

**FEATURE BASED IMAGE RETRIEVAL USING CLASSIFICATION AND
RELEVANCE FEEDBACK TECHNIQUE**Keyuri M. Zinzuvadia¹, Prof. Bhavesh A. Tanawala², Prof. Keyur N. Brahmhbhatt³¹PG Student, Department of Computer Engineering, B.V.M. Engineering College, V. V. Nagar, India²Assistant Professor, Department of Computer Engineering, B.V.M. Engineering College, V. V. Nagar, India³Assistant Professor, Department of Information Technology, B.V.M. Engineering College, V. V. Nagar, India

Abstract-Now a day, digital world increase with bandwidth, handheld devices, storage technologies, social networking sites and huge volume of images are stored on web. With significantly huge image database it is difficult to mine that data and retrieve relevant images. Image mining work related to this problem in that image retrieval is an important phase. In the field of image processing Feature based image retrieval is important research area. It extracts low level features like color , texture and shape and compute similarity function from images. The main problem of FBIR has been semantic gap between low level visual feature and high level image semantics.

In Proposed system architecture HSV space histogram will be used for colour information extraction. Gabor filter will be use for texture feature extraction and shape feature is using invariant moment method. In this study composite approach of multiple feature extraction using hsv histogram, Gabor feature and moment invariant method will be use. Based on the extracted feature Support Vector Machine classification technique is applied. Here classification reduce the search space and reduce retrieval time. And SVM accurately classify images in less amount of time than any other classifier. After that Query Weight update relevance feedback algorithm has been applied which retrieve more relevant images as per the user feedback of relevant image .This improves accuracy of finding relevant image for given query image.

Keyword: - FBIR, Feature Extraction, color, texture, shape, Classification technique

I. INTRODUCTION

Feature Based Image Retrieval (FBIR) or content based image retrieval is the retrieval of images based on their visual features such as color, texture and shape. The ultimate goal of a FBIR system is to avoid the use of textual descriptions for an image by the user. This kind of a textual-based image retrieval system always suffers from two problems: high priced manual annotation and inaccurate and inconsistent automated annotation. [4].As a result fbir which extract visual content of images like color, shape, texture, edge, layout and the desired images are retrieved from a large collection of images on the basis of features that can be automatically extracted. Most FBIR systems work in this way: Load query image, a feature vector is extracted from the query image. A feature vector is extracted from each image in the database and the set of all feature vectors is organized .It is matched against the feature vectors of the query image and give relevant images from the database. The block diagram of basic FBIR system is shown in Fig. 1.

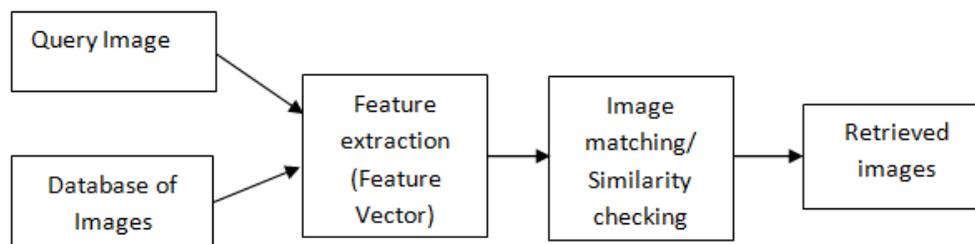


Fig. 1 Block diagram of FBIR

1.2 Related Work

The development of feature based image retrieval (FBIR) systems is very attractive research area because of its wide

range of applications in different fields medical treatment, digital photo library, space imaging, bioinformatics, prevention of crime etc.

In Efficient Content based Image Retrieval System using Mpeg-7 Features. MPEG-7 standard is use to provide a rich set of standardized tools to describe multimedia content.Mpeg-7 Stands for Multimedia Content Description Interface. MPEG-7 has used five Color Structure Descriptor for color and Edge Histogram Descriptor for texture. It has allowed quick and efficient content identification and addressing a large range of applications. These two features are combined to increas e the performance of CBIR Systems [1].Another proposed work of content based image retrieval has use color, texture and shape features. For color feature extraction hsv histogram, Gray Level Co-occurrence Matrix (GLCM) for texture feature extraction and moment invariant method for shape feature extraction was used. Combination of these three features with grab cut algorithm strongly improves precision and recall value [2].

