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SEMI-SUPERVISED INTERACTIVE IMAGE RETRIEVAL METHOD BASED ON AVERAGE ABSOLUTE DEVIATION

K. VENKATASALAM, Dr. P. RAJENDRAN M.E., Ph.D., MISTE.

Assistant Professor/Cse, Mahendra College Of Engineering.
Professor Knowledge Institute Of Technology

ABSTRACT

Content Based Image Retrieval has recently gained more attention because of its number of applications in Image Management, Medical databases and Web search. A wide range of solutions based on relevance feedback technique have been implemented in the recent past to handle various issues in CBIR. All the existing feedback technique gives privilege to user's view point for semantic analysis of the Image. Semantic Analysis of the Image can also be done by quantifying the lower level features. In this paper, we propose a statistical based method known as Average Absolute Deviation is used to quantify the gray scale information in the ROI image. The acquired image has been processed to extract two different feature vectors, one consisting of gray scale image and other one consisting of Gabor image of the gray scale intensity. The extracted ROI image from the acquired image is divided into arbitrary number of parts according to the size of the image. This AAD method quantifies the feature information of the sub image of the both ROI image and filtered ROI image. Matching between Query Image and Reference Image is done based on Euclidean distance. The performance evaluation of this proposed method is analyzed by comparing it with the existing methods in the literature to show the achievement in terms of accuracy and processing speed.

Keywords: *Image Retrieval, Deviation, ROI, ADD, Accuracy, Processing Speed*

1. INTRODUCTION

From the recent past, the content based image retrieval has become one of the most active research directions in the multimedia information processing because of the rapidly increasing requirements in many practical applications, e.g., architectural design, museum management, education and fabric design [1]. Moreover, it is also desirable to develop image retrieval tools to browse and search images effectively and efficiently because of the explosive growth of personal image records and image records on the Internet [2]. To give text annotations to all images manually is tedious and impractical . In addition, automatic image annotation is generally beyond current techniques. Finally, a picture says more than a thousand words[3]. Therefore, content-based image retrieval (CBIR) has gained much attention in the past decades. CBIR is a technique to retrieve images from an image database such that some users focus on the modern building so the best match could be a modern building in the middle image; while others may focus on the beauty, the best match could be a beauty in the right image. Retrieved images are semantically relevant to a query image provided by a user [4]. It is based on representing images by using low-level visual features, which can be automatically extracted from images, to reflect the color texture and shape [information of the image. However, the gap between the low-level visual features and the high-level semantic meanings usually leads to poor performance[5].

2. EXISTING WORK

Wei Bian and Dacheng Tao [6] proposed a mechanism called the biased discriminative Euclidean embedding .In this mechanism, the image are parameterized as samples in the original high-dimensional ambient space to discover the intrinsic coordinate of image low-level visual features. They compared this mechanism against the conventional RF algorithms and show a significant improvement in terms of accuracy and stability based on a subset of the Corel image gallery.

Ja-Hwung Su, Wei-Jyun Huang, Philip S. Yu, and Vincent S. Tseng [7] proposed a novel method, which is based on the Navigation-Pattern-based Relevance Feedback in order to achieve the high efficiency and effectiveness of CBIR in coping with

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the large-scale image data. In terms of efficiency, the iterations of feedback are reduced substantially by using the navigation patterns discovered from the user query log.thier proposed work makes use of the discovered navigation patterns and three kinds of query refinement strategies, Query Point Movement (QPM), Query Reweighting (QR), and Query Expansion (QEX), to converge the search space toward the user's intention effectively. By using NPRF method, high quality of image retrieval on RF can be achieved in a small number of feedbacks.

Chih-Chin Lai and Ying-Chuan Chen [8] proposed a user-oriented mechanism for CBIR method based on an interactive genetic algorithm (IGA) is proposed. Color attributes like the mean value, the standard deviation, and the image bitmap of a color image are used as the features for retrieval. In addition, the entropy based on the gray level co-occurrence matrix and the edge histograms of an image are also considered as the texture features. Furthermore, to reduce the gap between the retrieval results and the users' expectation, the IGA is employed to help the users identify the images that are most satisfied to the users' need.

