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A REVIEW: IMAGE RETRIEVAL USING FUSION BASED TECHNIQUE

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Abstract:- As the scope in the field of Computer Vision is increasing, new research and development of efficient methods for searching, locating, detection, tracking of objects are focused. The Image contents are retrieved using descriptors and similarity is matched with the query image which must retrieve relevant images. Fusion based techniques are used for image retrieval by combining two or more descriptors giving multiple features from the descriptors. Instead of using the single descriptor either local or global descriptor the fusion based methods combine both global and local descriptors which can be advantageous to improve the accuracy. Multi-features in fusion based method gives distinct information about image contents like shape, texture and color for a single image . This report gives an idea about working on fusion based methods and the issues related to it which can be helpful to the researchers working and interested in this field.

Key Words: *Content Based Image Retrieval(CBIR), Fusion, Local descriptor, Global descriptor, Multi-features;*

1. INTRODUCTION

Content Based Image Retrieval(CBIR) is the process of extracting the visual contents of the image from large image database on the basis of desired features.The query image is processed internally on the basisof feature vector using different feature extraction techniques and stored in the database and the similarity is measured.

Feature descriptorsmay be globalor local. Local descriptorextracts features using a part or region of an image. The Global descriptor feature uses the visual content of the whole image. Fusion method is the combination of features from thequery images which may vary infeature content acquired from different descriptors. Multi-features can bemore informative and distinct about feature contentswhich help in the proper image classification on the basis of extracted features and its relativitywith images. A single descriptor gives limited information about image features based on the descriptor and thus have limited accuracy, to overcome this issue fusion based technique is used. Sometimes global descriptor gives better retrieved images than local descriptor and sometimes local descriptor performs better than global descriptor[1].The Fusion based method uses both global and local descriptor to retrieve a single image which can be comparedwith the database images to match the similarity and improve the accuracy.

There are two types of fusion:

1. Early fusion refers to combining the features into a single form before the comparison or learning.
2. Late fusion refers to the combination of features at the last stageafter the comparison or learning about individual features.

The paper consists of the following sections: Content Based Image Retrieval is explained in section Ⅱ. Related Work regarding fusion based technique is explained in section Ⅲ. Datasets information is given in section Ⅳ. Issues in fusion technique is discussed in section Ⅴ. And section Ⅵ consists of Conclusion and Future Work.

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2. CONTENT BASE IMAGE RETRIEVAL

Fusion based method is challenging task in CBIR and undergoes different processing, representation, segmentation, feature extraction, combinations and similarity matching.

2.1Feature Extraction

The Feature gives the information about contents in the images like shape, color, and texture. Feature Extraction is the process of extracting image contents of user's interest by applying different descriptor. Descriptorsprocesses and encode an image so that it can be compared and matched to other images. The processing of input image may have large and redundant data which can be converted into reduced set of features(feature vector) which contains desired relevant information for the entire data. The process of selecting features is called as feature selection. Feature extracted can be stored as Graphs, Binary codes, Hash codes, Bag of Words,Tree structure, Histogram , Distance vector etc.

2.2 Similarity Matching

Similarity of the query image is matched with the database images in the CBIR process to retrieve relevant images from the database.

2.2.1. Jaccard similarity matching- It is a used for comparing the similarity between sample sets. It is defined as the ratio of size of the intersection to size of union of the sample sets.

$$J(i, i') = \frac{|\mathbb{N}\kappa(i) \cap \mathbb{N}\kappa(i')|}{|\mathbb{N}\kappa(i) \cup \mathbb{N}\kappa(i')|} \quad (1)$$

where J(i, i')- Jaccard similarity coefficient, (i,i')-two image Coefficient, $\mathbb{N}\boldsymbol{\kappa}$(i,i')- Top k retrieved images.

2.2.2. Euclidean Distance- It measures distance between two points of image in Euclidean space.

$$\text{Euclidean distance} = \sqrt{\sum_{i=1}^{n}(qi - pi)^2} \quad (2)$$

where, $p = p_1, p_2,.., p_n$ and $q = q_1, q_2,.., q_n$ are two points in Euclidean *n*-space.

2.2.3.Mean Square error(MSE)- It is the process of appraisal of an unobserved quantity which calculates the average of the squares of error.

$$MSE = \frac{1}{n}\sum_{i=n}^{n}(Yi' - Yi)^2 \quad (3)$$

where Yi'- vector of n predictors, Yi- vector of observed values.

