www.arpnjournals.com

CONTENT BASED IMAGE CLASSIFICATION AND RETRIEVAL USING VISUAL BAG OF FEATURES AND ADABOOST ALGORITHM

Parthiban S.[1] and Srinivasa Raghavan S.[2]
[1]Department of Computer Science and Engineering, Veltech Dr. RR & Dr. SR Technical University, Chennai, Tamil Nadu, India
[2]Department of Mathematics, Veltech Dr. RR & Dr. SR Technical University, Chennai, Tamil Nadu, India
E-Mail: parthibans1983@gmail.com

ABSTRACT

This paper proposes the content based classification and retrieval of images using Visual bag of Features and adaboost classifier. The Visual bag of Features has been extracted from the input images and then the visual bag of features is classified using the adboost classifier algorithm. The proposed algorithm greatly reduces the Storage cost and efficient search using the inverted data structure. The efficiency of the proposed algorithm is tested with Mean Opinion Score (MOS).

Keywords: CBIC, CBIR, visual vag of features, adaboost algorithm.

1. INTRODUCTION

With the recent development in the technology and the digital applications, the capture and sharing of Digital Medias like photos, audios and videos have greatly increased. The large amount of media needs an efficient way to classify and categorize it for easier retrieval. This paper focuses on developing an algorithm for Content Based Image Classification which will provide an efficient way to classify the images for easier and faster retrieval through Bag of Features and Adaboost algorithm. Study shows that many researches has been carried out in this area [1]. The image retrieval can be either text based or Content based. The text based image retrieval was done based on the meta data created by the users while classifying the images. But this method contains a lot of human interventions. The Content Based Image Retrieval (CBIR) method was done based on their visual content created using color, texture, shapes and local descriptors. CBIR method can be applied efficiently on various domains for large datasets [8]. Several methods has been proposed on content based image retrieval algorithms [3, 4, 5, 8]. CBIR plays a major role in developing Web based visual search engine. A CBIR based on the Bag of Visual words was developed based on the bag of words approach.[6]. A CBIR is a three stage process which consists of Code book definition, image description and similarity definition. The code book contains the extracted descriptors from the image dataset. The code book generated contains the clustered descriptors of all the images in the collection. Visual word was framed for each cluster of description and the visual dictionary was prepared using the visual words. Histogram was used to describe each image and it was assigned to each visual word. Then the resultant was ranked based on the term frequency inverse document frequency score which influence the visual words search. The search is carried out using fast and tree based inverted structure [7].

The rest of the paper is organized as follows. Section 2 of the paper provides an overview of Bag of features and adaboost algorithm. Section 3 deals with the proposed algorithm and section 4 deals with the experimental analysis and section 5 concludes the paper.

2. MATERIALS AND METHODS

This section provides an overview of Bag of Feature representation.

2.1 Bag of features

Bag of features approach is a method advanced from text retrieval of visual classification [2]. This contains multiple stages like feature extraction and representation, generation of vocabulary using visual features and Vector generation using Bag of Features.

2.1.1 Feature extraction and representation

Local features were extracted from the images and were used to represent the images. Various Feature extraction algorithms were studied in the literature. Several algorithms outperforms well for Bag of features representation and on studying the literature, Harris and Maximally stable external regions detector performed well under various conditions. Most of the approaches avoid region of interest detection and simply extract the local image features at dense grid points. Mainly the low textures image regions will be ignored by most of the detectors. Absence of the textures would be discriminative among the images. Feature descriptors are used to represent the local neighborhood pixels. Histogram was used to represent the local feature set in Bag of Visual Words models. The SIFT (Scale Invariant Feature Transform) generates a 128 dimensional feature vector with a sampling point of 4X4X8. Based on the huge set of feature vector, the classification efficiency was improved.

2.1.2 Vocabulary generation

Large features set collection with large set of image database will contains minor variation. The vector quantization approach was used to reduce the computational complexity caused due to the small changes of appearance among the images. Most of the Bag of Visual word approaches uses K-mean clustering algorithm to cluster the features of the training image into k visual words. Some methods also uses Guassian mixtures.

