IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

A Survey on CBIR Using Affinity Graph Based on Image Segmentation

Vrunda Korde

ME Student, Dept. of Computer Engineering, MCOERC, Nasik, Maharashtra, India

Abstract: Need of image retrieval has increased with the addition of digital images. Construction of graph for capturing perceptual grouping cues of an image is important for graph based image segmentation. Basic CBIR system capture only the local visual feature, thus to cover the gap between local feature and high level visual perception we proposed this system. This technique introduces graph-based image segmentation method in order to retrieve the content-based images. In this CBIR system first, query image over-segmented into multiple super-pixels then extraction of visual features e.g. color, shape and texture. Affinity graph construction is there for building a graph from super-pixels. Finally graph edit distance will be used for graph matching between query image and database images. Then images with smallest edit cost will be retrieve and display relevant result to user. Thus proposed CBIR system using graph based image segmentation will improve performance and accuracy.

Keywords: Content Based Image Retrieval, Image Segmentation, Graph Construction, Graph Matching, Super-pixel.

I. INTRODUCTION

Today digital images are very important bearer ofinformation. There are various techniques to process digital images, which are categorized into three types, image processing, image analysis, and image understanding.Image segmentation is type of image analysis.Image segmentation aims to divide an image into various significant areas and is important step for many computer vision tasks e.g.object recognition[1], scene interpretation[2], or content based image retrieval[3].As the size and volume of digital images increases, the need for CBIR has also been increased. CBIR techniques provide great solution to retrieved relevant images from large digital images database. In previous CBIR techniques all digital images in database are represented by their visual features(e.g.Image contents) which include color, shape, and texture. Visual feature present a visual perception of digital images.

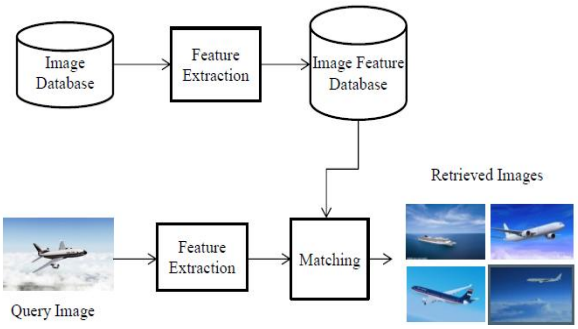

Fig. 1 Basic CBIR System

In basic CBIR technique visual features are extracted from all images and stored into feature database for further use. Fig.1 shows basic CBIR system,in which query image is given as input to the system,then system extract feature from query image.Then similarity between visual feature of query image and visual feature of all images stored in image feature database get compared using a matching method. System retrieved only those images having higher similarity scores. Traditional image retrieval systems are content based image retrieval system in which low-level features are used for indexing and retrieval of images.

Basic CBIR systems unable to cover the gap between the low level features and high level perception of images. To meet this requirement as a pre-processing step, graph based image segmentation is used in content based image retrieval (CBIR). In this technique, construction of graph capturing perceptual grouping cues of an image is fundamental for graph based image segmentation. Due to the huge variety and uncleared of visual grouping patterns, in presence of faint object boundaries and cluttered background, segmentation is very difficult in natural images.

II. RELATED WORK

In this section, we have studied various research papers related to the content based image retrieval techniques and also various image segmentation methods. These paper focused on different Edge-based, Region-based, Graph-based methods for both CBIR and image segmentation. The brief review of previous research papers is as follows:

A. Content Based Image Retrieval Technique:

Technique based on image or visual contents usually referred as features for the purpose of searching images with respect to request and interest of user from large image databases. Since 1990s with the emergence and advancement of this field makes it possible to represent image by using low-level features instead of keywords. For CBIR technology few strong applications could be identified as architecture design, art & craft museums, archaeology, medical imaging and geographic info system, trademark databases, weather forecast, criminal investigations, image classification, image search over the

DOI 10.17148/IJARCCE.2016.55231

IJARCCE
ISSN (Online) 2278-1021
ISSN (Print) 2319 5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 5, May 2016

Internet and remote sensing field for indexing biomedical images by contents.