Concept learning technique with fuzzy k-NN classification and relevance feedback technique has proposed algorithm where color, texture and shape feature were extracted using different techniques. Color feature was extracted using HSV histogram technique which has 54 components. Texture feature was Extracted using Gabor filter with 48 components. Edge histogram method was use for shape feature extraction. After that semantic network was created by fuzzy knn classification technique. Then query weight update algorithm was use as relevance feedback algorithm. As per that algorithm weight is given to each feature and it was adjusted based on the user feedback .And user were provided with more satisfactory results. This experiment shows that classification accuracy was improve with relevance feedback algorithm [3].

Other performance analysis of different feature extraction and classification have computed. Where different feature extraction methods like Principal Component Analysis (PCA), Linear discriminate analysis (LDA), Independent Component Analysis (ICA) have used. Then feature wise classification was applied with support vector machine classifier and Nearest Neighbor Classification technique. The performance is calculated in terms of Recognition Rate, F-score. As per the final experimental result they have concluded that Support vector machine classifier work best with all the feature combination and gives accurate result than nearest neighbor classifier [4]. There are many methods available for relevance feedback .A survey for relevance feedback in FBIR system was carried out. Where different technique of learning like, short term learning and long term learning were explained. After that query refining methods like query point movement and updating weight vector were discussed [7].

II. PROPOSED APPROACH

Feature based Image retrieval is very interesting research area and it can be developed as per the application. Here in our proposed approach it was divided into following tasks:

1. Texture, Color and shape Feature generation from images stored in database
2. Classification was applied on images based on combination of three features.
3. After final result user can give feedback for relevant images and relevance feedback algorithm work on it.
4. Similarity search and output the result.

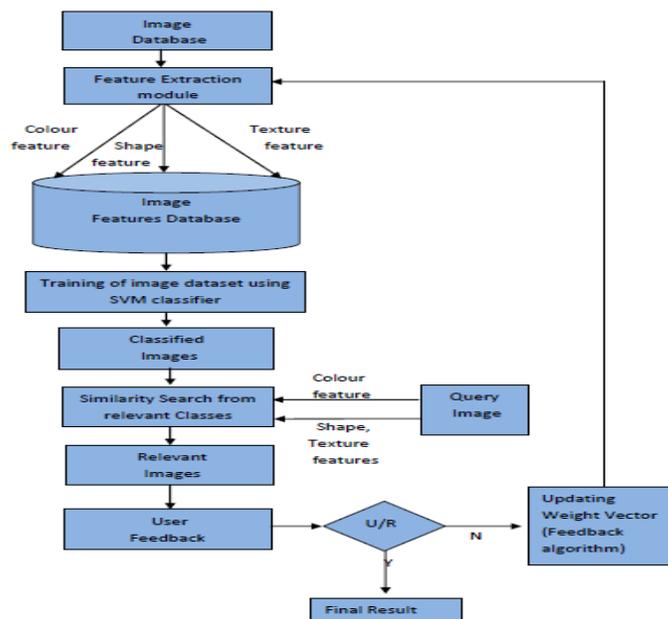


Fig.2 Proposed System

2.1 Feature Extraction

2.1.1 Color feature extraction using Quantized HSV histogram

The main method of representing color information of images in FBIR systems is through color histograms. As the color map each row represents the color of a bin. The row is composed of the three coordinates of the color space. The first coordinate represents hue, the second saturation, and the third, value, thereby giving HSV. Quantization in terms of color histograms refers to the process of reducing the number of bins by taking colors that are very similar to each other and putting them in the same bin [2]. Obviously quantization reduces the information regarding the content of images but as was mentioned this is the tradeoff when one wants to reduce processing time [10].

Algorithm:

- Step 1: Create dataset of images using defined feature extraction method store it in .mat file.
- Step 2: Feature extraction of Query image using color histogram.
 - Convert RGB to HSV
 - Quantize each h, s, v equivalently to 8x2x2 bins
 - Create final histogram matrix of size 8x2x2 that gives single 32 dimensional feature vector.
- Step 3: Pass Query image and calculate same feature from it.
- Step 4: Calculate distance between all images in database and query image features.
- Step 5: Store that distance and Sort it in ascending order. Show top images from database.