2.1.3 BoVW vector generation

After generation of vocabulary for the image, histogram of visual words and visual frequencies were generated for each image. For retrieval, the same method is followed and the nearest neighborhood search is carried out within the vocabulary to improve the retrieval time. This frequency distribution is referred to as Bag of visual words and can be used in the machine learning steps similar to bag of words descriptor for text documents classification and retrieval.

The proposed algorithm for training the classifier is as follows:

Step 1: Read the image from the dataset

Step 2: Extract the SIFT features from all the images from training dataset

Step 3: Construct the visual vocabulary by reducing the number of features

Step 4: Train the algorithm using the adaboost classifier algorithm.
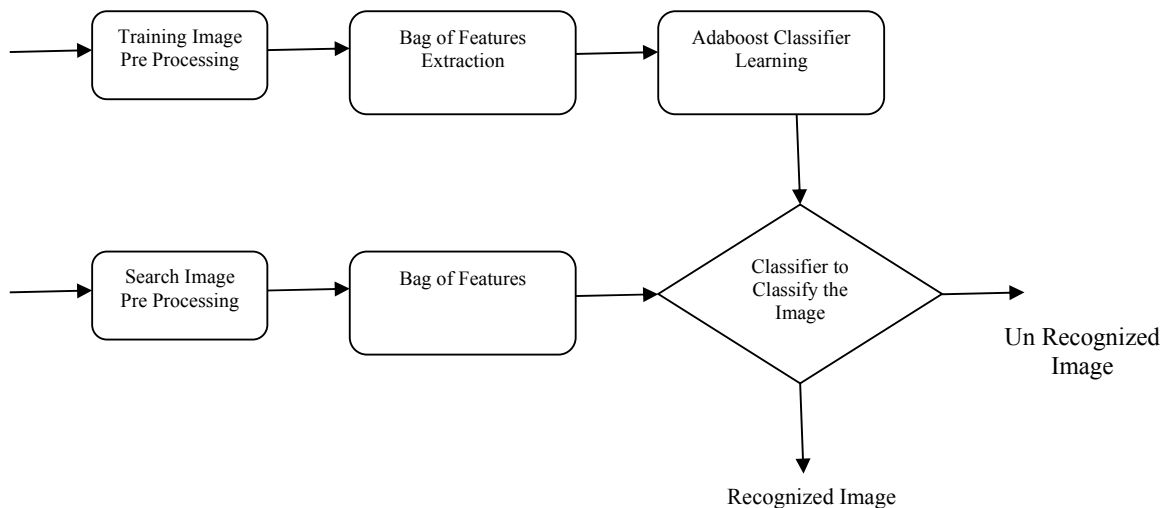
3. ALGORITHM

Figure-1. Block diagram of training and recognition of images.

4. EXPERIMENTAL ANALYSIS

The proposed process is validated using the Mean Opinion Score from the users. The Retrieval process can be better evaluated only by the user acceptance testing through Human Mean Opinion Score. A GUI was developed for the Image Classification and Retrieval algorithm using Matlab 7.14.0.739. The proposed algorithm is tested with Oxford dataset [8] which is a standard dataset for large scale particular object retrieval.

4.1 Experiment to analyse the subjective quality metrics

Subjective Evaluation was carried out on the proposed algorithm to validate whether the retrieval algorithm had provided the relevant results to the query Image. This assessment is obtaining the Mean Opinion Score from the users on the query results of the proposed algorithm. MOS is a 5 point scale with 1 as the least score and 5 as the best score. The MOS is obtained from the users using a Questionnaire as shown in Figure-2.

Subject evaluated: Image
Qualitative Analysis
5 - Excellent (Contains All relevant Images)
4 - Very Good (Contains relevant Images)
3 - Good (Contains some relevant Images)
2- Bad (Contains very few relevant Images)
1 - Very Bad (Contains no relevant Images)

S.No.	Details	1	2	3	4	5
1	Retrieval of relative Videos				*	
2	Similarity between the query video and retrieved videos					*
3	Preservation of Originality in the retrieval				*	
4	Quality of the video				*	

Figure-2. Questionnaire distributed to obtain the mean opinion score from users.

www.arpnjournals.com

In this experiment, the Mean Opinion Score was obtained from the users and the average of MOS is shown in Table-1.