Subramanian Murala, R et al [9] Innovated an approach for content based image retrieval system based on local tetra patterns. Unlike binary and ternary pattern, quantifies the correlation between the referenced pixels with the neighbor pixel based on directional coding that are calculated by first order derivates in vertical and horizontal direction. In addition to that Gabor transform coding of the given image pattern is done and combined with the tetra pattern coding to improve the effectiveness of the system.

3. PROPOSED WORK

The query Image is obtained from the user, since the variation in the spatial locations affect the matching accuracy, it is essential to build the coordinate system for cropping the Region of Interest (ROI) from the Original Image. From the acquired ROI image, the feature extraction is done in two folds. The first one for extracting local information i.e., Intra-class structure information and second one for extracting non-local information i.e., inter-class structure information.

A) Feature Extraction Process

The main steps for feature extraction process are as follows:

1) Divide the ROI image into arbitrary number of segments according the size of the Image in such a way that each segment contains 1000 pixel. For example, the size of the ROI image is 160x250 pixels, the number of segments can be 40 segments. The feature element extracted in each of these segments gives the local information enclosed in the subspace.

2) Compute the average of the gray scale values in each segment. From the computed mean value, the absolute deviation is calculated to obtain Average Absolute Deviation (AAD) for each segment. The AAD parameter can be obtained by the following equation

$$AAD = \frac{\sum_{i=1}^{N} \left| gi(x,y) - Ai \right|}{N}$$

Where N is the total number of pixels in each segment gi(x,y) gives the gray level value of the segment and A_i is the average value. Likewise AAD for each segment is calculated to extract various feature information in the intra-class level.

3) To extract most prominent feature of the image additional to the local information, the ROI image is subjected to the bank of log Gabor filters. These filters can extract the basic information such as magnitude, Spatial and frequency information of the image [10]. By applying bank of log Gabor filters [11] for each image, say M number of images we obtained based on different dimensions and rotations.

4) From the filtered image, the extraction of feature information is done by dividing the image in to number of segments say N, which is equivalent to the number of segments in the ROI image. For each segment AAD parameter is computed. From this a new vector representing the feature information of MXN (1000) size for each image is obtained.

5) Both the feature information is fused by combining serially the two sets of feature vector into single-Vector. Suppose α be the information vector 1 with n dimension and β be the information vector 2 with m dimension obtained from the arbitrary information ξ The combination of these vector can be done by using weighted amalgamation method. This method gives weights are fixed according to

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the dimensionality of the vector. $\Psi = (^{\alpha}{}_{\Phi\ \beta})$ where Φ is the weight, can be called as amalgamation coefficient. This amalgamation coefficient is obtained by giving higher order weights to higher dimensional vector, since higher dimensional vector provides more powerful information than the low dimensional vector. This is achieved by comparing the dimensions n and m, and the value of Φ is obtained from values between ω and ω^2, where $\omega = n/m$, if n>m.

Algorithm: Feature Extraction Algorithm based on AAD

For a given query image – set Q,
F V1 (1…N) = [0…0]; // Initializing feature information vector 1
F V 2(1…M) = [0…0]; // Initializing feature information vector 2
N = size of the image/1000; // to obtain segment of size 1000.
Divide the ROI image into N segments;
g(x,y); // stores of gray level values of the pixels in each segment
For** N=1 to j **do
A= (A +g (x, y)) /N

End for
For** n=1 to i **do
AAD(i) =| g(x,y)-A|
End for
For** N=1 to i **do
F V1 (1…N) = ***AAD (i)***
End for
Apply log Gabor filter to obtain filtered image with different dimensions;
Let M be the number of image obtained from the Gabor filter;
For** i=1 to M **do
For** j=1 to N **do
AAD (i,j) = | g(x,y)-Aj|
End for
For** i=1 to M **do
For** j=1 to N **do
F V2 (1…N, 1…M) = ***AAD (i ,j)***
End for
End for
Combining of two feature vectors to obtain Union-Vector [1…N, 1…M];
End for

B) Matching process

The feature information of the query image is compared with those values obtained from the reference image in the database to generate matching scores. The matching score is calculated by computing Euclidean distance between the feature information vectors obtained from query image and Reference image. The most similar image for the given query image is obtained by finding the image sets with minimum Euclidean distance.