Output:

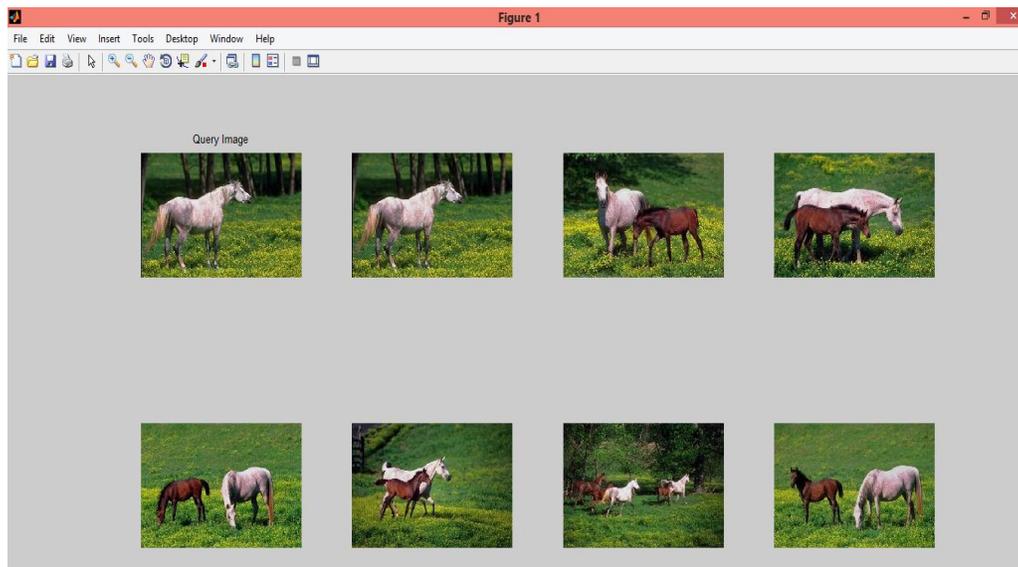


Figure 3: Result of Quantized HSV histogram based image retrieval

2.1.2 Texture feature extraction using Gabor filter

Texture is also powerful low level feature for image retrieval application. Texture is innate property of all surfaces which describe visual patterns. We have used Gabor filter which is linear filter used for edge detection. Frequency and orientation representation of Gabor filter is similar to human visual system [8].

The 2D Gabor Filter is given by:

Frequency part

$$\text{Gabor}\{s\} = \exp(-(\log(\text{radius}/f_0))^2 / (2 * \log(\text{sigmaOf})^2));$$

$$\text{Gabor}\{s\} = \text{Gabor}\{s\} .* \text{lp};$$

Orientation part

$$ds = \sin\theta * \cos(\text{angl}) - \cos\theta * \sin(\text{angl});$$

$$dc = \cos\theta * \cos(\text{angl}) + \sin\theta * \sin(\text{angl});$$

$$d\theta = \text{abs}(\text{atan2}(ds, dc));$$

$$\text{spread}\{o\} = \exp(-d\theta^2 / (2 * \theta\text{Sigma}^2));$$

Filter by multiplying frequency and orientation part.

$$\text{filter} = \text{Gabor}\{s\} .* \text{spread}\{o\};$$

Here s =frequency, o =orientation, lp =lowpassfilter, sigmaOf =Gaussian deviation, angl =orientation's angle, θSigma =ration of orientation and frequency part f_0 =central frequency.

Algorithm:

Step1: Create feature database

For every images in database

Gabor filter banks of 24 filters are constructed in terms of two components. We have used 4 scales and 6 Orientation
 The radial component, which controls the frequency band that the filter responds, the angular component, which controls the orientation that the filter responds.

The two components are multiplied together to construct the overall filter.

Apply these filters to all images in database and calculate meanAmplitude and SquaredEnergy for all filters

Image is converted into frequency domain to directly multiply with frequency response of Gabor filters.

Store resultant 1*48 size feature vector in database

Step2: Extract same Features from query image.

Step 3: Calculate distance between all images in database and query image features

Step 4: Store it and Sort it in ascending order, Show top images that are specified in query.

Output:

