Simple, International Journal of Advanced Trends in Computer Applications (IJATCA)
Volume 3, Number 8, August - 2016, pp. 1-5
ISSN: 2395-3519

International Journal of Advanced Trends in Computer Applications
www.ijatca.com

CONTENT BASED IMAGE RETRIVAL WITH SURF SVM AND MDA

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Abstract: *In this paper an efficient algorithm is presented on the basis of SURF, SVM and MDA. For the detection and description of image features SURF algorithm is used. Firstly the SURF feature detector is applied for the extraction of reference images and for matching the feature points in the image, respectively. In the feature points matching process, false matching points are removed through this algorithm. Here SURF algorithm is used to detect and descript the interest points, and matching the interest points. In this paper, the same is tried to retrieve with the utilization of SURF and then for further classification they are fed into SVM (Support Vector Machine) and MDA (Multi-linear Discriminant Analysis). SURF is fast and robust interest points detector which is used in many computer vision applications. For the implementation of this proposed work we use the Image Processing Toolbox under MATLAB Software.*

Keywords:: CBIR, SURF, Support Vector Machine, MDA, classification, interest point

I. INTRODUCTION

Earlier the methods used for image matching can be divided into two classes namely; first is based on image matching and second is based on feature matching. In the matching method, the image grey value is directly used to determine the space geometry transform between the images. The matching method based on integral image content is the method which makes full use of the information of the image. In the feature matching stage, the fixed size window and even whole image matching are adopted in estimation, so the calculation is simple and also easy to be performed. In recent years, very large collections of images and videos have grown rapidly. In parallel with this growth, con-tent based retrieval and querying the indexed collections are required to access visual information. The main two components of the visual information are texture and color.

The history of the content-based image retrieval can be divided into three phases: first is based on artificial notes, second is based on vision character of image contents and third is based on image semantic features. The image retrieval on the basis of artificial notes, labels the images by using text. The problem with this approach is that, it brings hefty workload and on the other hand, it still debris subjectivity and uncertainty. So the image retrieval based on artificial notes still remains insufficiency. The further study which acclimate the vision image features become the main focus of research. The main character of this method is the extraction of image feature impersonally and the accuracy of the features extraction depends on whether the retrieval is good or not.

In the system based on image semantic feature classified the semantic features into two levels; middle level feature and low- level feature. In Low-level feature, color, texture and inflexion are involved whereas in middle level shape description and object feature are involved. CBIR (Content based Image Retrieval) systems try to retrieve the images which are similar to a user-defined specification or pattern for e.g., shape sketch, image. Their main objective is to support the image retrieval which is based on the content properties like shape, color, texture. CBIR approach has many advantages but one of the main advantages is the feasibility of an automatic retrieval process, where as the traditional is the keyword-based approach, which is very laborious and time-consuming.

II. METHODOLOGY

The methodology of the system involves following four phases.

Phase 1: Code is developed for opening GUI for this implementation. After that we *code is developed for*

loading the input image and database images to generate the database or mat file.

Phase 2: Develop a code for the feature extraction process. For the feature extraction process the SURF technique is used. After that the complete features of loaded image is obtained.

Phase 3: After that code is developed for the classification using the SVM and MDA classification.

Phase 4: At last code is developed to calculate PSNR, MSE, CCR and Accuracy obtained and analyzed with previous results.

