An Unsupervised Classification Framework for Content Based Image Retrieval using Semantic Assistant Based Visual Hashing

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Abstract— To provide high quality content-based search services over huge volume of image collections, both efficiency and effectiveness are important issues. Advanced indexing structure is essential to scale the big data space and facilitate accurate search. The most naive approach for CBIR is to sequentially compare query image with each sample stored in the database. Its linear complexity leads to the poor efficiency and low scalability in real environment. Also, visual features usually have high dimensions. How to solve the curse of dimensionality is still an open research question, which has not been addressed properly. In most real CBIR applications, approximate retrieval results can sufficiently satisfy user's information needs. An rising technology to support scalable content-based image retrieval (CBIR), hashing has been recently received great attention and became a very active study domain. In this study, to propose a novel unsupervised visual hashing method is known as semantic-assisted visual hashing (SAVH). Renowned from semi-supervised and supervised visual hashing, its core design is to effectively extract the rich semantics latently embedded in auxiliary texts of images to enhance the usefulness of visual hashing without any explicit semantic labels. To achieve the target, a unified unsupervised skeleton is developed to learn hash codes by concurrently preserving visual similarities of images, integrating the semantic assistance from assisting texts on modeling high-order relationships of inter-images and characterizing the correlations linking images and documents.

Key words: Content-based image retrieval, semantic-assisted visual hashing, auxiliary texts, unsupervised learning

I. INTRODUCTION

The Content based image retrieval (CBIR) is an automatic technique that takes an image as query and returns a set of images like to the query image. Low–level images features similar to texture, color are extracted from the images of the database to them in conditions of their features .Images of the same classes are expected to have same and related character. Consequently, when resemblance measure is performed on the image features, the consequential set achieves a elevated level of retrieval performance. CBIR has several advantages over the traditional text based retrieval .Using the visual features of the query image in CBIR is a more efficient way of finding relevant images than searching based on text annotations.

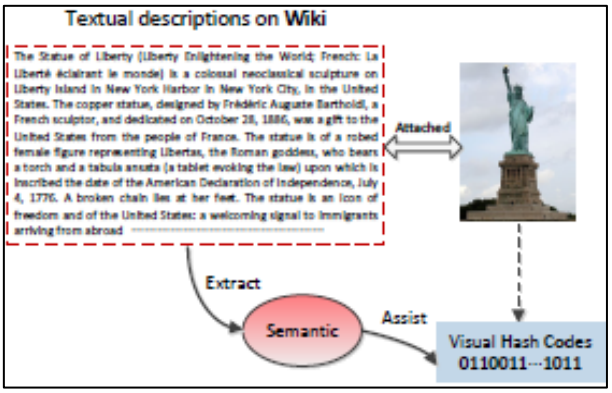

Fig. 1: Structure of DNA

In this work, we propose a novel unsupervised visual hashing scheme, termed as semantic-assisted visual hashing (SAVH), to effectively perform visual hashing learning with semantic assistance. The key idea is to extract semantics automatically from the noisy associated texts to enhance the discriminative capability of hash codes, and thus facilitate the performance improvement of visual hashing. SAVH works as follows: First, hash code learning is formulated in a unified unsupervised framework, where relaxed hash codes are learned by simultaneously preserving visual similarity of images and considering the assistance of texts. More specifically, our framework integrates two important assistance of auxiliary texts to effectively mitigate the inherent limitations of visual features. The first assistance models high-order semantic relations of images by constructing topic hyper graph, while the second one correlates images and latent shared topics detected via collective matrix factorization. Then, an optimization method based on augmented Lagrangian multiplier (ALM) is proposed to iteratively calculate the optimal solution. We specially preserve Bits-uncorrelated constraint during iterative process to facilitate learning and simultaneously reduce information redundancy between hash bits. Finally, hash functions are constructed based on linear regression to enable out of- sample query extension. Linear projection can support efficient hash code generation in online retrieval.

Instead of considering only visual feature or equally treating images and texts, SAVH specially exploits the auxiliary texts to assist visual hashing. Two important assistances from auxiliary texts: modeling semantic correlations of images with topic hyper graph, correlating images and latent shared topics via collective matrix factorization, are proposed to effectively incorporate semantics into the hash codes. SAVH is designed in a unified unsupervised learning framework, which comprehensively considers visual similarity preservation of images and semantic assistance. An effective solution based on ALM is proposed to calculate the optimal hash codes.

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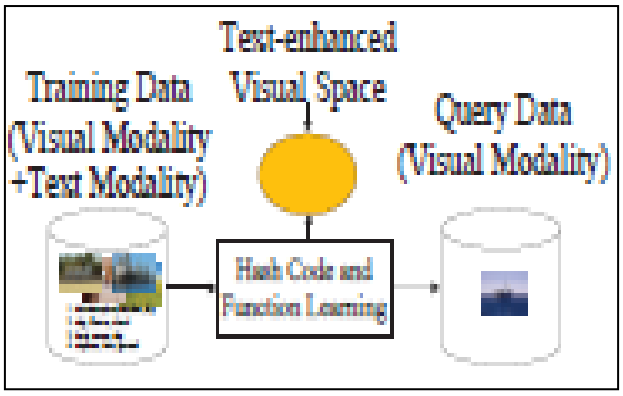

Fig. 2: Basic Structure of Unsupervised SAVH

A. *Characteristics*

Data mining is an effortless form of information gathering methodology where in which all the relevant information goes through some sort of identification method. And eventually at the end of this process one can determine all the characteristic of the data mining method.

