPUT: Collection of images, query image

OUTPUT: Relevant image retrieval

STEP1: Give the input image collections and feature extraction process for feature extraction of image (color layout, edge histogram, color edge direction and color texture).

STEP2: Classification using SVM classifier where a set of *M* labels are defined as $\{\omega_1, \ldots \omega_i, \ldots \omega_M\}$ and construct the category list for each X_{jk} , the concept probabilities are determined by the prediction of the multiclass SVMs as

$$P_i K_j = P(y = i | X_{jk})$$

STEP3: These outputs as category vector of the database images, are stored as category index along with the feature indices in a logical database.

STEP4: Similarity measurement, where the similarity between a query image I_q and target image I_j is described as

$$\text{Sim}\,(I_q, I_j) = \sum_F \propto^F S^F (I_q, I_j)$$

STEP5: For a query image, similar feature extraction is performed.

STEP6: After obtaining a ranked-based retrieval result, users next provide the feedback about relevant images and that information is utilized to update the final feature weights for the next retrieval iterations.

III. FEATURE EXTRACTION

In image retrieval system, the feature extraction plays the important role in classification system. Here we are using low-level features such as color, shape and texture. The color is anmost important feature. In color properties the RGB color with color histogram calculation is used. Next important feature is shape, the edge oriented histogram is done for shape features and for the texture properties we are using Gabor wavelet filter that gives high texture results.

IV. SUPPORT VECTOR MACHINE (SVM)

A. *Support Vector Machine*

Support vector machine (SVM) were originally designed for binary classification. SVM is based on statistical learning theory. The main aim is to determining the location of decision boundaries. A special property of SVM [3] is, it simultaneously minimizes the empiricalclassification error and maximizes the geometric margin. SoSVM is called as Maximum Margin Classifiers SVM classification [3] by constructing an *N*-dimensional hyper-plane that optimally separates the data into two categories. Several approaches have been suggested, but two are the most popular: (1) “one against many” where each category is split out and all of the other categories are merged; and, (2) “one against one”. The numbers of methods have to extend the multiclass problem. In this work we are using “one against one” where *K(K-1)/2* models are constructed, where k is the number of categories.

B. *SVM for multiclass classification*

Originally, SVMs were developed to perform binary classification. However, applications of binary classification are very limited, where most of the classification problems involve more than two classes. The most common pair-wise classification: K(K-1)/2 binary classifiers areapplied on each pair of classes. Each sample is assignedto the class getting the highest number of votes. A votefor a given class is defined as a classifier assigning thepattern to that class.The pair-wise classification is more suitable for large problems.Therefore, the pair-wise approach was used inour experiments study.

V. SIMILARITY MATCHING

The goal of similarity matching is to find visually similar images.The linear combination of similarity matching [2] is used between a query image I_q and target image I_j is described as

$$\mathrm{Sim}(\mathrm{I_q}, \mathrm{I_j}) = \sum_{\mathrm{F}} \propto^{\mathrm{F}} \mathrm{S^F}(\mathrm{I_q}, \mathrm{I_j})$$

Where $S^F(I_q, I_j)$ are the similarity matching function in individual feature spaces and $\propto^{\mathbf{F}}$ are weights generally decided by users within the different image representation schemes within the framework.

VI. RELEVANCE FEEDBACK

The search systems operate using a standard retrieval model, where a searcher, with a need forinformation, searches for documents that will help supply this information.The Relevance feedback (RF) is an interactive process [5] which refines the retrievals to a particular query by utilizing the user's feedback into account. The feedback procedure, called Relevance Feedback (RF), repeats until the user is satisfied with the retrieval results.

VII. EXPERIMENTAL RESULTS

In this section, we present the retrieval system using 20 images (MRI, CT, US) in the database.

A. *Database Image*

In Fig.1 the database creation, there are three different images (MRI, CT, US), are loaded to create the training images, the first 10 images are MRI image, then 11 to 21 images are Ultrasonography images and last four images are CT scan images. Fig.2 presents the histogram plot, the x-axis indicates the row (No of Pixels) and y-axis indicates the column (no of pixel intensity). This plot represents the pixel variation for database images.

Fig. 1Training images

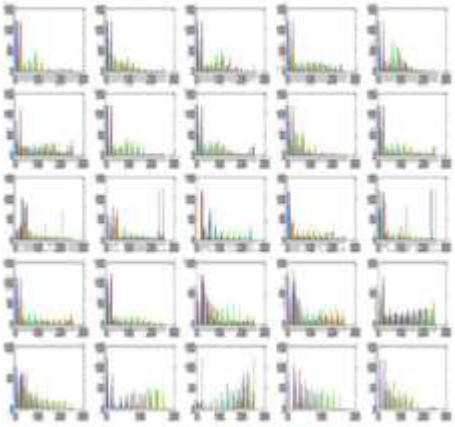

Fig. 2Histogram Plot for Database Images

B. Query Image

In Fig.3, the query image is nothing but input image. In this process, we are selecting one of the query image from database. Fig.4 presents the histogram plot for single query image. Retrieved image is the output, after performing the query image selection which is shown in Fig.5.