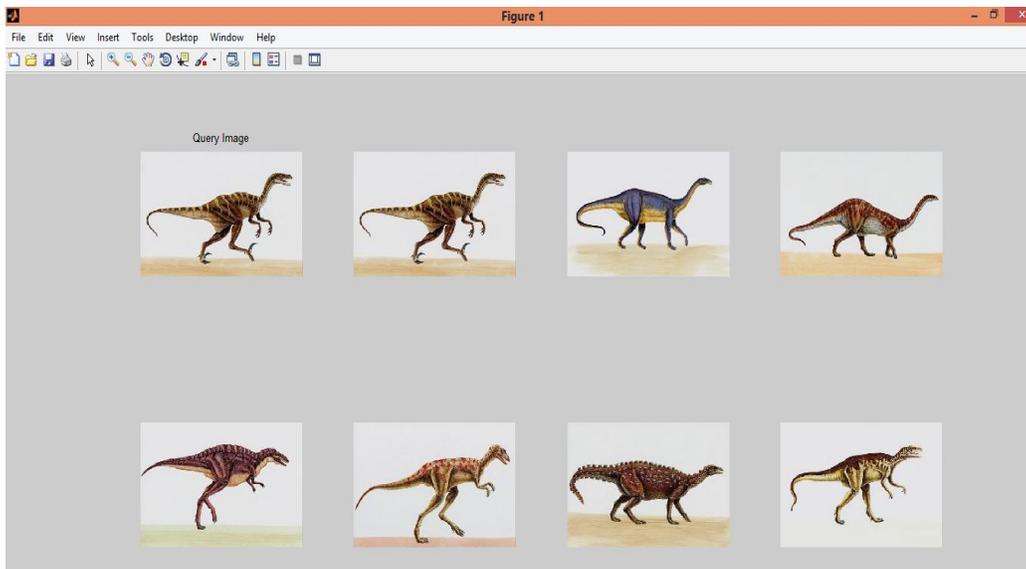


Figure 4: Result of Gabor filter based image retrieval

2.1.3 Shape feature extraction using moment invariant technique

Moment invariants have been frequently used for shape features for image processing. Moments can be used to provide characteristics of an object that uniquely symbolize its shape. Invariant moments are invariant to translation, rotation and scaling.

- Step 1: Create feature database
For every image in database
Calculate first seven invariant moments for each image in the database and Store resultant 1*7 feature vector in database.
- Step 2: Extract same Features from query image.
Take query image to calculate first seven moments and store it.
- Step 3: Calculate distance between all images in database and query image features
- Step 4: Store that distance and Sort it in ascending order. Show top images that are same or similar to given query image.

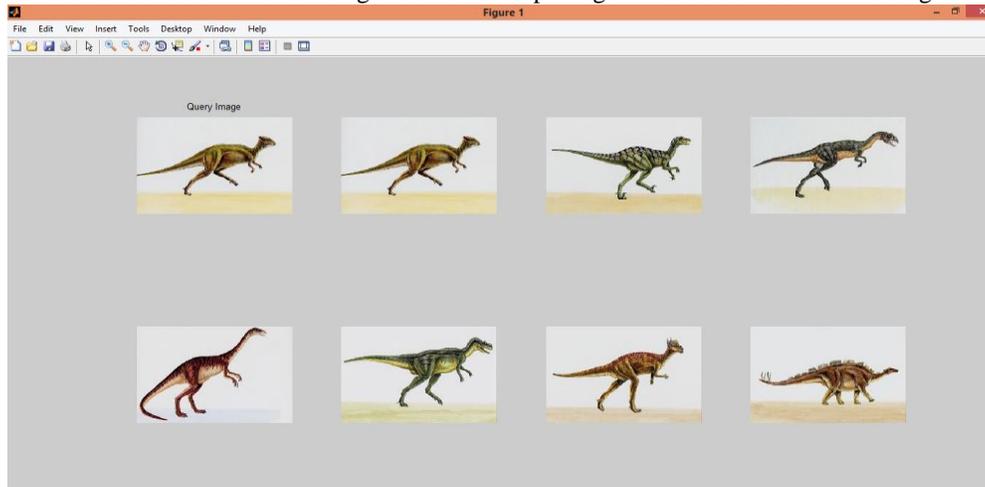


Figure 5: Result of moment invariant based image retrieval

2.2 FBIR using multi feature extraction technique

We have use a novel approach of multiple feature extraction using HSV Histogram, Log Gabor feature and Moment invariant. Here by using these formulae we can retrieve appropriate images from the database with more accuracy rather than each individual approach. Using Multi-feature extraction each feature adds its unique advantages so that accuracy is better with compare to individual feature. A Novel approach of multi features extraction using HSV histogram, Log Gabor features and Moment invariant gives a single $32 + 48 + 7 = 87$ dimensional feature vector.