Definition of CBIR: Visual features as color, shape and texture are implemented for retrieval of images. Traditional methods of image indexing have been proven neither suitable nor efficient in terms of space and time so it triggered the development of the new technique. It is a 2 step processwhere image features are extracted in first step to a distinguishable extent. In second step matching of features which are visually similar is done.

CBIR systems deploy variable matching strategies to find most relevant images in the database to the query image based on the similarities of global features. Traditional content based image retrieval system mostly indexed and retrieved low level visual features images. Even though these low levelfeatures are unable to draw the meaningful content of images which result in unsatisfactory performance of CBIR system. For instance in [5], the proposed algorithm is focused on image retrieval not only on the basis of colour information but also on shape and texture features. In [6], Region-based image retrieval (RBIR) techniques try to cover the drawback of global features .In which RBIR representing images at region-level, which are approximate to the cognition of human visual system. Later in [7], authors deploy a new content-based image retrieval approach using texture and colour features, which result in higher retrieval effectiveness. In [8], CBIR system retrieving an image with specific features, and then the features vector of database images with the feature vector of query image having compared. Many of CBIR systems have used vectors to store and retrieve images, since comparison of vectors is relatively simple, but in those systems relationship between regionsof images are not taken into consideration. An efficient method for content-based image retrieval is Relevance feedback (RF) approach and it also cover gap between low-level visual feature and high-level perception [9].High level features as keywords, text description uses by humans to measure similarity and image interpretation. On the other hand the low level features with semantics [10, 11] usually color, shape,texture extraction is done automatically using computervision techniques. System proposed in [12] was designedto cope with audiovisual queries combining generalapproach to any real valued similarity measure forembedding in current CBIR systems [13].

In order toeliminate the semantic gap CLUE methodology ispresented to retrieve image clusters which are semantically coherent. In other CBIR systems top matched target images are displayed to users. After giving image as query, target image collections are chosen near or similar to query image.

These target images can be clustered by using N-Cut clustering into different semantic classes by putting image of same semantic in one cluster. Then the image clusters is displayed by the system and similarity measure model is adjusted with respect to feed back of user.

B. Image Segmentation

However, image segmentation remains to be a challenging research topic in the computer vision. Image segmentation is a way to partition an image in to the regions with similar visual features. Here we are focused on graph based segmentation techniques which turn the problem of image segmentation into a problem of graph partitioning. Graphs are very effective tool, to build a graph we need to describe nodes and edges and also their weights which represents relationship between them. Lots of works have been done to build a graph. There two categories of graph construction, Supervised and Unsupervised. Unsupervised method again divided into adaptive and static technique. In adaptive graphs, similarities between data point get computed by considering all other data points and edges and simultaneously weights on them are assigned. Without consideration of other data point pairwise similarities get computed in static graphs. There is various graph construction method which are used in different task of computer vision. Most graph-based image segmentation approaches construct a static graph in which only local relationship between data points are taken into consideration [14]. Some methods for graph construction are:

1) KNN Graph (K Nearest Neighbors): In this graph each and every points get connect to all others points in its k-nearest neighbour and using pairwise similaritydistance between them is computed.But as pointed in [15] the problem with KNN-graph is it may include noisy edges in neighbourhood of data points and its size is fixed.

2) ε-Graph: It is a neighbourhood graph which connects all neighbouring data points whose pairwise similarity is less than ε. Constructed graph is unweighted and constant pairwise similarity is chosen. Problem with this graph is selection of single ε for all nodes in graph not selectneighbour's data points properly.