1) Increased quantities of data: In earlier days, data mining system can be determined with the assist of their clients and customers, but in today's date one can acquire any number of information without the help of those clients. Moreover, after this kind of mutiny in the data mining system, it also added one more problem and that is large quantities of work. With the help of these information technology one can acquire a large number of information without any extra weight or trouble.
2) Provides incomplete data: Most of the people provide incomplete information about themselves in some of the analysis conducted with the help of data mining systems. Therefore, people ignore the value of their information and that is why they bring to incomplete information about themselves in those surveys conducted for the profit of the data mining systems. Moreover, these data mining systems changed the perspective of people and because of that, public fear the exchange of their personal information.
3) Complicated data structure: Data mining is a structure where in which all the information is gathered and incorporated with the help of information collection techniques. These are more of manual and rest is technological. Therefore, most of the understanding and resolve of these data mining can be a bit difficult than other structure of information technology.

B. *Benefits*

There are several types of reimbursement and advantages involved in data mining systems. One of the essential matters of these data mining creates a complete configuration of analysis of data mining techniques.

1) It is helpful to predict future trends: Most of the functioning the data mining systems carries on all the informational factors of the elements and their construction. And one of the common benefits that can be derived with these data mining systems is that they can be caring while predicting future trends. And that is quite possible with the help of technology and behavioral changes adopted by the community.
2) It signifies customer habits: For example, while working in the marketing industry one can be aware of all the matters of customer behavior and their habits. And that is possible with the help of data mining systems. It handles all the information acquiring techniques. It is helpful in keeping the track of customer behavior and their activities.
3) Helps in decision making: There are some people who make use of these data mining techniques to assist with some kind of decision making. Nowadays, all the information a .bout anything can be resolute without difficulty the help of technology and similarly, with the help of such technology one can make a precise decision about something unknown and unanticipated.
4) Increase company revenue: As it has been explained earlier that data mining is a process where in which it involves some variety of technology to acquire some information about something possible. And this type of skill makes things easier for their profit earnings ratio. As people can collect information concerning the marketed products online, It finally reduces the cost of the product and their services.
5) It depends upon market based analysis: It is a system where in which all the information has been gathered on the basis of market information. At the present time, technology plays a crucial role in everything and that casualties can be seen in these data mining systems. Hence, all the information collected through these data mining is basically from marketing scrutiny.
6) Quick fraud detection: The Major parts of the data mining process is basically from information gathered with the help of marketing assessment. And with the help of such marketing analysis one can also find out those fraudulent acts and products on hand in the market. And moreover, with the help of it one can understand the importance of accurate information.

II. RELATED WORK

A. *Semantic-Assisted Visual Hashing*

The basic framework of the SAVH-based CBIR system. The system mainly includes two core components: offline learning and online hashing. Offline Learning. This component aims to learn hash codes of database images and simultaneously generate hash function for query image. It consists of four main steps. First, visual and text features of images are extracted to transform image pixels to mathematical vector representations. Then, a text-enhanced visual graph is constructed with the assistance of topic hyper graph, and latent semantic topics are detected under guidance of text information. Next, hash codes of database images are learned in a framework which preserves correlations of images and that between images and semantic topics. Finally, hash functions are generated with respect to the hash codes within a linear regression model.
Online Hashing. Visual feature of query image is extracted. Then, it is mapped into binary codes with hash functions. Finally, the similarities between query image and database images are calculated in Hamming space, and database images are returned in order of distance ascending.

1) SAVH Algorithm:

Input:
Database images: $\{In\}n = 1,$
=1, query image q.

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Output:
Hash codes of database images: Y, hash functions: F.
Image retrieval results for image query *q*.
Offline Learning
1) Extract features of database images, obtaining X(1); X(2);
2) Compute visual graph Laplacian matrix L*G*;
3) Compute topic hyper graph Lalacian matrix L*THG* viaEq.(7);
4) Learn relaxed hash codes via Algorithm 1;
5) Construct hash functions F;
6) Project database images into binary hash codes with F;
Online Hashing
7) Extract visual feature of query image;
8) Project query visual feature into hash codes;
9) Calculate the Hamming distances between hash codes of query image and that of database images;
10) Rank Hamming distances and return retrieval results.