2.3. The Performance metric in CBIR is measured by

The overall performance of the methods used in the process of CBIR is measured using performance metric.

2.3.1.Precision rate- It is used for measuring the accuracy of the system.

$$\text{Precision} = \frac{\text{Count of Relevant Images Retrieved}}{\text{Total Image Retrieved}} \quad (4)$$

2.3.2. Recall Rate- It measures the Robustness of the system.

$$\text{Recall Rate} = \frac{\text{Count of Relevant Images Retrieve}}{\text{Total Relevant Images in Database}} \quad (5)$$

2.3.3. Mean Average Precision(MAP)- It gives the mean for the average set of queries.

$$MAP = \frac{\sum_{q=1}^{Q} AveP\ (q)}{Q} \quad (6)$$

where Q=number of queries,AveP- Average Precision.

2.4. Framework of Fusion Method

A Fusion based image retrieval method is described by combining the features of local and globaldescriptors as shown in figure 1. The original query image features are extracted using the two descriptors and the features are fused into a single image to retrieve the original image. In some cases, local descriptor gives better retrieval results as it works on a part within the image like SURF descriptor[14] which is scale invariant, rotation invariant helpful in object tracking, detection, image

registration,classification and image retrieval. And sometimes global descriptor like HSV color[25] gives better retrieval results as it gives information of whole image. Both local and global descriptor compliments eachother and can be advantageous for better image retrieval. The fusion extracted features is stored and further the similarity can be matched with the retrieved image/images and the database images and the accuracy can be checked.

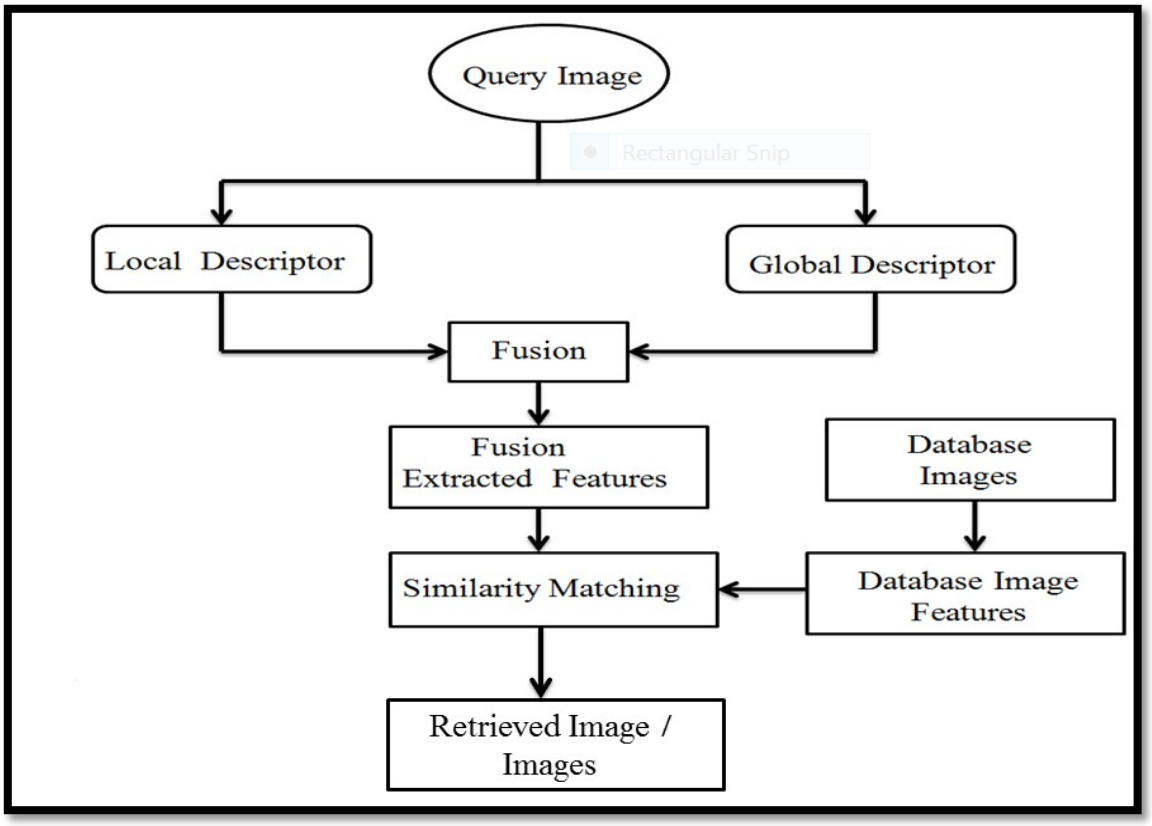

Fig 1: General Fusionmethod for image retrieval.