3) Fully Connected Graph: These graphs consider positive similarity of data points while connecting all point with each other. Here if similarity function compute local neighbourhood relationship by itself then only this graph in useful.These graphs are not able to give expected segmentation result, as only local relationship between all the data points are considered [16],[17]. For instance in [18], author proposed segmentation with multi-scale graph decomposition, which only consider fine and coarse level details of image. In [13], author proposed a segmentation method in that input image pre-segmented into various small regions to consider every pixel as a graph node.

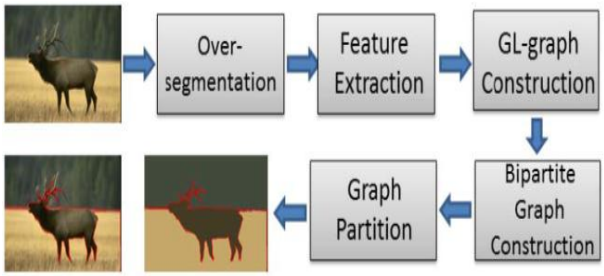

Fig. 2Existing Graph cut system for image segmentation

The framework of the existing graph cut method for image segmentation is given in Fig.2. In which first input image over-segmenting at different scales and those over-segmented regions are called as "superpixels". Then visual features extracted from the superpixels. A Global /Local graph is then formed to capture both short and long range grouping cues. Finally result of image segmentation is gained by constructing bipartite graph and its partition [4]. After studying literature and finding the research gap, we proposed a system aims to develop a "CBIR using affinity graph based on image segmentation" which construct static graph for e.g. Adjacency Graph over all super-pixels to enforce the perceptual grouping laws e.g., proximity, similarity and continuity over local and global relationship among super-pixels in order to improve result of image segmentation also improve performance of CBIR system.

III.PROPOSED SYSTEM

Fig. 3 shows the system architecture of proposed CBIR system using graph based image segmentation. Here system start by over-segmenting query image which result in segments also called as "super-pixels". Various visual features like colour, shape and texture are then extracted from the super-pixels. Affinity graph is then constructed to capture both local and global visuals features of super-pixels. Furthermore, problem of image segmentation turns into graph partitioning using bipartite-graph which shows the connection between pixels and super-pixels. Finally, graph comparison will be there, which represents every image as a graph, and transform image segmentation problem into graph matching problem. In addition, by using a Graph EditDistance, the similarity between graphs obtained. Indexing and retrieval step will be there which gives retrieved images.

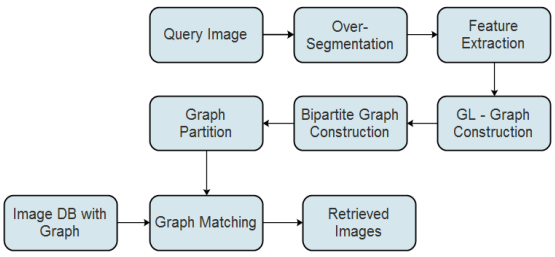

Fig. 3 The framework of proposed CBIR system

IV.CONCLUSION

This paper reviews various existing techniques for content based image retrieval and also for image segmentation. In basic CBIR technique, only feature matching is done between query image and database images. Various regions-based, edge-based image segmentation techniques are there but our main focus on graph-based Image segmentation. Proposed system improves the effectiveness and accuracy of content based image segmentation.

ACKNOWLEDGMENT

We are pleased to convey our thanks to all who rendered their precious guidance to us. We would like to express our appreciation and thanks to **Prof. Dr. G. K. Kharate**, Principal, and M.C.O.E.R.C. Nasik. I am also thankful to Prof. V. H. Patil, Head of Computer Department, and M. C. O. E. R. C. Nasik. We are thankful to IJARCCE reviewer for their review and comments.