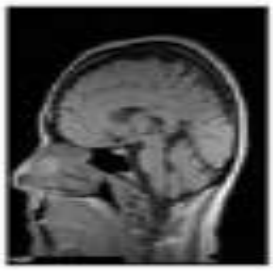

Fig. 3 Query Image

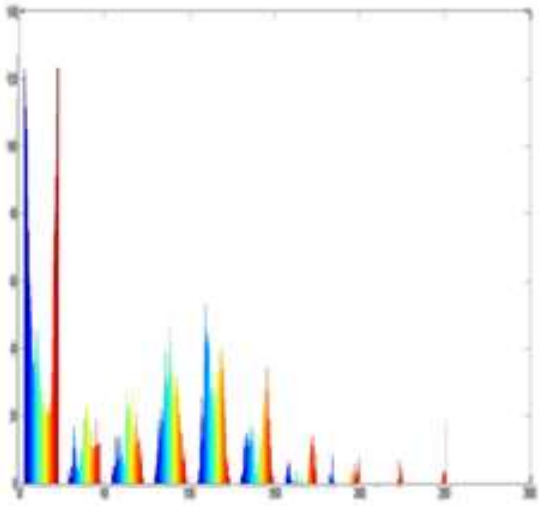

Fig. 4 Histogram Plot for Query Image

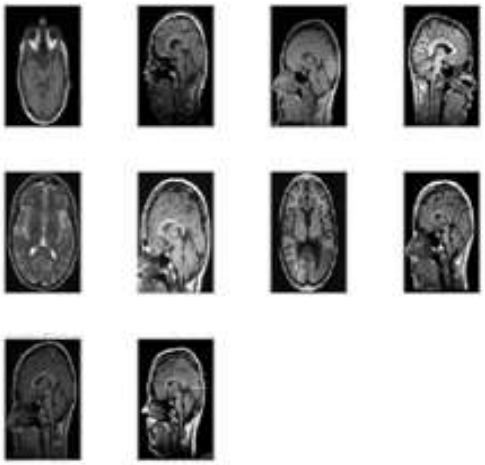

Fig. 5 Retrieve Image

In Fig.6, the positive sample are the images given by user feedback, related to the images predicated from the retrieved image sample. For giving this feedback we are trying to achieve theimproved performance compared to the retrieve image. To achieve better filtering when compared to the previous stage of the retrieval performance, an user feedback is given. The obtained output is shown in Fig.7 which is the image retrival system with RF.

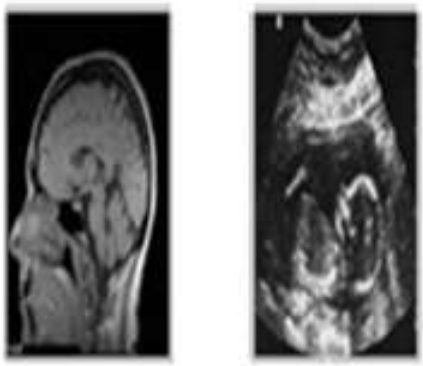

Fig. 6 Positive Samples

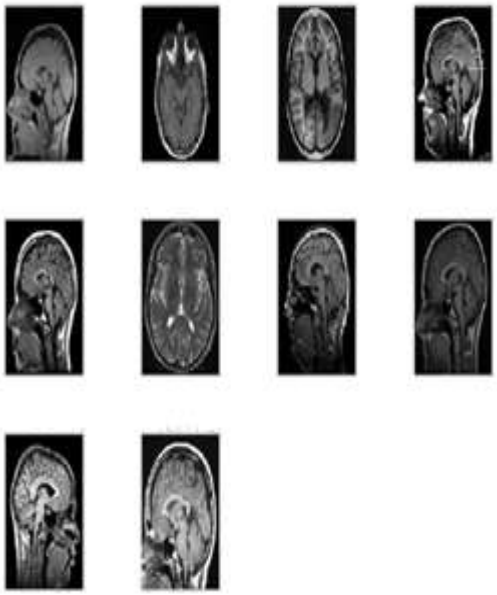

Fig. 7 Retrieved Images with RF

VIII. CONCLUSION

In this work, a learning-based and classification-driven image retrieval framework is proposed for collecting the images from the different modalities. Here the retrieval system using SVM classification is to filter out the irrelevant images followed by the linear combination of similarity matching. To be more profitable, relevance feedback techniques are incorporated into CBIR, such that more precise results can be obtained by taking user's feedback into account. The problem in this approach are the limitation of support vector technique lies in the choice of kernel, speed and size of the system in training and testing of large database is low and clustering accuracy is less. In order to overcome these limitations, in future work we will use the neural network based approach which is used to separate an image database into different classes.

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