2.5. Image Retrieval

Retrieving image of user's interest. The retrieved images should be exact or relevant to the query image. Image is retrieved on the basis of similarity matching between extracted image and the database images.

3. RELATED WORK

Many Researchers have worked in the field of computer vision and focused on feature extraction and similarity matching of images from the database. Various techniques are discussed by different authors on fusion based method to improve the retrieval process.

A. Query Specific Rank fusion using Page Rank Algorithm.

The Author Shaoting Zhang *et.al* has Proposed[1]the unsupervised fusion method to improve the retrieval precision. The method retrieves the results as rank graphs for the query image using page rank algorithm and weighted maximum density sub graph. Multiple graphs are merged and re-ranked by link analysis on fused graph.In this paper[16], the author Xianglong *et al*. described multi-hash tables for fusion and ranking the images. For each query image hash table, bitwise query adaptive weights are assigned. Query specific rank fusion[1] of all images is calculated. The similar images are retrieved and combined in a graph using Page Rank algorithm.

This paper[3] is based on multi-modal graph based learning. The author Meng Wang *et al*. used graph regularize framework to maintain the similarity and re-ranking of the graph. The Difference between

two ranked lists is estimated using squared loss method and re-ranking is done using normalised graph laplacian. Distance between graphs is calculated using Mahalanobis distance metric.

The paper[5] is based on weakly supervised method, the author Cheng Deng *et al.* has described Co-Regularized Multi-Graph Learning (Co-RMGL) framework for fusion of multi-graphs which consists of intra-graph concept to maximize the query to target distribution. Comparison for attribute vector called as Co-RMGL+AI and attribute mining called Co-RMGL+AM is also done.

The author Dong Wenfei*et al.* has proposed fusion method[7] by applying weights for multi-features. In this method the weights are adjusted dynamically for single features and fixed weights are assigned to the fusion based features and then the comparison is done.

B. Method using the Inverted index.

The author Liang Zheng *et al.* introduced Coupled Multi-index(c-MI) method[10] at the index level. The objective is to overcome illumination changes and improve recall by applying multiple assignments. The model represents packing and padding system. Packing steps consist of the fusion of descriptor as one dimension of coupled multi-index. Padding steps include techniques to increase the retrieval performance. An Inverted indexis calculated which uses three parameters image ID, TF(Term-Frequency) data and metadata of each index feature. The proposed method in the paper[8] is also based on inverted multi-index having different multidimensional features. The author Neelanjan Bhowmik *et al.* used Codebook which is associated with inverted indices and merged to generate the final list. PCA and PLS are used for dimension reduction and limits the computational complexity respectively. The author Xiangbin Shi *et al.* [12]proposed the mFFMI framework for efficient image retrieval. The mFFMI method is used for fusion and works on associating feature tuple with visual words. Extracted features are stored in the form of inverted multi-index to improve the accuracy of the method. The mFFMI framework Multiple Assignment is used with mFFMI to enhance the recall rate in the method.In this paper[11], Sparse Contextual Activation (SCA) method is used for encoding local features of an image. The objective of author Song Bai *et al.* is to improve the time efficiency, retrieval performance. Inverted index having two parameters image ID and membership grade is used to store images with their features. To improve the performance of SCA further local consistency enhancement (LCE) is developed.

The author Priyanka Daga*et al.* has focused[26] on solving the problem of inappropriate segmentation by the method of Spectral clustering. For a query image, its texture gradient is calculated and Gray level co-occurrence matrices (GLCM) are applied to extract features and segregate the region. Further, the spectral clustering algorithm is applied to cluster the region and final image is retrieve.