REFERENCES

[1] Y. J. Lee and K. Grumman, "Object-graphs for context-aware category discovery," in Proc. IEEE Conf. Computer. Vis. Pattern Recognition., Jun. 2010, pp. 1–8.
[2] M. P. Kumar and D. Koller, "Efficiently selecting regions for scene understanding," in Proc. IEEE Conf. computer. Vis. Pattern Recognition. Jun. 2010, pp. 3217–3224.
[3] S. Belongie, C. Carson, H. Greenspan, and J. Malik, "Color- and texture based image segmentation using EM and its application to content-based image retrieval," in Proc. IEEE 6th Int. Conf. Computer. Vis., Jan. 1998, pp. 675–682.
[4] Xiaofang Wang, Yuxing Tang, Simon Masnou, and Liming Chen, "A Global/Local Affinity Graph For Image Segmentation", IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 24, NO. 4, APRIL 2015
[5] Swati Agarwal, A. K. Verma, Preetvanti Singh, "Content Based Image Retrieval using Discrete Wavelet Transform and Edge Histogram Descriptor", International Conference on Information Systems and Computer Networks, proceeding of IEEE xplore-2013.
[6] Feng Jing, Mingjing Li, Hong-Jiang Zhang, Bo Zhang. "An Efficient and Effective Region-Based Image Retrieval Framework". IEEE Transactions on Image Processing, vol. 13, NO. 5, MAY 2004.
[7] Xiang-Yang Wang, Hong-Ying Yang, Dong-Ming Li "A new content-based image retrieval technique using color and texture information", Computers Electrical Engineering, Volume 39, Issue 3, April 2013, Pages 746-761
[8] Ying Liu, Xin Chen, Chengcui Zhang, Alan Sprague, "Semantic clustering for region-based image retrieval "J. Vis. Communication. Image R. 20 (2009) 157166.
[9] Heng chen, zhicheng zhao, "An effective relevance feedback algorithm for image retrieval" 978-1-4244-6853-9/10/ 2010 IEEE.
[10] Lars Jacob Hove, 2004. Extending Image RetrievalSystems with a Thesaurus for Shapes, Master'sThesis.
[11] Wilson, C., B. Srinivasan and M. Indrawan, 2000.A General Inference Network Based Architecturefor Multimedia Retrieval, In Proceedings ofIEEE International Conference on Multimediapp: 347-350, New York City, USA, 2000.
[12] Roland Kwitt, Peter Meerwald and Andreas Uhl,2011. Efficient Texture Image Retrieval Using Copulasin a Bayesian Framework, IEEE transactions on imageprocessing, pp: 20.
[13] Yixin Chen, 2005. Member, IEEE, James Z. Wang,Member, IEEE and Robert Krovetz, CLUE: Cluster-Based Retrieval of Image by Unsupervised Learning,IEEE transactions on image Processing, 14.
[14] U. von Luxburg, "A tutorial on spectral clustering," Statist. Computer. Vol. 17, no. 4, pp. 395–416, 2007.
[15] X. Yang and L. J. Latecki, "Affinity learning on a tensor product graph with applications to shape and image retrieval," in Proc. IEEE Conf. Computer. Vis. Pattern Recognition. (CVPR), Jun. 2011, pp. 2369–2376.
[16] T. H. Kim, K. M. Lee, and S. U. Lee, "Learning full pairwise affinities for spectral segmentation," in Proc. IEEE Conf. Computer. Vis. Pattern Recognition, Jun. 2010, pp. 2101–2108.
[17] Z. Li, X.-M. Wu and S.-F. Chang, "Segmentation using superpixels: A bipartite graph partitioning approach," in Proc. IEEE Conf. Computer. Vis. Pattern Recognition., Jun. 2012, pp. 789–796.
[18] T. Cour, F. Bénézit, and J. Shi, "Spectral segmentation with multiscale graph decomposition," in Proc. IEEE Computer. Soc. Conf. Computer. Vis. Pattern Recognition., Jun. 2005, pp. 1124–1131.

BIOGRAPHY

Vrunda Korde is a M.E student in the Computer Engineering Department, MCOERC, Nashik, Savitribai Phule Pune University, Pune. Her research interests are Information Retrieval, Data Mining, Image Processing.