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A Survey on Face Recognition Using Attribute Based Tree Construction and Sparse Codewords

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ABSTRACT: Improvement in digital technologies makes availability of digital camera and camera smart phones easier. Many of peoples are able to buy camera smart phones and share photos clicked by them in online system. Smart phone users are also interested in searching facial photos of their interest which includes sport icons and others. This makes available digital photos online which are in turn searched on photos content based. Many applications like to give features like content based image search from large a digital photo which is an emerging technology. This paper proposes semantic codewords generation method to utilize human face attributes that contain semantic clues of the face photos to improve content based face retrieval. In human attributes based face image retrieval system, proposes two methods named attribute-enhanced sparse coding and attribute embedded tree construction to improve the face retrieval. The sparse codewords of existing images from database are get compared with sparse code words of query image and attribute based tree construction gives result of face image retrieval ordered from higher matching to lower matching.

KEYWORDS: Face detection, Face attributes, sparse code words generation, content based face photo search, photo search

I. INTRODUCTION

The number of smart phone users grows increasingly. The simple camera functioning in smart phone gives a chance to every smart phone user to make a click. Such a simple photography function in phones increases a lot of digital photos. For different purposes this photos comes online. Also universal storage of digital media contains number of photos of peoples from different fields like movies, sports, politics, education, etc. Such a huge collection welcomes online users for searching these digital photos. Searching and mining of this large scale human face photos is challenging problem.
To make an input query of photo and finding out search result from large photo database is an objective of proposed paper. Previous works in this sector uses low level features to represent faces. But low-level features lacks semantic meanings and face photos usually have high intra-class variance like expression, posing, so the retrieval results are unsatisfactory.
To deal with above mentioned issue, a system proposed having a new perspective view on content based face photo retrieval by incorporating high-level human attributes into face image representation and image search on attribute based tree construction to improve search performance.The proposed system was useful in human face image search on social networking websites. Also, it is useful in crime investigation to find out suspects from large database of human face images.
Proposed system is as said combination of low-level features and automatically detected human attributes for content-based face image retrieval. Attribute-enhanced sparse coding exploits the global structure and uses several human attributes to construct semantic codewords. Attribute-embedded further considers the local attribute signature of the query image and attribute based binary tree construction ensures efficient retrieval in the online stage.The codewords generated by the proposed coding scheme helps in reducing the quantization error and improve face retrieval. Proposed system also suggest certain informative attributes for face retrieval and these attributes are also promising for other applications like face verification.

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II. RELATED WORK

Previously, to deal with human face photo retrieval from large database, Wu et al. [2] proposes to use identity based quantization. To resolve the quantization loss, they use a state-of the-art features [3] with principal component analysis for re-ranking. Chen et al. [4] propose to use identity constrained sparse coding along with component-based local binary pattern (LBP).Both these methods fail to give satisfactory results as they might require clean training data and massive human annotations. Traditional techniques mainly called as CBIR uses colour, texture and gradient to represent images. To deal with large scale data, mainly leveraged inverted indexing or hash based indexing are used. These indexing systems combined with bag-of-word model (BoW) [5] and local features like SIFT [6], gives efficient similarity search. But these systems face a problem of low recall due to the semantic gap [7].

It's very important for many real time applications to detect human attributes automatically. To work in it, Kumar et al. Propose a learning framework to automatically detect describable visual attributes. This methodology gives an excellent performance on keyword based face image photo retrieval. Siddiquie et al.[8] and Scheirer et al. [9]works further to improve key word based human photo search. Siddiquie et al. uses a Bayesian network approach to utilize the human attributes for face identification.

Raina et al. propose a machine learning framework using unlabeled data with sparse coding for classification tasks ,Yang et al. [10] apply the framework on SIFT descriptors along with spatial pyramid matching and maximum pooling to improve classification results.

All work did in sector of face photo retrieval from large scale digital image database mostly achieve success on key word based search. But the method not exploited to generate more semantic scalable key words. And hence, face image photo retrieval using input query image.

III. METHODOLOGY

The proposed system is contains mainly three modules, *Image Pre-processing, Sparse Codewords Generation* and *Attribute based Binary tree Construction.* The face photo images from face database and the input query face photo image, both undergo same modules but with different intentions. The database face photo images undergo the process flow of first two modules, image pre-processing and sparse code words generation. After sparse codewords generation modules, the generated sparse codewords from face photo image database are stored. When input query face photo image was submitted by user, it undergoes first two modules same as database face photo images. But then after, attribute based tree was constructed against this sparse codewords and already generated sparse codewords from database. The generated sparse codewords are only stored if and only if they are not already present in the database. The described process is represented in architecture diagram as shown below.

