International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 3 Issue: 8
ISSN: 2454-4248
226 – 229

An Image Indexing and Region based on Color and Texture

D. Kiran [1] , C. H. Suresh Babu [2] , T. Venu Gopal [3]
[1] Asst. Professor, Daripally Anantha Ramulu College of Engineering and Technology, India
[2] Professor, Sree Vaanmayi Institute of Engineering and Technology, India
[3] Associate Professor and Head, Dept. of CSE, JNTUH College of Engineering, India
[1] *Email: kiran_daripally@hotmail.com*

Abstract: From the previous decade, the enormous rise of the internet has tremendously maximized the amount image databases obtainable. This image gathering such as art works, satellite and medicine is fascinating ever more customers in numerous application domains. The work on image retrieval primarily focuses on efficient and effective relevant images from huge and varied image gatherings which is further becoming more fascinating and exciting. In this paper, the author suggested an effective approach for approximating large-scale retrieval of images through indexing. This approach primarily depends on the visual content of the image segment where the segments are obtained through fuzzy segmentation and are demonstrated through high-frequency sub-band wavelets. Furthermore, owing to the complexity in monitoring large scale information and exponential growth of the processing time, approximate nearest neighbor algorithm is employed to enhance the retrieval speed. Thus, a locality-sensitive hashing using (K-NN Algorithm) is adopted for region-aided indexing technique. Particularly, as the performance of K-NN Approach hinges essentially on the hash function segregating the space, a novel function was uncovered motivated using E8 lattice which could efficiently be amalgamated with multiple probes K-NN Approach and query-adaptive K- NN Approach. To validate the adopted hypothetical selections and to enlighten the efficiency of the suggested approach, a group of experimental results associated to the region-based image retrieval is carried out on the COREL data samples.

Keywords: *Image Indexing, K-NN Algorithm, Fuzzy Segmentation, Corel Dataset, Region-based indexing.*

*****

I. Introduction

From text-based image retrieval to content-based image retrieval (CBIR), image searching has undergone several challenges, especially with the advent of image acquisition devices and exchange through internet. To bridge the semantic gap [1] between the description of an image in terms of physical low-level features and its high-level semantic content, region-based image retrieval (RBIR) tools intend to avoid the global description by representing images at the object level so that it can be close to the user visual perception [2]. Furthermore, we would treat other two big issues which are managing the multidimensional data sets and finding the nearest neighbor [3]. In fact, a variety of data structures have been successfully applied for indexing and searching images in a low-dimensional space [4, 5]. However, the task becomes extremely expensive in the case of large-scale data sets, where the number of elements in the index may reach or exceed 106 images with small-sized features. The main challenges in this case are: How to define the best similarity measure between images? and how to scale a very large number of elements? Therefore, proposing the most suitable representation in memory becomes necessary. Indeed, the best index structuring has to improve search speed, to decrease memory requirements and to provide accurate results according to specific distance metrics. To resolve the problem of the exponential dependence on dimensionality (known as 'the curse of dimensionality' [6]), various works have efficiently adapted the random projection idea for the approximate nearest neighbor (ANN) search in high-dimensional data sets on the cost of retrieval accuracy [7, 9]. Among the approximate schemes, k-NN algorithm is the most popular one and many extensions have been proposed to address the limitations of this indexing method.

In this work, we propose a region-based scheme for approximate large-scale retrieval using the concept of k-NN method. The proposed region-based hash algorithm is defined according to a new function D [12]. The main originality of this function consists in the fact that it is inspired from the E8 lattice in order to improve the quantifier estimation. To objectively evaluate the accuracy of the proposed region- based method, many experiments were carried out on the standard COREL data set while using the recall/precision indicator and the number of k-nearest neighbors. Indeed, using COREL data set is explained by the fact that it fits better in the general context of CBIR where no labels or tags are used to describe images. Particularly, the proposed approach is limited to regions of low-level features without textual annotation or learning step. Moreover, the indexing as well as the retrieval phases are carried out on regions instead of images. Thus, the number of treated elements increases many times compared with the original number of the image data set. An objective comparison with similar state-of- the-art indexing methods shows the improvement made by the proposed method. The remaining of this paper is structured as follows.

 ISSN: 2454-4248
226 – 229

Section 2 briefly describes the background of conventional and approximate indexing methods and the basic K-NN algorithm. In Section 3, we would introduce the proposed region-based hashing scheme including the suggested indexing method and the approximate search phase. In Section 4, some experiments with an objective assessment study are produced. Conclusions and ideas for further work are summarized in Section 5.