The author Liang Zheng *et al.*[4]has described unsupervised score level Late fusion method based on L shape score curve to make the method query adaptive. The score value for the graph is normalized using $l1$ normalization technique and then the graph is fused. Cumulative Match Characteristic (CMC) curve method eliminates the negative impact of worst features and the computational complexity increases for sensitive parameters and assigning global weights to features is sensitive to changes in the query image.

C. Online and Offline phases used for working of methods.

The paper[21] states the combination of local and global features. The offline and online phase working is used by the author K. Kavitha *et al.* Offline phase works on feature extraction and online phase works on fusion and similarity matching. In the paper[27] the author Zihang XU *et al.* also described the online phase which retrieves local features and arranges it semantically and the offline phase is used for feature fusion and indexing. The hyper-graph method is used to obtain the relations between low-level visual features and their additional information regarding its location. The author Zhanning Gao *et al.* has described the method Democratic Diffusion method(DDA) in the paper[28], the online phase and offline phase query fusion method is used for re-ranking and effective retrieval. The main idea of the author was to re-weight the feature vectors and later aggregate it to contract the image. In the paper[18] the author Xiaogang Wang *et al.* has worked on online and offline stages and used re-ranking concept. The offline stage performs the task of assigning keywords to the query image and store them using semantic signature using shape and color features. The online stage performs similarity matching and re-ranking using the reference classes. Re-ranking precision is checked by assigning and comparing the global and adaptive weight for the query image. The Fusion

based method in this paper[6] aims to extract textual and visual information of the image. The author Raniah A. Alghamdi*et al.* has used two data mining techniques association rules mining and clustering algorithm for image retrieval. The method is proposed in online and offline phase. Offline phase combines textual and visual features using semantic association rule mining algorithm. The main retrieval procedure takes place in online phase using clustering.

In this paper[9] the author Fan Yang *et al.* has described the fusion of multi-feature information and Re-ranking algorithm for image retrieval. Multiple features graphs are fused using Markov model and weights are assigned to images. The Vector of locally aggregated descriptor (VLAD) is used for aggregating multi-features. Diffusion method is applied after fusion to minimize noise and accomplish better retrieval performance.

In this paper[13] the author Leila Kabbai *et al.* has introduced the HLG-SIFT method by combining local features and global features. HLG-SIFT is the histogram of local and global features using SIFT and Upper-Lower LBP(UL-LBP) respectively.Comparison between BoW-SIFT and HGL-SIFT is done using Euclidean distance for similarity measurement.

In this paper[14] the author Ardhisha Pancham *et al.* tried to overcome the computational and storage problem and reduce the dimension by using SURF-PCA. PCA is the dimension reduction technique and SURF is usedfor motion tracking, object detection, image registration, and classification. Kalman filter is used for minimizing the dimension for reliable tracking. Tracking for 64-D descriptor is done by projecting the matrix with lower feature space. Global NN(GNN) algorithm was used to extract the best features and track an object.

The author Sugata Banerji *et al.*[15] has proposed the method using Local Binary Pattern(LBP) and Bag of words(BOW) to improve the performance. LBP is combined with DCT and BoW to extract features. Spatial pyramid matching(SPM) is done for the extracted features.

The author H B Kekre *et al.* proposed the fusion method[17] for Modified Block truncation coding(MBTC) and Gabor filter. The modified BTC has created an Inter Band Average Image(IBAI) which has separated the RGB color space.

The author Hua Yuan *et al.*[19] proposed Multiple Attribute Decision Making (MADM) method. Fusion matrix and entropy analysis are done and weights to the query image are assigned using correlation analysis on each feature.

D. Feedback based fusion method.

The author Bahareh Bagheri *et al.* [20] has described a feedback Borda count fusion method. Two kinds of fusion is done using short term learning (STL) algorithms $J_{R\text{-}N}$ and Support Vector Machine(SVM) and the rank list is made according to the features of the query image. The Baroda count method of each image combines the ranks and accordingly the image is retrieved. The author jing-yan Wang*et al.* has also described a feedback based multi-feature fusion for color, texture and shape. The method[2] used fusion for extracting the color features of an image using the color histogram, for the texture it is gray co-occurrence matrix and for the shape it is moment invariants. Precision rate of image retrieval is increased by using the weighted regulation algorithm.

E. Spatial feature level fusion method

The paper[22] demonstrates the fusion of Global, Semi-global and local features. The author Md. Mahmudur Rahman *et al.* used HSV color as the global feature, Region-based image retrieval (RBIR) is used as local features and semi-global features workon grid based method and divide the image into five overlapping parts considering the centreas the main part of the image. The similarity is measured by assigning weights to the query image.