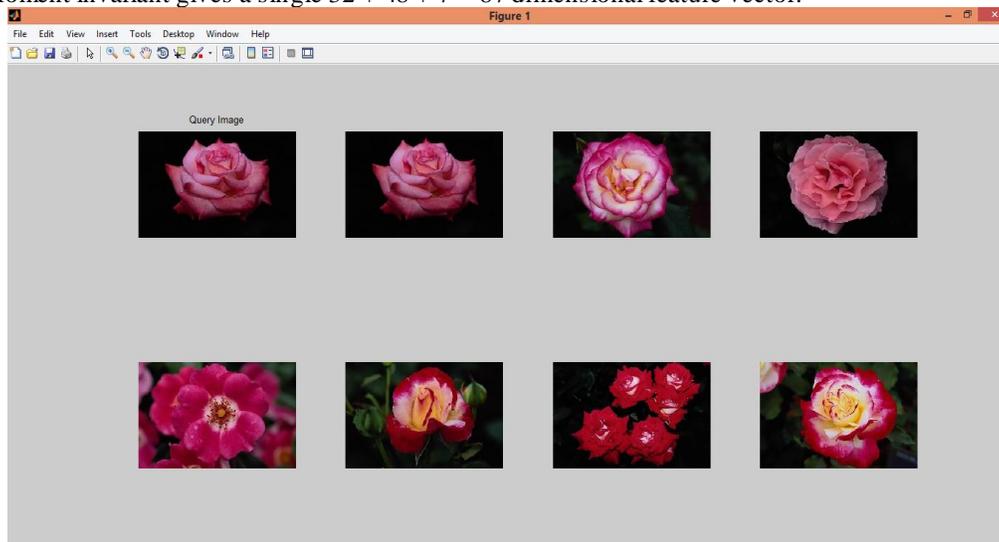


Figure 6: Result of image retrieval using multiple features

2.3 SVM Classification with multi feature extraction

We have used Support vector machine classification algorithm to classify images in predefined categories. The supervised machine learning techniques perform the classification process with the help of the already categorized training

data. When the supervised learning algorithms are trained with the known training data, it is able to generalize the new unseen data.

Hence, given a query image, the low level features are extracted and it is given as input to the machine learning algorithms which is already trained with the training data [7]. The machine learning algorithm predicts the category of the query image which is nothing but the semantic concept of the query image. Hence instead of finding similarity between the query image and all the images in DB, it is found between the query image and only the images belonging to the query image category.

Here we have used one-against-one / Pair Wise Coupling (PWC) which constructs $N*(N -1)/2$ SVM binary classifiers. For each pair of classes, there is one classifier. The class which gets the highest vote is the class of the data point. Hence, when a query image feature vector is given to the SVM, it predicts its class (semantic concept).

Algorithm:

Step 1 from all classes label the feature vector of images.

Step 2 Train Support vector machine according to the label attached to the feature vectors and generate model.

Step 3 Find the query image's class label which it belongs according to feature vector calculated of it.

Step 4 Perform classifications of the images.

Step 5 Calculate distance between all images in database and query image features. Store that distance and Sort it in ascending order.

Step 6: Show top images that are same or similar to given query image.

Output:

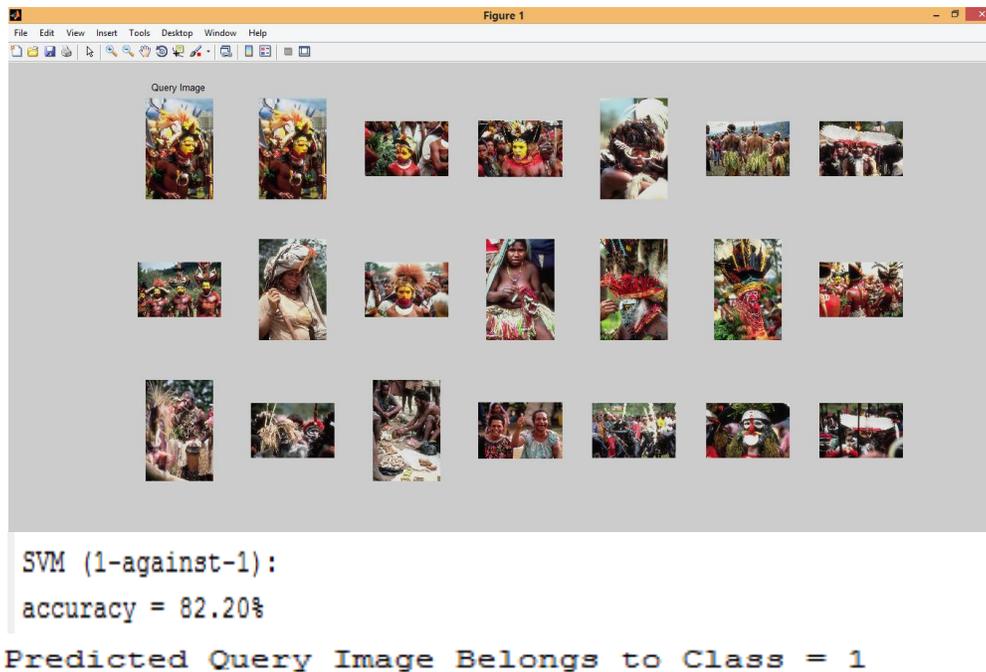


Figure 7: Result of image retrieval using multiple features and SVM Classification

2.4 Relevance feedback algorithm with FBIR

Relevance feedback is feature of Information retrieval system. Main idea behind relevance feedback process is to take initially returned image for given query image and use that information to find whether or not those results are relevant or not as per the user perspective.[7] Relevance feedback basically used to get user intention for given query results. We will go to use Updating Weight Vector which is query refinement method.