II. K-NN Indexing Techniques

2.1 Conventional Indexing Techniques

Conventional indexing techniques can be classified into two main classes: data-partitioning techniques and space-partitioning techniques. The first class consists in partitioning data space according to data distribution. R-tree [16] is among the most popular methods that belong to this class. The algorithms derived from this technique are based on a bounding rectangle. In order to solve the problem of rectangular structures rigidity, other alternatives [16] were proposed, such as the SS–tree based on bounding spheres and the SR-tree using both spheres and rectangles. Nevertheless, structuring indexes based on data-partitioning methods, such as R-tree and its variants (R*-tree, SS-tree, SR-tree), suffer from overlapping between bounding shapes. This problem increases as much as the dimensionality grows. Once the trees are defined, finding the nearest neighbor is solved with a complexity of θ (log N), where N is the number of elements. The second class is based on space partitioning. Among the techniques belonging to this class, we can mention kd-tree, local split decision (LSD)-tree and local split decision for high-dimensional feature vectors (LSD h)-tree [17, 8]. However, this second class suffers from the long processing time to backtrack through the defined tree in order to find the optimal solution. To conclude, the main problem with multidimensional space-partitioning algorithms is the deterioration of their performance when the size of the search space is very large. Thus, all nodes in the data set have to be explored, what increases the computational complexity to reach θ(N) [18]. This is due to the rigid division of space giving the existence of unused cells (or buckets) during the indexing phase. In addition, the division of each space dimension leads to a huge number of cells to be considered during the retrieval phase. To overcome the drawbacks of data partitioning and space partitioning, other structures were exposed such as the hybrid tree [19], VA file [17] and the pyramid tree [20].

2.2 K-NN Algorithm

Approximate approach was proposed after finding that the performance of all the nearest neighbor search techniques inevitably degrades when the data size increases. Unlike conventional multidimensional techniques, those based on approximation approach can better resist against the curse of dimensionality. They also help to accelerate the nearest neighbor searching while introducing imprecision during searching. Particularly, an efficient approximation algorithm can be used to solve the problem of the exact nearest neighbor by listing all the approximate closest neighbors before choosing the closest point to the query [21]. As a concrete example of effective approximate techniques for solving the curse of dimensionality, K-NN ALGORITHM [10, 11, 13] allows to structure indexes reliably and to accelerate thus the retrieval phase. Instead of using the data-partitioning techniques or the space- partitioning ones, where performance degrades and becomes comparable to a linear search in the large dimensionality case, K- NN ALGORITHM technique [14] optimizes the search for the closest neighbors. In fact, many K-NN ALGORITHM extensions use a probabilistic model to find the nearest neighbors while dealing with the curse of dimensionality.

For each feature vector of image, we first retrieve its k- NN from a large dataset annotated previously. For this, we exploit approaches which are based on features between images to estimate their similarity. In our work, we determine the similarity degree of a target image with others within the collection according to the Euclidean distance measure. This measure is commonly used in image classification and image retrieval within the VSM. The color and texture features are used in this work to represent the images.

III. Proposed Methodology

The main idea of the proposed method is to index images based on the visual content of regions. For each region, a set of local descriptors is computed and then stored in an index. Thus, the index of each image is defined according to k-nn algorithm. Once the index of images is defined, the user can submit his request. The same processes of regions' extraction and description are applied to the query image. After referring to the index, features that contain closer results to the query image are extracted. Here, similarity measure based on wavelet descriptors distance is applied and images whose regions are closer to those of the query are retrieved. Since all the above- mentioned steps do not provide accurate results, an exact similarity measure using maximum common sub-graph isomorphism should be applied on the returned set of retrieved images in order to get closer to the query image. Consequently, the number of treated elements becomes very limited in comparison to all the components of the index.

3.1 Indexing Phase

The treated regions in the proposed method are coarsely segmented by a fuzzy watershed algorithm [23]. These regions are characterized by two low-level properties: high-frequency wavelet sub-bands and weights evaluating their

 ISSN: 2454-4248
226 – 229

visual importance [24]. To measure the visual content of a coarse region, we used the fuzzy spectral information provided by high-high sub-bands of level 2 (HH2) of the wavelet transformations. Indeed, this restriction to the sub-bands of high frequency is justified by the fact that this band comprises details of regions. Moreover, low frequency includes basically the coarse shape of objects. Regarding the nature of treated images, using these sub-bands may mislead the retrieval phase. In fact, almost the same results are found with the entire wavelet bands (Fig. 2) but with the cost of an additional computational time during the exact retrieval step. This cost may reach 85.31% [25].