Algorithm: Matching Algorithm based on Euclidean Distance

For a given Query Image Q,
Union-Vector is obtained as UVQ [1…M, 1…N];
For the reference Image in the Database P,
Union –Vector is obtained as UVP [1…M, 1…N];
***For** i=1 to M do*
***For** j=1 to N do*
$W_i = 1/v_i$

$$ED_{x,y} = Sqrt \sum_{i=1}^{d} (wi)^2 (x_i - y_i)^2$$

End for
End for
Check for the minimum valued Euclidian vector to find similar images;
End for.

4. PERFORMANCE EVALUATION

The performance of the proposed system is evaluated by means of creating an image database from the gallery of photo images which is divided according to the syntactic groups. The Photo gallery has images with same semantic representation are in different group. Also have some images with different semantic representation in the same group. Each group has at least 50 images and at most 100 images.
In our experiment, 700 queries were totally given for the performance analysis of the system. In that the first 400 queries were taken as training samples to train the proposed CBIR system and the remaining queries were used to analyze the performance. In this paper, Accuracy rate, Equal error rate, Coherence rate and Retrieval rate are

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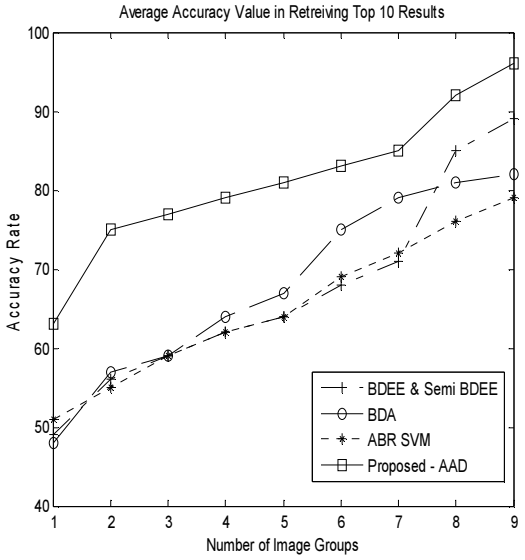
used to analyze the of the performance of the proposed CBIR system.

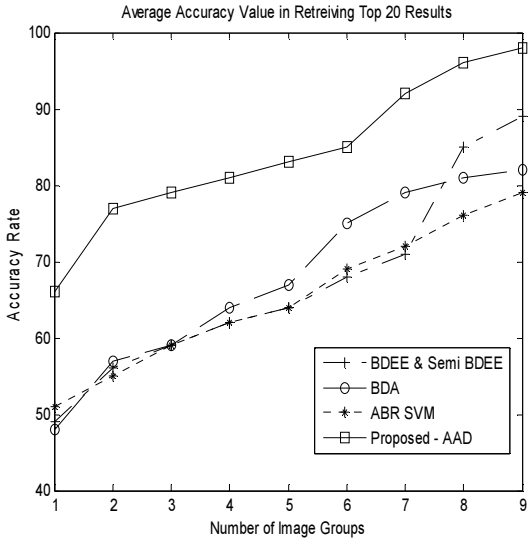
a) **Accuracy Rate:** Accuracy rate is the percentage of significant Images obtained in the Top N results.
b) **Error Rate:** Error rate serves as a measure of error obtained in the retrieval of Images. This error rate of the algorithm well describes about the stability of the algorithm for various types of conceptual images.
c) **Coherence Rate:** Coherence rate measure the semantic gap between the query image and the retrieved top N image results. Lesser the gap the more the Coherence Rate.
d) **Retrieval Rate:** The retrieval rate measures the performance of the system in terms of processing speed of the query. This is computed by calculating the time taken for getting the query image, processing the query image to obtain feature information and Matching with the Image database.