2) System Architecture

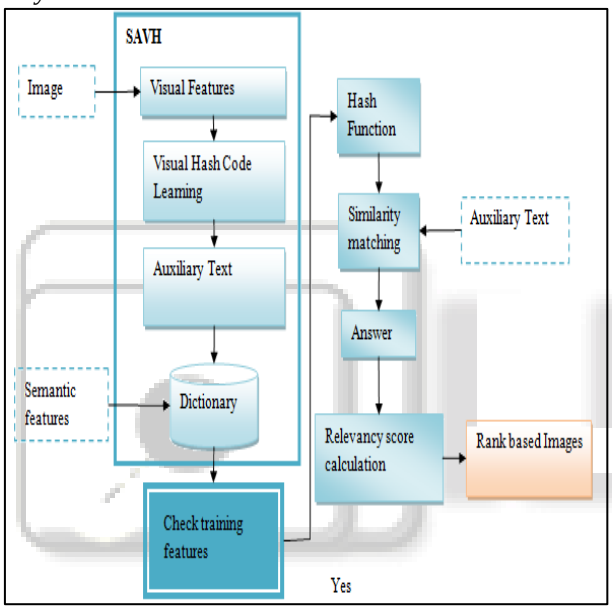

Fig. 3: System Architecture

B. System Models

- Image Acquisition
- Visual Features Extraction
- SAVH
- Classification
- Result Evaluation

1) Image Acquision

It can be broadly defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through anything processes need to occur afterward. Performing image acquisition in image processing is constantly the first step in the workflow sequence because, without an image, no processing is possible.

2) Visual Features Extraction

Instead of considering only visual feature or equally treating images and texts, SAVH specially exploits the auxiliary texts to assist visual hashing. Two important assistances from auxiliary texts: modeling semantic correlations of images with topic hyper graph, correlating images and latent shared topics via collective matrix factorization, are proposed to effectively incorporate semantics into the hash codes.

3) SAVH Model

The SAVH-based CBIR system. The system mainly includes two core components: offline learning and online hashing. In Offline Learning. This component aims to learn hash codes of database images and simultaneously generate hash function for query image. It consists of four main steps. First, visual and text features of images are extracted to transform image pixels to mathematical vector representations. Then, a text-enhanced visual graph is constructed with the assistance of topic hyper graph, and latent semantic topics are detected under guidance of text information. Next, hash codes of database images are learned in a framework which preserves correlations of images and that between images and semantic topics. Finally, hash functions are generated with respect to the hash codes within a linear regression model. In Online Hashing. Visual feature of query image is extracted. Then, it is mapped into binary codes with hash functions. Finally, the similarities linking query image and database images are calculated in Hamming space, and database images are returned in order of distance ascending.

4) Classification

Unsupervised Learning in Our Approach is achieved by the use of offline Mining and online Learning techniques. Offline learning database gets updated by the online hashing codes once user posts a newer Kind of Query image to the Answering System. The online hashing Comprises a large collection of related images Resources in its backend which helps to retrieve a related resource to the Query based on lexis keywords. This Search is completely indexed and thus the retrieval time is faster.

5) Result Evaluation

The proposed work supports relevance search, so it first identifies the type of query image. It then locates the similar visual features-aware images by utilizing the SAVH approach.

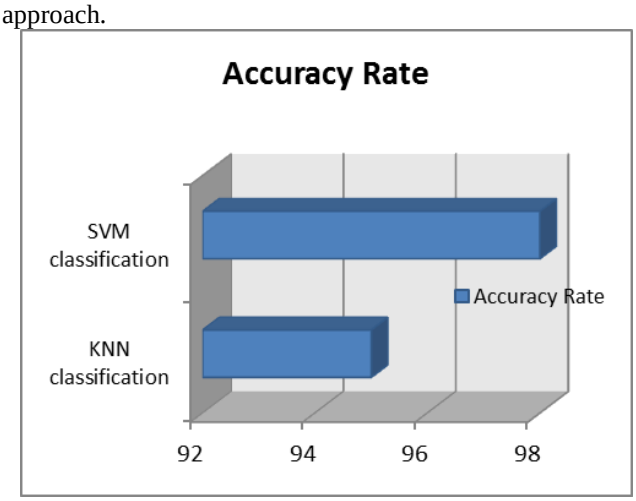

Fig. 3: Accuracy Rate

III. Results and Discussion

Experimental results can evaluate the performance of the system using Accuracy rate. The accuracy rate is calculated using true positive, true negative, false positive and false negative metrics. So the accuracy rate is defined as:

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{FN} + \text{TN} + \text{FP}}$$

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Proposed framework provide improved accuracy rate in disease classification and analyzed severity level of diseases.

IV. CONCLUSION

Most existing single component and different element hashing approaches for CBIR assemble their plans with just visual highlights. They overlook the profitable semantics required in the related writings. Albeit unsupervised cross-modular hashing methodologies can influence content for recovery undertaking over heterogeneous modalities, they similarly treat visual and content, what's more, still neglect to completely take favorable circumstances of content. Not the same as them, this study proposes a compelling hashing structure, SAVH. Our thought is utilizing the related writings of pictures to help the visual hashing utilizing unsupervised learning. SAVH can coordinate additional discriminative data into the produced visual hash codes and capacities. In addition, SAVH has an imperative favorable position that its disconnected learning can successfully influence semantics required in content, while its internet hashing requires just visual picture as info. This attractive property coordinates the necessities of genuine application situations of CBIR. Far reaching investigates a few standard picture datasets approve that the execution of visual hashing can be enhanced with the help of content, and SAVH can accomplish unrivaled execution looked at with a few best in class strategies.

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