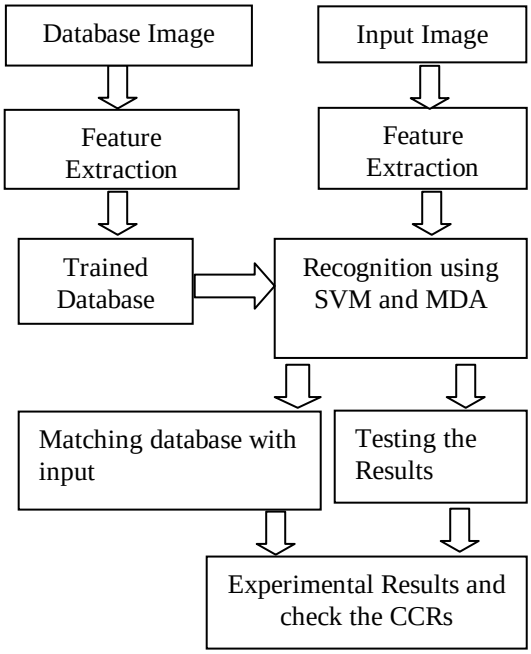

Fig.1: Flow Chat

Feature Extraction

In digital image processing and in pattern recognition, extraction of feature is a distinctive form of dimensionality reduction. When the input data provided to an algorithm is excessively large to be handled or processed, it is imagined to be particularly redundant. Then the input data is converted into a reduced representation set of features, which is named as features vector. The transformation of the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task by using the reduced representation instead of the full size input. Extraction of features involves facilitating the amount of resources necessary to characterize a large set of data accurately. Generally the analysis with a large no. of variables requires a large amount of power for computation and memory or an algorithm for classification which over fits the training sample and generalizes new samples. The feature extraction is a general term for approaches of creating the combinations of variables for describing the data with sufficient accuracy. In digital image processing, a color histogram is a representation of the distribution of colors in an image. The pre-processing of image is done and after pre-processing is completed, the SVM is used to segregate the various categories. The training data should be sufficient to be statistically significant. The classification parameters are calculated by using support vector machine learning. In the training process, training data is analyzed to find an optimum way to categorize the images into their respective classes.

Recognition

Recognition is done using support vector machine (SVM) and Multi linear discriminant analysis (MDA) classifier. These are discussed below.

Support Vector Machine (SVM)

SVM is a classification method which was introduced by Vapnik in the year 1992. This classifier is mainly used in bioinformatics and other disciplines due to its many advantages like highly accurate, can process the high-dimensional data such as gene expression. It belongs to the general category of kernel methods. A kernel method depends on the data obtained through dot-products. In this case, kernel function is used which computes a dot product in possibly high dimensional feature space. There are two advantages Firstly, it has the ability to generate non-linear decision boundaries. Secondly, by using kernel functions the user is allowed to apply a classifier to data with no obvious fixed-dimensional vector space representation, examples of such data in bioinformatics are sequence, either DNA or protein, and protein structure, etc. The main aim is to provide the user with an instinctive understanding of the choices regarding which kernel is to be used and provide guidelines related to general usage. The examples shown were achieved using the PyML machine learning environment. These were the examples which focus on the kernel methods and SVM. Some of the characteristics of SVM are; *Flexibility* in choosing a similarity function, *Sparseness* of solution when dealing with large data sets, Ability to handle large feature spaces. SVM has been used successfully in many real-world problems like gait recognition, text categorization, image classification, bioinformatics i.e. for Protein classification, Cancer classification etc. And SVM has its successful application in hand-written character recognition.

Multi Linear Discriminant Analysis (MDA)

MDA can be used to identify three or more than three class classifications. The main aim of MDA technique is to maximize the distance between different classes and minimize the difference between each class. The advantages of MDA are that, it helps to resolve the problem of small sample size. The available feature

dimension in MDA is not limited by number of classes in the data whereas in LDA it is limited. There is reduction at a large extent in the computational cost.

$$S_B = \sum_{j=1}^{\prod_{o\neq k} m_o} S_B^j, S_B^j = \sum_{c=1}^{N_c} n_c (\bar{Y}_c^{k,j} - \bar{Y}^{k,j})(\bar{Y}_c^{k,j} - \bar{Y}^{k,j})^T$$

$$S_W = \sum_{j=1}^{\prod_{o\neq k} m_o} S_W^j, S_W^j = \sum_{i=1}^{N} (Y_i^{k,j} - \bar{Y}_{c_i}^{k,j})(Y_i^{k,j} - \bar{Y}_{c_i}^{k,j})^T$$

Matching

Surf is used in various systems for performing matching operation. It is a robust local feature detector and is good at handling images with rotation and blurring. But it is not good at handling viewpoint and illumination changes. Analysis shows that SIFT is three times slower than SURF. It approximates the schemes which are previously proposed with respect to uniqueness, repeatability, and robustness and yet can be computed and compared much faster as compared with other matching techniques.