We compare the proposes algorithm against Relevant Feedback algorithms like, Marginal Biased Analysis MBA, Biased Discriminant analysis (BDA) and Random Subspace SVM[] ABRSVM.

The following figure 1 is the graphical illustration of the experimental results of the CBIR system based on the Accuracy Rate. The results were analyzed in terms of Top 10, 20 and 30 ranking position and illustrated in figure 1 a, b, c. The accuracy rate of the proposed AAD algorithm for CBIR system reaches up to the maximum of 97% for the queries belonging to the various conceptual groups.



(a)



(b)

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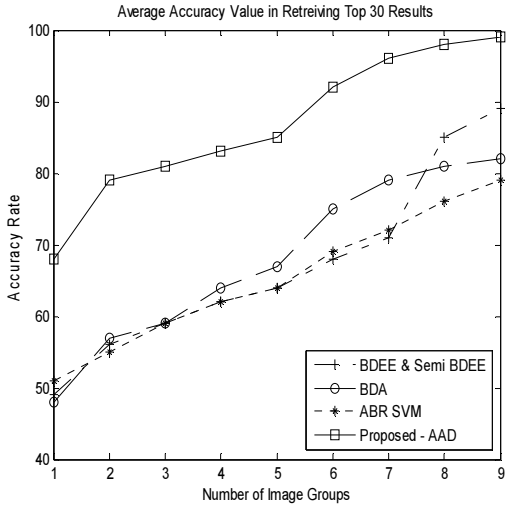
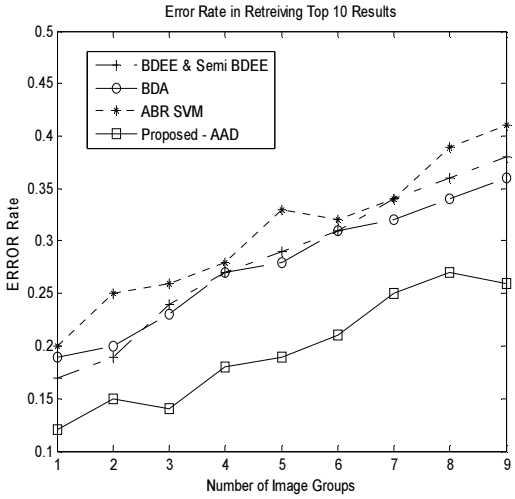


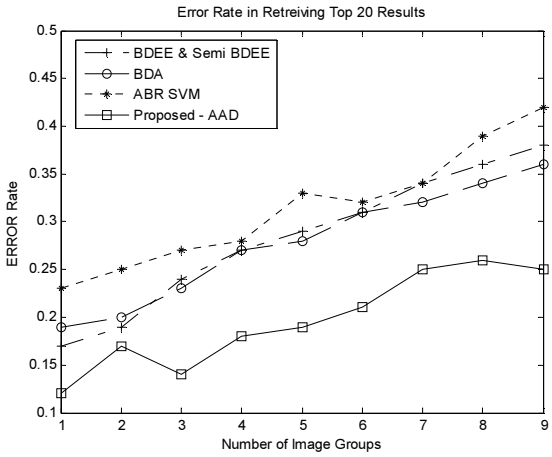
(c)

Figure 1(A,B,C): Performance Analysis Of Proposed AAD Algorithm Based On Accuracy Rate.