In query weight update algorithm weights of different features are change in the query representation. It allows system to learn user's interpretation of similarity function. Since each image is represented by an N dimensional feature vector, then enhance importance of those dimension of feature that help in retrieving relevant images and reduce weights of

which is not help in retrieving relevant images. Based on the user feedback weight of features are updated and provide images according to user satisfaction [7]. Relevance feedback also increases classification accuracy.

Algorithm:

- Step 1** Compute mean image feature for user’s feedback images
- Step 2** After that calculate weighting matrix for positive feedback images by computing variance of that images and store it in matrix.
- Step 3** With output of relevance feedback multiply weighted matrix with Euclidean distance calculated between query image and database images.
- Step 4** Store that distance and Sort it in ascending order. Show top images that are same or similar to given query image.

Output:

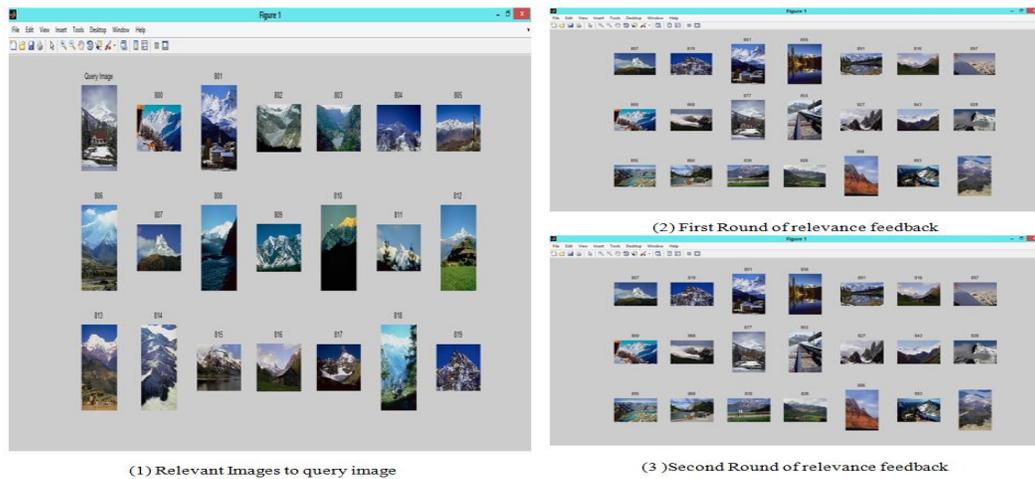