The author Yogita Mistry *et al.* has described[29] 2D complex dual tree Discrete wavelet transformation and Local binary pattern feature fusion with six and four level of decomposition.

In this paper[23], the author Haiying Guan *et al.* has described feature normalization and its fusion for X-Ray images. The shape of an image is extracted and images are selected according to semantic concepts and the fusion algorithm Picked-Weighted-Score (PWS) is applied. Further, the features are normalized using Min-Max, Z-score, Tanh and Cut-off Gaussian.

The author Shamik Sural *et al.* has described the method[24] to calculate the Hue, Saturation and value of HSV color descriptor on the basis of pixel intensity of image and color histogram and

segmentation is generated. The segmentation of colors is done by using K-means clustering by combining pixel with the similar color. In this method the color details cannot retain semantic information after certain degree and the histogram methods can also be improved.

The paper[25] represents the edge detection technique with color spaces. The author Ravneet Kaur Sidhu developed a double threshold technique to improve the performance. Canny edge detector is used in different color spaces like HSV, RGB,L*a*b*. It gives details of RGB to HS, L*a*b* conversion.

Table 1:Summarized Literature Survey

Sr.No	Reference No. Concerned Author(s) & Year	Concept used	Fusion method used by authors.	Performance Evaluation Parameter	Database Used	Claims by Concerned Author(s)	Our Findings
1	[1]Shaoting Zhang, Ming Yang, Timothee Cour, Kai Yu, Dimitris N. Metaxas.	Unsupervised graph based fusion.	Graphical Fusion of SIFT and HSV descriptor is used.	N-S score, Precision, Mean Average Precision.	Holidays, Ukbench, Corel, SFlandmarks	Rank the Images. Boost the retrieval precision rate without sacrificing their Scalability.	It avoids some issues such as over-fitting and lack of manual annotations. Memory is consumed in storing Vocabulary tree and GIST performs poorly for Illumination.
2	[4]Liang Zheng, Shengjin Wang, Lu Tian, Fei He, Ziqiong Liu, and Qi Tian.	Late fusion method at score level using L-shape Curve. Cumulative Match Characteristic(CMC).	Fusion of SIFT, HSV and GIST descriptor is used.	Mean Average Precision.	Holidays, Ukbench, VIPeR.	To make the method query adaptive using good and bad features on normalised L-shape curve to increase the searching accuracy. Person re-identification is also done.	Accuracy decreases with small Change is feature weight. Increase in Computational complexity.
3.	[10]Liang Zheng, Shengjin Wang, Ziqiong Liu, and Qi Tian.	Coupled Multi-index.	Fusion at indexing level is done. SIFT and Color names descriptor is used.	N-S Score, Mean Average Precision.	UKbench, Holidays, DupImages, Mobile images and MIR Flickr	To find all images sharing similar appearance in real time. And perform feature fusion at Index level.	The multi-index is organized around the codebook to increase the accuracy.

4.	[11]Song Bai, Xiang Bai.	Sparse Contextual Activation, local consistency enhancement.	Fusion using SIFT and HSV descriptor.	N-S Score, Average Re-ranking time.	PSB, YALE, MPEG-7, Ukbench dataset.	To improve the time efficiency of re-ranking Procedure and the retrieval performance in an unsupervised manner	It is sensitive to size of neighborhood set and local enhancement parameters. As the parameters increases the performance decreases.
5.	[9]Fan Yang, Bogdan Matei and Larry S. Davis.	Vector of locally Aggregated descriptor, Markov model.	Fusion is done using SIFT and GIST descriptor.	N-S Score, Mean Average Precision.	Holidays, UKbench, Oxford and Paris	To reduce noise and achieve better retrieval performance	The VLAD performance decreases due to large view point changes in Oxford and Paris dataset
6.	[6]Raniah A. Alghamdi, Mounira Taileb, Mohammad Ameen.	Multimodal Fusion method based on Association rules mining.(MFAR).	Fusion of Textual and visual features using MPEG-7 descriptor and K-means algorithm.	Mean Average Precision	CLEF	To achieve best precision score among different query category.	It extracts both textual and visual features of the query.
7.	[5] Cheng Deng, Rongrong Ji, Wei Liu, Dacheng Tao, and Xinbo Gao	Co-Regularized Multi-Graph Learning (Co-RMGL)	Fusion using SIFT, HSV and GIST.	Mean Average Precision	Paris, Holidays, UKbench.	Highlight the unique strength of individual feature modality.	Weakly supervised learning by image attributes is performed to denoise the images. The performance decreases as the candidate image increases.
8.	[12] Xiangbin Shi, Zhongqiang Guo, Deyuan Zhang, Xuejian Fang.	Multiple Features Fusion Based Inverted Multi-Index(mFFM)	Fusion of RootSIFT, color name and Gray Level Co-occurence matrix is used.	N-S score.	Holidays, UKbench.	To improve the accuracy using inverted index.	Multiple Assignment are used with mFFMI to enhance the recall rate.
9.	[8]Neelanjan Bhowmik, Ricardo	Inverted multi-index	SIFT, SURF and Shape context descriptor.	Mean Average Precision	COIL and PARIS	To improve similarity search and efficiency.	Combining optimal configuration before