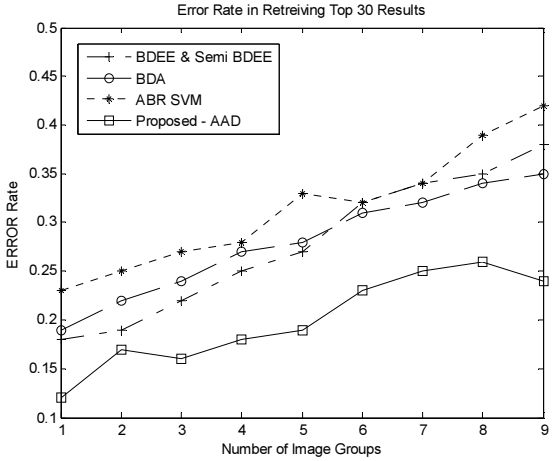
The following figures are the graphical illustration of the experimental results of the CBIR system based on Error Rate. The results were analyzed in terms of Top 10, 20 and 30 ranking position and illustrated in figure 2 a, b, c. The Error rate of the proposed AAD algorithm for CBIR system reaches to the minimum of 0.13 for the queries belonging to the various conceptual groups.



(a)



(b)



(c)

Figure 2(A,B,C): Performance Analysis Of Proposed AAD Algorithm Based On Error Rate

The following figures are the graphical illustration of the experimental results of the CBIR system based on Coherence Rate. The Coherence rate of the proposed AAD algorithm for CBIR system reaches to the maximum 98% for the top 30 ranking results for the queries belonging to the various conceptual groups.

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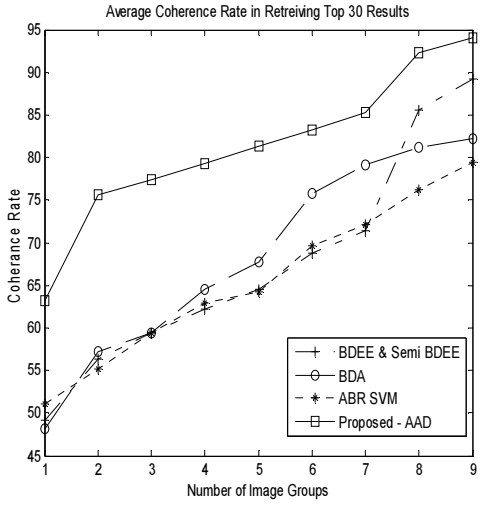

Figure 3: Performance Analysis Of Proposed AAD Algorithm Based On Coherence Rate

The following figures are the graphical illustration of the experimental results of the CBIR system based on Retrieval Rate. The Average Retrieval rate of the proposed AAD algorithm for CBIR system is 55% for the queries belonging to the various conceptual groups.

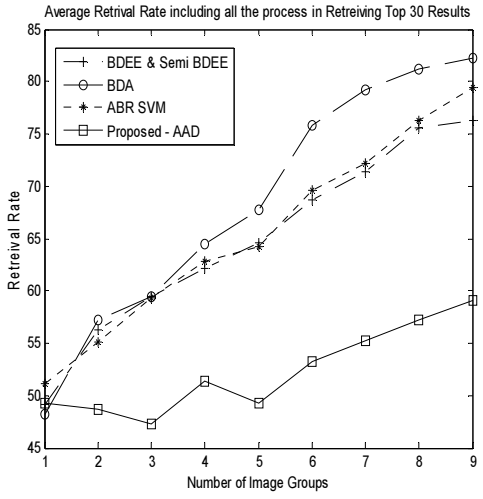

Figure 2: Performance Analysis Of Proposed AAD Algorithm Based On Retrieval Rate

For the results illustrated in the figure 1, 2, 3 and 4, the following are the discussion made on the results:

1) In all the cases of Accuracy Analysis, the proposed AAD algorithm constantly outperforms the existing algorithms in the Literature.

2) In the case of Error rate analysis, the obtained error rate for the proposed solution is found to be minimum, shows the stability of the algorithm towards various types of Input.