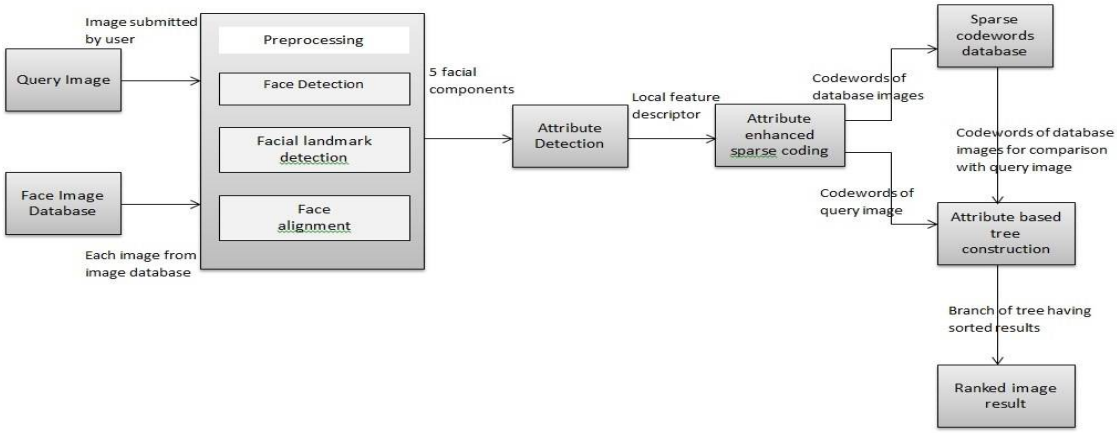

Fig 1. System Framework

The module *Image Preprocessing* contains sub modules, *Face Detection, Facial Landmark Detection* and *Alignment*. First apply face detector to find the locations of faces.Viola-Jonesface detector is used to find the locations of faces in face photo image. Now locate different facial landmarks on the faces. Active shape model is applied to

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locate 68 different facial landmarks on the image.Using these facial landmarks, we apply co-ordinate based mapping process to align every face with the face mean shape. By applying co-ordinate based mapping process, five facial components, formally known as face attributes are detected. These five facial components are two eyes, nose tip, and two mouth corners. These were the output from first module which was submitted as an input to next module, *Sparse Codewords Generation.*

The *Sparse Codewords Generation* module contains submodules, Attribute Detection and Attribute Enhanced Sparse Coding. This module is implemented as described hereafter. Now, sparse codewords are generated by attribute enhanced sparse coding. For detected five facial components including two eyes, nose tip, and two mouth corners, 7 X 5 grids, are extracted. Total 7 X 5 X 5 means 175 grids are extracted.From each grid, application can extract an image patch and compute a 59-dimensional uniform LBP feature descriptor as our local feature.After obtaining local feature descriptors, application can quantize every descriptor into codewords using attribute enhanced sparse coding. The generated sparse codewords with an image index are stored in sparse codewords database. Every face photo image from database undergoes these two modules and sparse codewords are generated for each and every face photo image in database. Sparse codewords for each image with image index was stored in sparse codewords database.

When an input query face photo image was submitted by user, the image undergoes same process as described above. After sparse codewords generation from query image, Attribute based Tree Construction algorithm is implemented to find out and hence retrieve most similar face photo images starting from maximum close face photo image.

To build attribute based binary tree, the attributes of query image such that query image is considered as root of the tree.The images from image database having matching attributes are bind to right branch of the tree while unmatched images are ignored.The right branch of tree was get modified each time new image get bound.If image under bounding have more attributes than last node of branch then it get bound to parent of last node and if not then it get bind to last node.In this way of binding, along with finding similar face photo images from database for query, ranking of images was also performed.Ranking of resultant images is in order from highest matching to lowest.Since, finding and ranking of images get performed in single process by ignoring non matching images, it works fast as compared to existing method of Attribute embedded inverted index based search.

IV. CONCLUSION AND FUTURE WORK

The proposed system utilizes the human visual facial attributes like eye pairs, mouth, etc. to generate semantic key words called as sparse codewords. Sparse codewords improves discriminative image representation. The proposed system first off all generates sparse codewords from available large scale image database and stores it. This sparse codewords are then used to construct a sparse codewords attribute based binary tree for fast and efficient retrieval of query image search result from large scale image database. The attribute based binary tree construction ensures efficient retrieval in the online stage.

Thus proposed a system having a new perspective on content based face image retrieval by incorporating high-level human attributes into face image representation and image search on attribute based tree construction to improve search performance.

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