III.EXPERIMENTAL RESULTS

In this section, we perform experiments to prove the adequacy of the proposed approach. The comparison of the accuracy, PSNR, MSE is done with the given values to the proposed work. The accuracy rate is approx 98 percent i.e. much higher as compare with the previous methods.

Fig 2 shows all the graphs for estimated average PSNR, average MSR, feature point and the matching point in the proposed approach. This shows that the proposed system is much efficient as compared with the previous system. All the parameters are calculated just to verify the efficacy of the system.

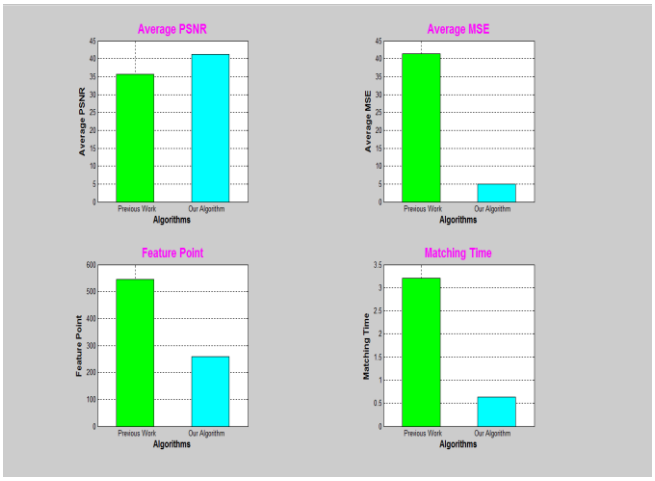

Fig 2: PSNR, MSE, Feature point and Matching point graphs

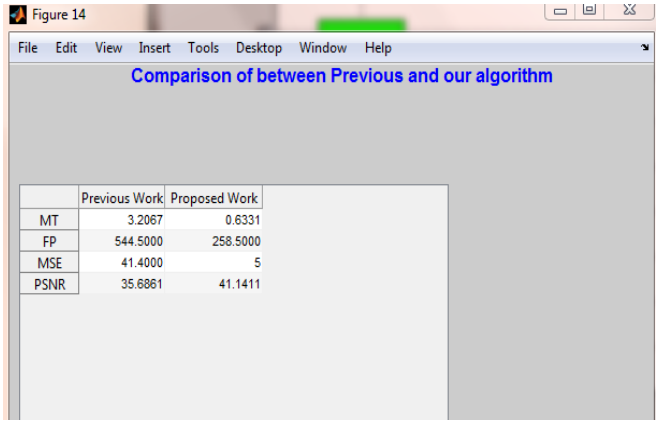

Fig 3: Comparison between previous and proposed approach

Fig 3 shows the comparison between all the parameters of both previous and proposed approaches. This shows that the approach which is proposed in this paper is a better approach than that of previous.