3) In the analysis of coherence rate, the proposed algorithm has maximum coherence rate showing that there is minimum semantic gap between the query Image and reference image listed from the database as query results.

4) Retrieval Rate of result images when a query image is given is analyzed and found that the proposed algorithm AAD has average retrieval rate when compared to the existing works in the literature.

5) Finally we can conclude that, the proposed algorithm based on AAD performs well in terms of accuracy, error rate, coherence rate and retrieval Rate.

5. CONCLUSION

In this paper, we have presented a new algorithm for CBIR based on Average Absolute Deviation. Using this method, the intra class information are extracted from the ROI image and most prominent feature information is obtained by filtering the image using log Gabor filters. The AAD parameters are obtained from the filtered image as feature information. Both feature information vectors are combined serially, if the vectors are in same dimensions and weighted amalgamation method is used for combining vectors of different dimension. The performance of the proposed algorithm for CBIR based on AAD is evaluated by comparing it with the existing algorithms like BDEE and Semi BDEE, BDA, ABRSVM etc., This comparison is done by evaluating the parameters like Accuracy Rate, Error Rate, Coherence Rate and Retrieval Rate. In all the cases the proposed AAD algorithm outperforms the existing ones in the literature. As a future work, the selection of most prominent feature can be done by applying some of statistical analysis techniques such as Principal Component Analysis and Linear discriminant Analysis or the combination of both.

REFERENCES

[1] Gwénolé Quellec, Mathieu Lamard, Guy Cazuguel Béatrice Cochener, and Christian Roux,"Adaptive Nonseparable Wavelet Transform via Lifting and its Application to Content-Based Image Retrieval", IEEE

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

TRANSACTIONS ON IMAGE PROCESSING, VOL. 19, NO. 1, JANUARY 2010

[2] Lining Zhang, Lipo Wang and Weisi Lin, "Generalized Biased Discriminant Analysis for Content-Based Image Retrieval," IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART B: CYBERNETICS, VOL. 42, NO. 1, FEBRUARY 2012.

[3] Lining Zhang, LipoWang and Weisi Lin, "Semisupervised Biased Maximum Margin Analysis for Interactive Image Retrieval," IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 4, APRIL 2012.

[4] Gwénolé Quellec, Mathieu Lamard, Guy Cazuguel Béatrice Cochener, and Christian Roux, "Fast Wavelet-Based Image Characterization for Highly Adaptive Image Retrieval," IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 4, APRIL 2012.

[5] Hatice Cinar Akakin and Metin N. Gurcan, "Content-Based Microscopic Image Retrieval System for Multi-Image Queries," IEEE TRANSACTIONS ON INFORMATION TECHNOLOGY IN BIOMEDICINE, VOL. 16, NO. 4, JULY 2012.

[6] Wei Bian and Dacheng Tao, "Biased Discriminant Euclidean Embedding for Content-Based Image Retrieval," IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 19, NO. 2, FEBRUARY 2010.

[7] Ja-Hwung Su, Wei-Jyun Huang, Philip S. Yu and Vincent S. Tseng, "Efficient Relevance Feedback for Content-Based Image Retrieval by Mining User Navigation Patterns," IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING, VOL. 23, NO. 3, MARCH 2011

[8] Chih-Chin Lai and Ying-Chuan Chen, "A User-Oriented Image Retrieval System Based on Interactive Genetic Algorithm," IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, VOL. 60, NO. 10, OCTOBER 2011.

[9] Subrahmanyam Murala, R. P. Maheshwari and R. Balasubramanian, "Local Tetra Patterns: A New Feature Descriptor for Content-Based Image Retrieval," IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 21, NO. 5, MAY 2012.

[10] T. S. Lee, "Image representation using 2D Gabor wavelet," IEEE TPAMI, vol. 18, no. 10, pp. 957-971, 1996.

[11] D. Field. "Relations between the statistics of natural images and response properties of cortical cell", Journal of the Optical Society of America, vol. 4, no. 12, 1987.