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Sparse Vector Quantization and Genetic Algorithm Similarity Measure based Image Indexing Technique for CBIR

[1] D.Kiran, [2] Dr.T.Venu Gopal, [3] Dr.C.H.Suresh Babu
[1] Assistant Professor, Computer Science and Engineering department, Daripally Anantha Ramulu College of Engineering and Technology, Khammam, Telangana - 507 003.
[2] Professor, Computer Science and Engineering department, JNTUH College of Engineering Jagtial, Nachupally (Kondagattu), Kodimyal Mandal, Jagtial District, Telangana, India.
[3] Professor, Computer Science and Engineering department, Vathsalya Institute of Science and Technology, Anantharam(V), Bhongir(M), Yadadri Bhongir Dist., T.S., India

Abstract:- **Content Based Image Retrieval (CBIR) plays a significant role in the image processing field. Based on image content, CBIR extracts images that are relevant to the given query image from large image archives. The effective utilization of data stored in digital library is possible through effective image indexing and retrieval techniques. Vector Quantization (VQ) method appears to be good candidate for image indexing in CBIR, however, this method is inefficient to work on large scale image databases. Sparse Vector Quantization (SPQ) is employed to encode the high-dimensional vector of image features, where thesparse coding technique is introduced into approximate nearestneighbor search using soft assignment technique, apart from hard assignment employed VQ. In addition, the computation of similarity amongst the query and target image using simple Euclidean Distance is also very expensive. Thus, GeneticAlgorithm-based similarity measure is performed between the queryimage features and the database image features in Sparse Vector Quantization. Hence, from the proposed Sparse Vector Quantization and GeneticAlgorithm-based similarity measure Image Indexing technique, the database images that arerelevant to the given query image are retrieved. The performance efficiency of the proposed approach is analyzed using three image datasets such as Corel-1K, Corel-10K and Oxford-5K and showed that this approach has good precision -recall curve and maximum f-score values when compared to the existing compared CBIR approaches**

I. INTRODUCTION

Image retrieval is a field of research which has evolved to effectively access the huge quantity of imagesstored in digital image libraries. Earlier image retrieval systemsused the traditional database management approach to indexand retrieve images, based on simple attributes such as theimage number and text description [1, 2]. Such systems have anumber of limitations. Initially, query types are limited. Thesesystems cannot accept image content-based (pictorial) queries.Subsequently, the retrieval performance is low because the simpleattributes cannot describe images completely and accurately [13].To overcome these limitations, content-based image retrieval(CBIR) techniques have been actively pursued. Content-based image retrieval has attracted increasing interests in recent years. Given a query image, the image retrieval system obtains the images of the same object or scene from an image database. Due to large collections of images in the data- base, efficiency is an important factor. Therefore, developing an efficient indexing method for content-based image retrieval is of great significance. Indexing method [16] for CBIR is proposed to improve the retrieval performance having rich content in the images. This content can be extracted as various content features. Image database often represent the image objects as high-dimensional feature vectors and access them via the feature vectors and similarity measures [14, 15]. The main aim of this paperis to investigate the feasibility to carry out image indexingand retrieval based on compressed image data using sparse vectorquantization. The Vector Quantization (VQ) appears to be a good candidate becausecompressed data derived from VQ can be directly mapped topixel patterns.In general, VQ requires more bits in order to reduce quantizationdistortion. Since the size of codebook increases exponentiallywith respect to the total number of encoded

bits, VQ-basedmethod is ineffective for the data with high dimensionality.Although computational cost can be effectively reduced bydiving the long vector into small segments, PQ may fail to retrievethe exact nearest neighbor of a querywith high probabilitydue to the high quantization distortion and suffers from the inevitable nontrivial quantization distortion. To address the above limitations, Sparse Vector Quantization (SPQ) is employed to encode the high-dimensional vector of image features, where thesparse coding technique is introduced into approximate nearestneighbor search. Motivated by soft assignment [9], it is intendedto find the sparse representation for each segment of featurevector rather than hard assignment used in VQ.In contrast to the computationally intensive clustering algorithmused in all the VQ-based paradigms, we employ the sparsestructure along with the fast-stochastic online algorithm [11, 12] to efficiently generate the codebook, which optimizes thesparse representation of data vectors according to their quantizationerrors. Consequently, the proposed representation isessentially close to the original data in practice even with afew basics. The other limitation of VQ is the computation of similarity measure using Euclidean Distance which is computationally expensive that involved the many-to-many computation amongst the query and target image. In contrast to this, in this paper, genetic algorithm based similarity measure is employed which is efficiently estimated from their sparse vector quantization. This greatly reduces the computational cost and searching time.If the image database is of less amount of image thenthe computation time is not a big issue. Hence, we require aCBIR system with effective as well as efficient retrieval i.e.with remarkable retrieval performance in reducedcomputational complexity. Hence, we have chosen the geneticalgorithm to obtain the optimality in computational time aswell as to retrieve the relevant images for the given queryimage.

II. CONCLUSIONS

In this paper, an efficient indexing approach using Sparse Vector Quantization and Genetic Algorithm based Similarity Measure for computation is used as to retrieve the similar query images from large scale image databases. The Sparse Vector Quantizationapproach is employed to encode high-dimensional feature vectors intosparse representation. Genetic Algorithm based Similarity Distance Measure between two vectorsare efficiently estimated from their sparse product quantization.The sparse representationof the data vectors is optimized by minimizing their quantization errors such that the resulting representation is essentially close to theoriginal data in real-world. An extensive experiment was conducted by evaluating the proposed Sparse Vector Quantizationand GA Similarity Distance Measure technique for Retrieval of images on three publicly available image datasets, whosepromising experimental results show that the proposed method is fast andaccurate, and significantly outperforms the state-of-the-artapproaches with large margin. Furthermore, the result on theimage retrieval also demonstrates the efficacy of our proposedmethod while ensuring the retrieval accuracy.

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