These spectral transformations are applied to the color components of the treated region and modulated by a matrix [24]. In fact, each region has a minimum bounding rectangle (MBR) that allows the conservation of the matrix representation. To avoid structuring, it is necessary to avoid all the details that would burden the calculation [14] especially for a high number of data elements (regions) [26]. To resolve this problem, the k-NN technique is used as an index structure. Nevertheless, it is not the classical version of that structuring method but rather a modified one where the mainly treated object is a set of regions.

IV. Experimental Results and Its Analysis

The proposed indexing method is essentially intended for the region-based retrieval. Hence, the experiments are carried out in the context of CBIR. For regions that are defined using coarse segmentation, small details are merged into the salient region. Moreover, each region is characterized by a specific weight that reflects the semantic importance of this segmented part compared with the rest of the regions.

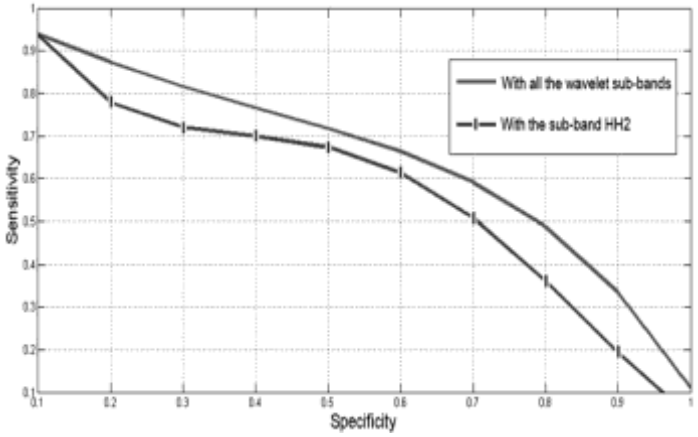

Figure 1: Receiver operating characteristic (ROC) curves comparing the retrieval results between the entire wavelet information and the sub-band HH2

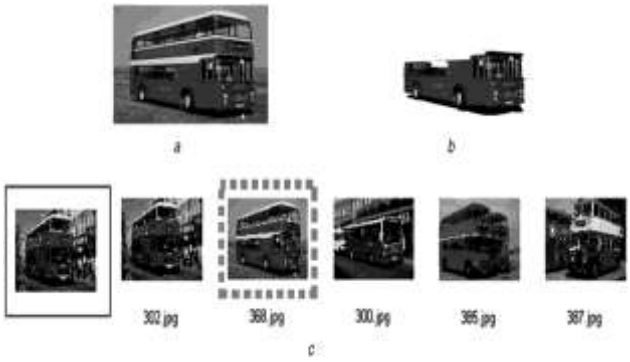

Figure 2: Retrieval of results of BUS image

Figure 3: Retrieval results of Flower image with indexing

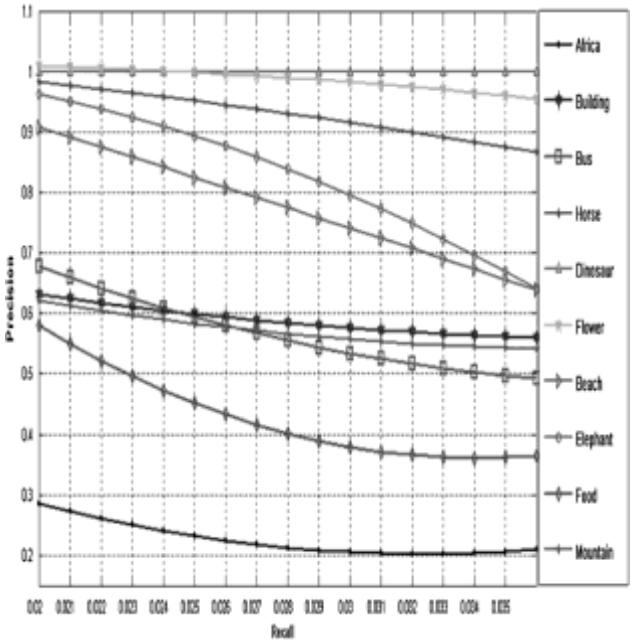

Figure 4: Recall/precision curves of E12 indexing method for COREL data set

V. Conclusions and Future Works

The incorporation of approximate index structures is measured as an outcome to attain sub-linear complex retrieval. In this paper, we are inspired through K-NN Approach so as to create a multidimensional large-scale

 ISSN: 2454-4248
226 – 229

index. Previous investigation showed that K-NN algorithms provide lesser time period to explore. Nevertheless, need lots of memory resources to be efficient. This is based on numerous constraints that are specified empirically. The experimental results was carried out on the benchmark COREL image data set that demonstrated the efficiency of the suggested method. The comparison amongst the indexed structure employing the suggested methodology minimizes the difficulty of the proposed method by minimizing the size of low-level descriptors although keeping high retrieval quality.