	Gonz´alez, Val´erie Gouet-Brunet, H´elio Pedrini.						similarity search can give better performance.
10.	[7] Dong Wenfei, Yu Shuchun, Liu Songyu, Zhang Zhiqiang, Gu Wenbo	Color histogram, color correlogram, gray level co-occurence matrix, tamura and hu moments.	Multi-feature fusion.	Precision rate.	Corel.	To increase the accuracy and similarity search.	The weights are adjusted dynamically for single features and fixed weights are assigned to the fusion based features which decreases results for different type of query.

4. DATASETS

4.1. Holidays.

The dataset includes a large variety of scene types like natural, man-made, water and fire effects images in high Resolution. The dataset contains 500 image[30] groups, each of which represents a distinct scene or object.

4.2. Corel.

There are 10000 images which contain 100 categories. Every category contains 100 images of size 192×128 or 128×192 in JPEG format clustered into several semantic categories such as people, beach, building, dinosaurs, elephants, buses, flowers, horses, mountains, and foods. The first 5000 images form Corel-5K Dataset[31], and all of the 10000 images form the Corel-10K dataset.

4.3.Wang.

The WANG database is a subset of 1,000 images of the Corel stock photo database which have been selected manually and which form 10 classes of 100 images each. The WANG database[32] considers similar images and tasks with several images from each category.

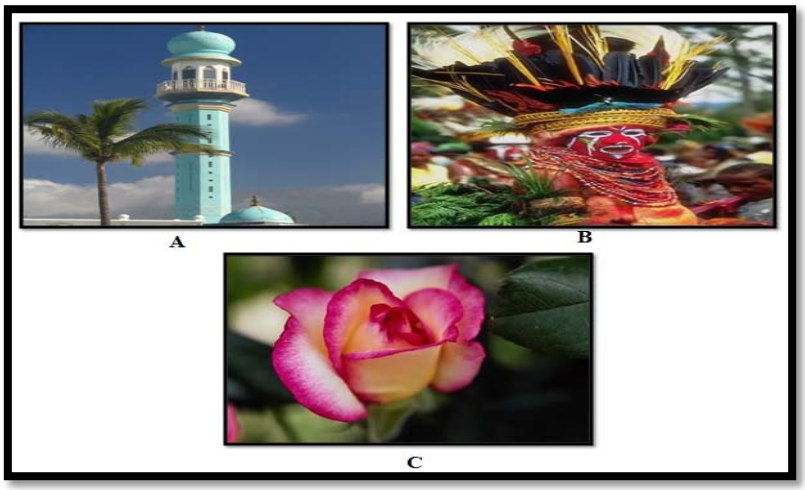

Fig 2: Sample Images of (A) Holidays Dataset (B) Corel Dataset (C) Wang Dataset.

5. ISSUES IN FUSED BASED TECHNIQUE

Fusion method helps to improve the retrieval accuracy. But certain problems are encountered in the fusion process. The fusion method has an issue regarding appropriate selection of descriptors for image retrieval to make the method query specific and adaptive. There are alsosome issues to manage multi-featuresfrom multiple descriptors as their features are extracted from the query image which increases the memory complexity. Some methods are sensitive to small changes in feature weights and neighborhood pixels which lead to decrease in performance and increase in computational complexity.