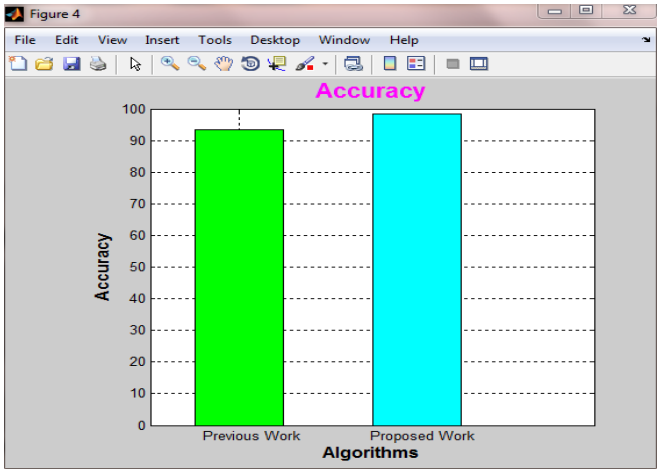

Fig 4: Graph for accuracy of previous and proposed approach

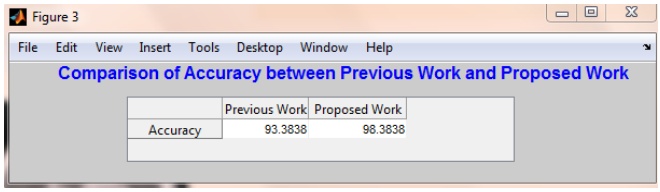

Fig 5: Comparison of accuracy for previous and proposed approach

Fig 4 and fig 5 shows the accuracy graph of previous and proposed approach. After comparison it is shown that the accuracy achieved is approx 98 percent which is better from the earlier methods.

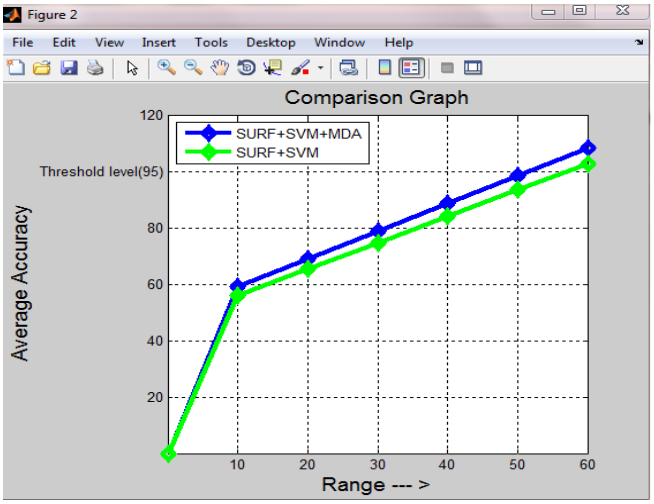

Fig 6: Comparison between previous and proposed algorithm on the basis of average accuracy

The fig shown above shows the comparison between the previous method and the proposed method on the basis of average accuracy. This shows that the approach which is proposed is more decisive and potent when compared with the previous used technique.

IV. CONCLUSION

The dramatic rise in the sizes of images databases has stirred the development of effective and efficient retrieval systems. The development of these systems started with retrieving images using textual connotations but later introduced image retrieval based on content. This came to be known as CBIR or Content Based Image Retrieval. Systems using CBIR retrieve images based on visual features such as colour, texture and shape, as opposed to depending on image descriptions or textual indexing. In this thesis, we have researched various modes of representing and retrieving the image properties of colour, texture and shape.

The application performs a simple colour, contents-based search in an image database for an input query image, using SURF, SVM, MDA and colour histograms. It extracts the features of images and then compares the features and colour histograms of different images. CBIR is still a developing science. As image compression, digital image processing, and image feature extraction techniques become more developed, CBIR maintains a steady pace of development in the research field. Furthermore, the development of powerful processing power, and faster and cheaper memories contribute heavily to CBIR development. This development promises an immense range of future applications using CBIR.

Future Scope

This is limited to acquiring or retrieving single image from group of database images. We can extend our research to work on the different images or more than one image simultaneously .Also in future more parameters like by enhancing the number of pixels quality can be considered. This can also extend this work for the infinite number of users. We can further apply new formulas or algorithm for the enhancement of accuracy in detection or retrieval of images and reducing time for execution. The proposed algorithm can be implemented on different tools.

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