References

[1] Liu, Y., Zhang, D., Lu, G., Ma, W.: 'A survey of content-based image retrieval with high-level semantics', Pattern Recognition., 2007, 40, pp. 262–282.

[2] Deselaers, T., Keysers, D., Ney, H.: 'Features for image retrieval: an experimental comparison', Inf. Retr., 2008, 11, pp. 77–107

[3] Arampatzis, A., Zagoris, K., Chatzichristofis, S.A.: 'Dynamic two-stage image retrieval from large multimedia databases', Inf. Process. Manag. 2013, 49, (1), pp. 274–285

[4] Grauman, K.: 'Efficiently searching for similar images', Commun. ACM, 2010, 53, pp. 84–94

[5] Lazaridis, M., Axenopoulos, A., Rafailidis, D., Daras, P.: 'Multimedia search and retrieval using multimodal annotation propagation and indexing techniques', Signal Process.: Image Commun., 2013, 28, (4), pp. 351–367.

[6] Andoni, A., Indyk, P.: 'Near-optimal hashing algorithms for approximate nearest neighbor in high dimensions', Commun. ACM, 2008, 51, pp. 117–122.

[7] Ge, T., He, K., Ke, Q., Sun, J.: 'Optimized product quantization for approximate nearest neighbor search'. Computer Vision and Pattern Recognition (CVPR), 2013, pp. 2946–2953.

[8] Paulevé, L., Jégou, H., Amsaleg, L.: 'Locality sensitive hashing: a comparison of hash function types and querying mechanisms', Pattern Recognit. Lett., 2010, 31, pp. 1348–1358.

[9] Nikzad, M., Abrishami Moghaddam, H.: 'An incremental evolutionary learning method for optimizing content-based image indexing algorithms', Int. J. Multimed. Inf. Retr., 2014, 3, pp. 41–52.

[10] Yu, C., Cui, B., Wang, S., Su, J.: 'Efficient index-based {KNN} join processing for high-dimensional data', Inf. Softw. Technol., 2007, 49, (4), pp. 332–344

[11] Gast, E., Oerlemans, A., Lew, M.: 'Very large nearest neighbor search: ideas, strategies and challenges', Int. J. Multimed. Inf. Retr., 2013, 2, pp. 229–241

[12] Gorisse, D., Cord, M., Precioso, F.: 'Locality-sensitive hashing for chi2 distance', IEEE Trans. Pattern Anal. Mach. Intell., 2012, 34, pp. 402–409

[13] Hess, S., Piatkowski, N., Morik, K.: 'Shrimp: descriptive patterns in a tree'. LWA, 2014, pp. 181–192

[14] Xu, P., Yao, D.: 'A study on medical image registration by mutual information with pyramid data structure', Comput. Biol. Med., 2007, 37, (3), pp. 320–327

[15] Sudhamani, M.V.: 'Multidimensional indexing structures for content-based image retrieval: a survey', Int. J. Innov. Comput., Inf. Control, 2008, 4, pp. 867–881.

[16] Urruty, T.: 'Optimization using indexation multidimensional: application aux descriptors multimedia'. PhD thesis, University of Science and Technology of Lille, 2007

[17] Philipp-Foliguet, S., Vieira, M.B., Lekkat, M.: 'Image retrieval by fuzzy regions sets matching', Inf. Interact. Intell., 2005, 5, pp. 9–39.

[18] Gallas, A., Barhoumi, W., Zagrouba, E.: 'Image retrieval by comparison between complete oriented graphs of fuzzy regions'. Proc. of the Int. Conf. on Intelligent Computer Communication and Processing, 2012, pp. 173–180.

[19] Gallas, A., Barhoumi, W., Zagrouba, E.: 'Image retrieval based on wavelet sub-bands and fuzzy weighted regions'. Int. Conf. on Communications and Information Technology (ICCIT), 2012, 2012, pp. 33–37.

[20] Yao, N., Qian, F., Lei Sun, Z.: 'Feature dimension reduction and graph based ranking based image classification', Appl. Mech. Mater., 2013, 380, pp. 4035–4038.

[21] Joly, A., Buisson, O.: 'A posteriori multi-probe locality sensitive hashing'. Proc. Of Int. Conf. on Multimedia, 2008, pp. 209–218.

[22] Wang, J.Z., Li, J., Wiederhold, G.: 'Simplicity: semantics-sensitive integrated matching for picture libraries', IEEE Trans. Pattern