In some cases, the time complexity also increases while similarity matching of the query image and the retrieved image due to the problems related to storage of multi-features.There are issues regarding using the supervised and unsupervised learning methods which affect the accuracy of the retrieval process.

CONCLUSION AND FUTURE SCOPE

Fusion based methods are emerging in the field of Image processing and computer vision. This paper provides information about improving the accuracy of the query image by using fusion based method of the global andlocal descriptor. It gives solutions to overcome the issues regardingsingle descriptor. It focuses on the selection of appropriate feature descriptor and different methodology to combine the multiple features. Different solutions and methods are provided and discussed by various authors to make the retrieval process accurate.

There is diverse scope in fusion based methods for future work used for Object detection, tracking, Person identification and re-identification, ranking and re-ranking. More focus on supervisedlearning and better methods of implementation can be given to reduce the computational complexity and help to improve the performance and accuracy using fusion based methods.

Refrences

[1] Shaoting Zhang, Ming Yang, Timothee, Kai YU, Dimitris N. Metaxas, "Query Specific Rank Fusion For Image Retrieval", IEEE Transaction on Pattern Analysis and Machine Intelligence, Vol.37, No.4, pp.803-815, 2015.

[2] Jing-Yan Wang, Zhen Zhu, "Image retrieval system based on multi-feature fusion and relevance feedback", in proceedings of International Conference on Machine Learning and Cybernetics, Vol.4, pp.2053-2058, 2010.

[3] Meng Wang, Hao Li, Dacheng Tao, Ke Lu, and Xindong Wu, "Multimodal Graph-Based Reranking for Web Image Search", IEEE Transactions on Image Processing, Vol.21, No.11, pp.4649-4661, 2012.

[4] Liang Zheng, Shengjin Wang, Lu Tian, Fei He, Ziqiong Liu, and Qi Tian, “Query-Adaptive Late Fusion for Image Search and Person Re-identification”, in proceedings of International conference on computer vision and pattern recognition,pp.1741-1750,2015.

[5] Cheng Deng, Rongrong Ji, Wei Liu, Dancheng Tao, and Xinbo Gao, "Visual Reranking through Weakly Supervised Multi-Graph Learning", in Proceedings of International Conference on Computer Vision, pp.2600-2607, 2013.

[6] Raniah A. Alghamdi, Mounira Taileb, Mohammad Ameen, " A New Multimodal Fusion Method Based on Association Rules Mining for Image Retrieval",in proceedings of Mediterranean Electrotechnical Conference(MELECON),pp.493-499,2014.

[7] Dong Wenfei, Yu Shuchun, Liu Songyu, Zhang Zhiqiang, Gu Wenbo ,"Image retrieval based on multi-feature fusion", in proceedings of International conference on Instrumentation and Measurement, Computer, Communications and Control, pp.240-243,2014.

[8] Neelanjan Bhowmik, Ricardo Gonz´alez, Val´erie Gouet-Brunet, H´elio Pedrini, Gabriel Bloch, “Efficient fusion of multidimensional descriptors for image retrieval”, in proceedings of International conference on image processing (ICIP), pp.5766-5770,2014.

[9] Fan Yang, Bogdan Matei and Larry S. Davis, "Re-ranking by Multi-feature fusion with diffusion for image retrieval", in Proceedings of winter conference on Applications of Computer Vision, pp.572-579, 2015.

[10] Liang Zheng, Shengjin Wang, Ziqiong Liu, and Qi Tian , “Packing and Padding: Coupled Multi-index for Accurate Image Retrieval”,in proceedings of International conference on computer vision and pattern recognition, pp.1947-1954, 2014.

[11] Song Bai, Xiang Bai ,“Sparse Contextual Activation for Efficient Visual Re-Ranking”, IEEE Transaction on image processing,Vol.25,No.3,pp.1056-1069,2016.

[12] Xiangbin Shi, Zhongqiang Guo, Deyuan Zhang, Xuejian Fang, "Multiple Features Fusion Based Inverted Multi-Index for Image Retrieval", International Conference on Virtual Reality and Visualization(ICVRV), pp.148-153, 2015.

[13] Leila Kabbai, Mehrez Abdellaoui, Ali Douik, "Content Based Image Retrieval using Local and Global features descriptor", in proceedings of International conference on Advanced Technologies for Signal and Image Processing (ATSIP),pp.151-154,2016.