Figure 8: Result of FBIR with relevance feedback

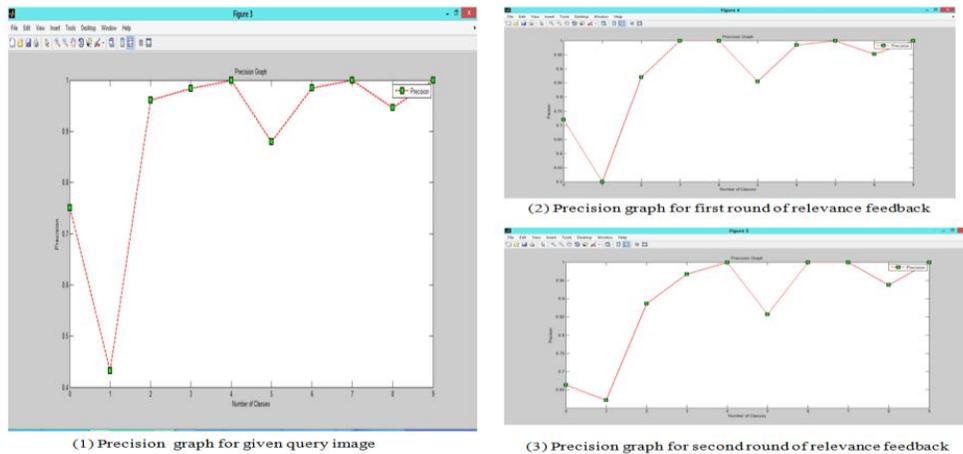


Figure 9: Precision graph of FBIR with relevance feedback

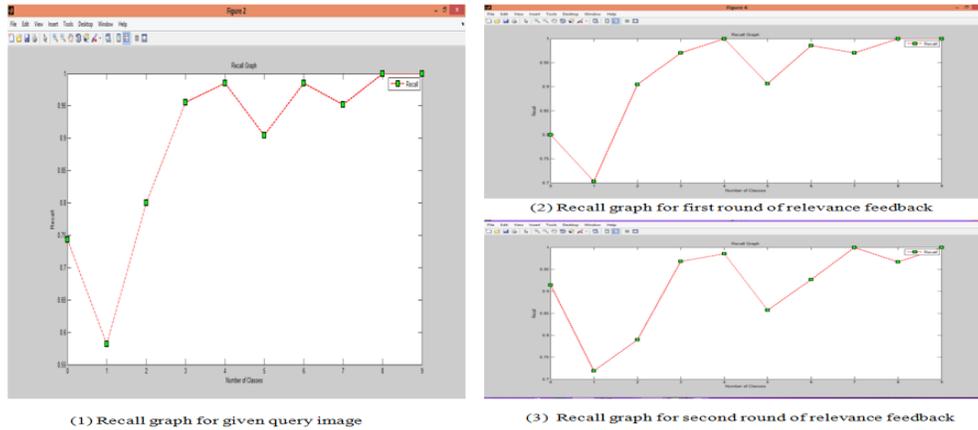


Figure 10: Recall graph of FBIR with relevance feedback

III. PERFORMANCE EVALUATION OF PROPOSED METHOD

In this paper, The WANG database is a subset of 1,000 images of the Corel stock photo database which have been manually selected and which form 10 classes of 100 images each [16] is used for classification. On considering the result of existing individual feature extraction technique compare to multi feature extraction technique gives good precision value. Here in each round of relevance feedback system finds more relevant images. And retrieval time is also reducing because of the classification technique use.

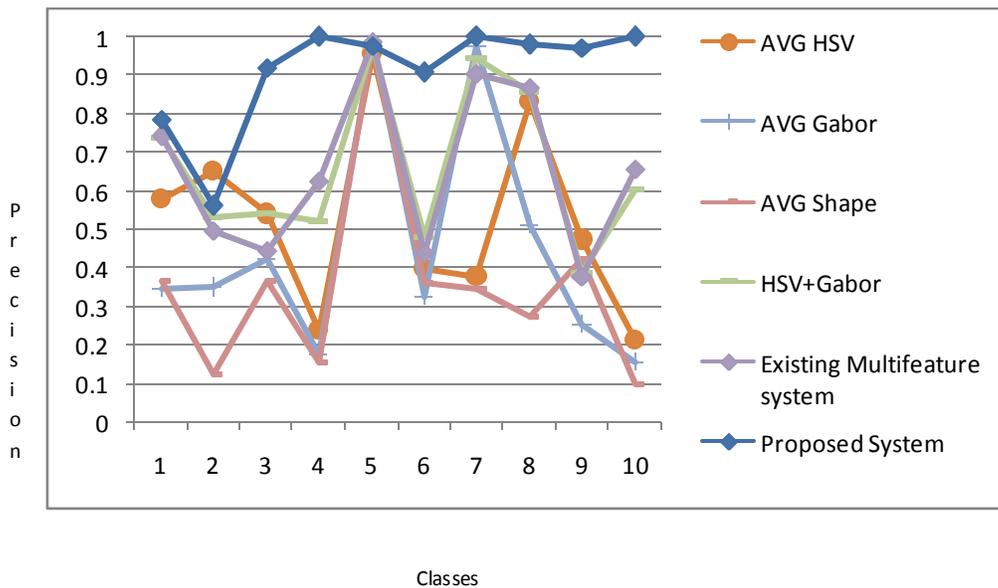


Figure 11 Comparison of Individual feature extraction system with proposed system

Thus FBIR with multiple feature extraction gives good result for some classes but for overall classes FBIR system with SVM classification gives best result compare to existing system.