Table-1. Subjective evaluation on retrieval process using proposed algorithm.

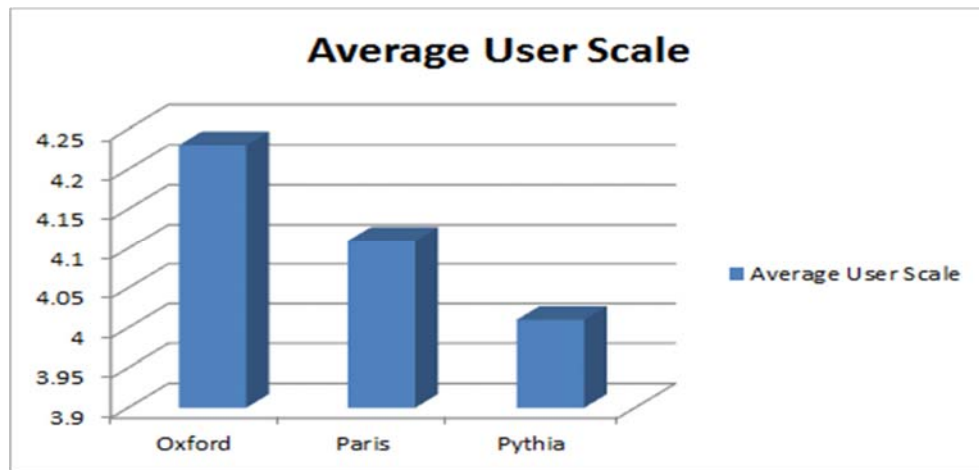| S.No	Query image dataset	Average user scale
1	Oxford	4.23
2	Paris	4.11
3	Pythia	4.01

Figure-3. Comparison of the average mean opinion score for various query images.

Table-1 shows that the MOS of the users is above 4 which contain the relevant videos in the retrieved query and Figure-3 shows the graphical representation of the Average Mean opinion Scores from the users.

5. CONCLUSIONS

In this paper, efficient Classification and retrieval of Images using the Visual Bag of features and adaboost algorithm is presented. Various literatures were also studied on the classification of Images and discussed. From the Subjective analysis carried out on the proposed process yields an average Mean Opinion Score of greater than 4 which exhibits the retrieval of the relevant Images from the query. The Objective analysis on the proposed algorithm will be carried out in our future study.

REFERENCES

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

[2] J. Sivic and A. Zisserman. 2003. Video Google: a text retrieval approach to object matching in videos. In: Proceedings Ninth IEEE International Conference on Computer Vision, number Iccv.pp. 1470-1477. IEEE.

[3] H. Jégou, H. Harzallah, C. Schmid. 2007. A contextual dissimilarity measure for accurate and efficient image search, in: IEEE Conference on Computer Vision and Pattern Recognition. pp. 1-8.

[4] D. Nistér, H. Stewénius. 2006. Scalable recognition with a vocabulary tree. In: IEEE Conference on Computer Vision and Pattern Recognition. pp. 2161-2168.

[5] E. Spyromitros-Xioufis, S. Papadopoulos, I. Kompatsiaris, G. Tsoumakas, I. Vlahavas. 2014. A comprehensive study over VLAD and product quantization in large-scale image retrieval, IEEE Trans. Multimedia. 16(6): 1713-1728.

[6] J. Sivic, A. Zisserman. 2003. Video Google: a text retrieval approach to object matching in videos, in: IEEE Conference on Computer Vision. pp. 1470-1477.

[7] R. Baeza-Yates, B. Ribeiro-Neto. 1999. Modern Information Retrieval, ACM Press.

[8] J. Philbin. 2010. Scalable Object Retrieval in Very Large Image Collections. Ph.D. thesis, University of Oxford, Oxford, UK.