[14] Ardhisha Pancham, Daniel Withey, Glen Bright, "Tracking Image Features with PCA-SURF Descriptors", in proceedings of International conference on Machine Vision Applications(MVA), pp.365-368, 2015.

[15] Sugata Banerji, Atreyee Sinha, and Chengiun Liu, "A New Bag of Words LBP(BoWL) Descriptor for Scene Image Classification" in proceedings of International conference on Computer Analysis of Images and Patterns, 2013.

[16] Xianglong Liu, Lei Huang, Cheng Deng, Bo Lang, and Dacheng Tao, "Query-Adaptive Hash Code Ranking for Large-Scale Multi-View Visual Search", IEEE Transaction on Image Processing,Vol.25,No.10, pp.4514-4524, 2016.

[17] H B Kekre, V A Bharadi, S D Thepade, B K Mishra, S E Ghosalkar, S M Sawant, "Content Based Image Retrieval using Fusion of Gabor Magnitude and Modified Block Truncation Coding", in proceedings of International conference on Emerging Trends in Engineering and Technology(ICETET), PP.140-145, 2010.

[18] Xiaogang Wang, Ke Liu, Xiaoou Tang, "Query-Specific Visual Semantic Spaces for Web Image Re-ranking", in proceedings of International conference on Computer Vision and Pattern Recognition(CVPR), pp.857-864, 2011.

[19] Hua Yuan, Lihong Ye, Ling Du, "A Novel Method for Image Feature Fusion based on MADM", in proceedings of International conference on Multimedia Technology(ICMT), pp.2877-2879, 2011

[20] Bahareh Bagheri, Maryam Pourmahyabadi, Hossein Nezamabadi-pour, "A Novel Content Based Image Retrieval Approach by Fusion of Short Term Learning Methods", in proceedings of International conference on Information and KnowledgeTechnology(IKT),pp.355-358,2013.

[21] K.Kavitha and Dr. M. V. Sudhamani, "Object based image retrieval from Database using combined features" , in proceedings International conference on Signal and image processing, pp.161-165,2014.

[22] Md. Mahmudur Rahman, Bipin C. Desai, Prabir Bhattacharya, "A Feature Level Fusion in Similarity Matching to Content-Based Image Retrieval", in proceedings of International conference in Information Fusion, pp.1-6,2006.

[23] Haiying Guan, Sameer Antani, L. Rodney Long, George R. Thoma ,"Comparative Study of Shape Retrieval using Feature Fusion Approaches", IEEE International Symposium on Computer Based Medical System(CBMS), pp.226-231, 2010.

[24] Shamik Sural, Gang Qian and Sakti Pramanik, "Segmentation and histogram generation using the HSV color space for Image retrieval", in proceedings of International conference on image processing,Vol.2,pp.589-592,2002.

[25] Ravneet Kaur Sidhu "Improved Canny Edge Detector in Various Color Spaces" in proceedings of International conference on Reliability, Infocom Technologies and Optimization (ICRITO), pp.1-6,2014.

[26] Priyanka Daga and Ram Kishan Dewangan , "Segmentation singpectral clustering based on texture features", International journal of Research in Engineering and Applied Sciences, Vol.2, No.2,2014.

[27] Zihang XU, Junping Du, Lingfei Ye, "Multi-feature Indexing for image retrieval based on hypergraph", in proceedings of International conference on cloud computing and intelligence systems(CCIS),pp.494-500,2016.

[28] Zhanning Gao, Jianru Xue, Wengang Zhou, Shanmin Pnag and Qi Tian, " Democratic Diffusion Aggregation for image retrieval", IEEE Transaction on Multimedia, Vol.18, No.8, pp.1661-1674,2016.

[29] Yogita Mistry, D.T. Ingole, and M.D Ingole, " Efficient Content based Image Retrieval using Transform and Spatial Feature Level Fusion", in proceedings of International conference on control, Automation and Robotics(ICCAR), pp.299-303,2016.

[30] Holidays Dataset[Online] Available: https://lear.inrialpes.fr/~jegou/data.php

[31] Corel Dataset[Online] Available: : http://www.ci.gxnu.edu.cn/cbir/Dataset.aspx

[32] Wang dataset[online] Available: http://wang.ist.psu.edu/docs/related/