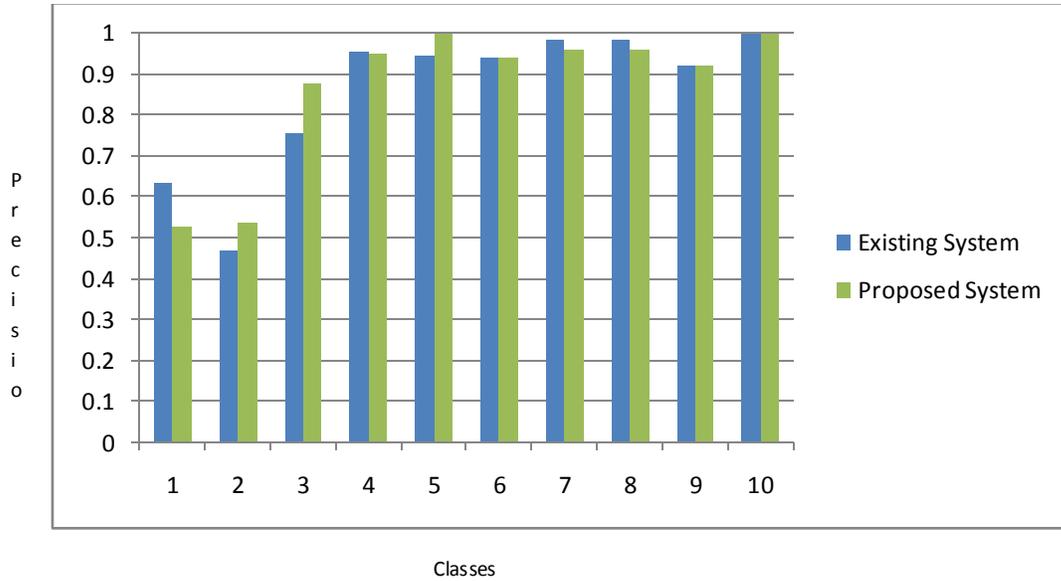


Figure 12 Comparison of Proposed System with Existing system

Proposed FBIR system with multi feature extraction with SVM classification and relevance feedback work more accurately compare to existing system.

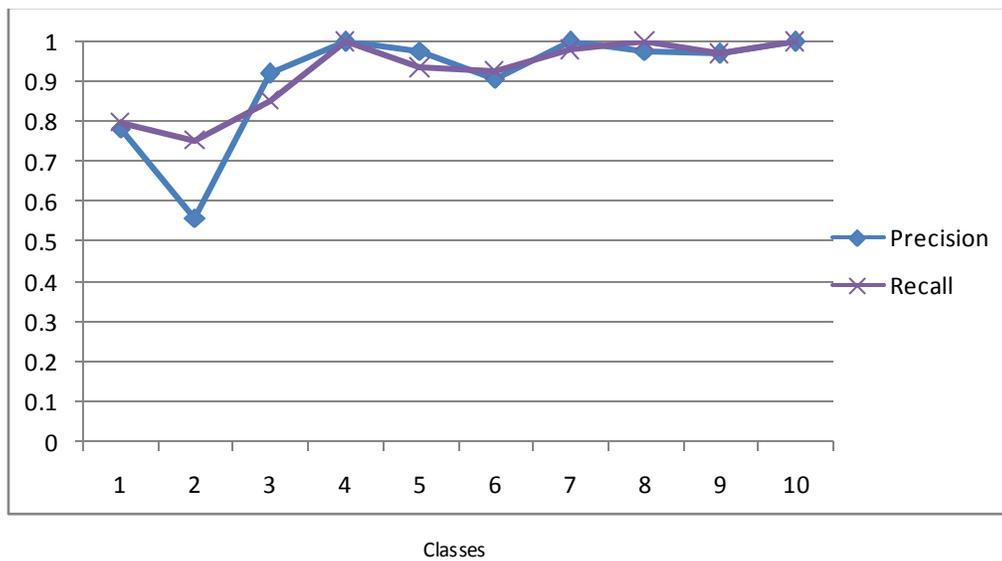


Figure 13 Precision/Recall graph

The Precision/Recall values and crossover point proves that the capability of Multi feature Extraction with SVM classification and relevance feedback based FBIR technique is better accuracy of relevant images from database than individual technique that used and outperform than existing method.

IV. CONCLUSION

Feature Based Image Retrieval is very versatile subject. And its result varies according to approach used. From above study we can say that color feature extraction using HSV space histogram based technique is more efficient and it requires less memory so resultant database is small. Gabor filter will be use for texture feature extraction which is near to human visual performance. For shape feature moment invariant method will be used which is invariable for translation, rotation and scale. Here multiple features are going to be used rather than individual feature extraction method which gives good result.

Main problem of FBIR is known as the “Semantic gap” problem. By using shape feature, machine learning algorithm and relevance feedback we try to reduce semantic gap. SVM classification predicts relevant class for given query so it can retrieve accurate result in less time. After that query weight update algorithm take feedback from user and provide satisfactory result to them by giving more relevant images to query image . Our Proposed system a novel approach for FBIR using multi feature extraction have higher accuracy of relevant image retrieval with compare to existing system.

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