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Automatic Face Annotation

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Abstract: ***Face annotation is related to face detection and recognition has many real world applications. To resolve the challenges in image processing and computer vision, recently research interests in mining weakly label web facial images has been done through automatic face annotation. This paper introduces a framework of search based face annotation (SBFA) by mining weakly labeled web facial image that are available on www. one challenging part of SBFA scheme is managing most similar web facial images and their weak labels. To avoid this problem, I propose an effective refinement of unsupervised label(RUL) scheme for refining the labels of web facial images. To speed up the proposed system, I also propose a clustering-based approximation algorithm which can improve the scalability.***

Keywords: Face Annotation, Face Detection, SBFA,

1. Introduction

Digital images are growing explosively in both size and number due to the popularity of social medias. Human facial images are the large portion of photos shared by users on the Internet. Some of them are tagged properly. The "Automatic Face Annotation" is important technique that aims to annotate web facial images automatically.

In multimedia and real world knowledge management systems, automatic face annotation has many applications. In classical face annotation approaches, different classification models are trained from a collection of well-labeled facial images by using supervised or semi-supervised machine learning techniques. These are limited in several aspects. Usually it is expensive and time consuming to collect large amount of human-labeled training web facial images.

To avoid these limitations using search based face annotation which aims to tackle the automatic face annotation task by exploiting content based image retrieval technique in mining number of weakly labeled facial images on the web. The main aims of SBFA is to assign correct name labels to a given query facial images.

2. Review of Literature

Different studies are perform face annotation in mining weakly labeled facial images which are present over internet in this human name are treated as input query and aims is to refine the text-based search results by achieving consist facial images.

2.1 Face Recognition Algorithm

A straight forward idea for automatic/semi-automatic face annotation is to integrate face recognition algorithms which have been well studied in the last decade. Girgensohn et al. used face recognition technology to sort faces by their similarity to a chosen face or trained face model, reducing user workload to searching faces that belongs to the same person. however, despite progress made in recent years, face recognition continues to be a challenging topic in computer vision research. most algorithms perform well under a controlled environment, while in the scenario of family photo management, the performance of face recognition algorithms becomes unacceptable due to difficult lighting/illumination conditions and large head pose variations[1].

2.2 Iterative Framework For Face Annotation

Recently, Riya developed an iterative framework for face annotation. In every iteration, the user was asked to manually label some faces, then the system used these labeled information to recognize faces that belong to the same person and proposed for user confirmation. Few technical details are available about iterative framework, but from experiments we can see that it still requires a lot of manual labeling to obtain final annotation results and also require user interaction for each iteration[7].

2.3 Pose Adaptive Face Matching

This method provides a way to compare the similarity between different images which may be captured in different light illumination, pose, camera quality etc. This provides an efficient benchmark for pose effective matching method. Thus the result becomes very efficient and a huge data base is available as *Labeled Faces in the Wild*. Here, the face micro pattern encoding is learned but the pattern sampling should be done manually. Automating this step with learning techniques may produce a more powerful descriptor for face recognition. To improve the results, Anno Search, a novel way to annotate images using search and data mining technologies is used. The proposed method works as follows: 1) searching for semantically and visually similar images on the Web, 2) and mining annotations from them. Firstly, at least one accurate keyword is required to enable text-based search for a set of semantically similar images. Then content-based search is performed on this set to retrieve visually similar images. At last, annotations are mined from the descriptions (titles, URLs and surrounding texts) of these images.

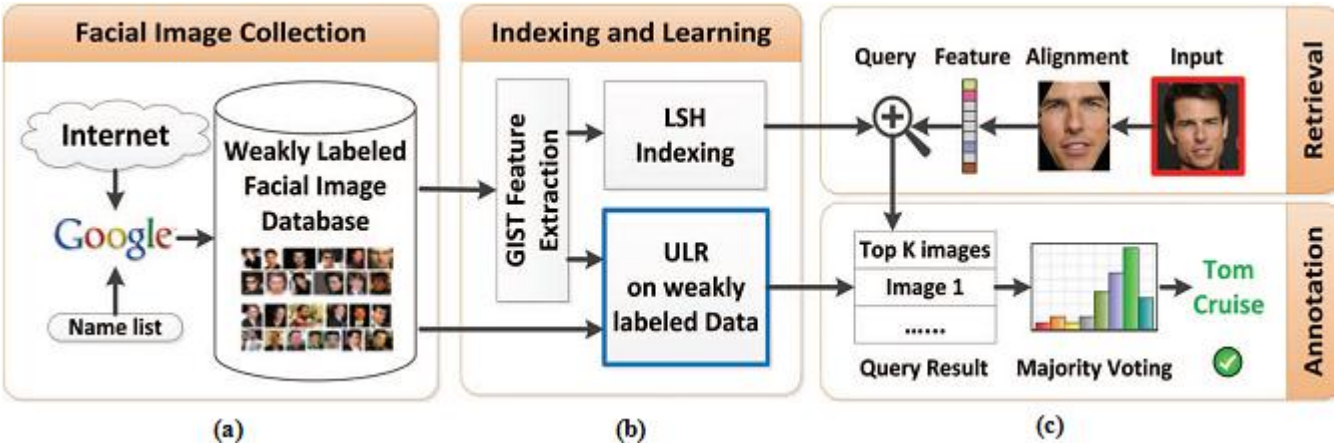

Figure 1: The system flow of the proposed search-based face annotation scheme

2.4 Graph Based Approach

Ozkan and Duygulu proposed a graph-based model for finding the densest sub-graph as the most related result [8]. In graph based approach the faces are represented as nodes and edges encode the similarity between two faces. Here they assume that the face of queried person occurs frequently and thus the obtained sub graph becomes a dense one. Normally a graph can be represented as G= (V, E), where V is the vertex and the E is edges and is weighted according to the similarity. They proposed the graph based method to find the similar subset with possible set of faces with query person name. Then apply a greedy graph algorithm. The approach used here is that find the right label to the query image and assign the same to all images available. The main drawback is this method didn't address the issue of multi person naming task. So some generative models are also proposed to overcome the problem of multi person naming, even though the efficiently of generative models are very low but graph based method is very efficient.

2.5. Retrieval Based Face Annotation

Dayong Wang, Steven C.H. Hoi, Ying He, Jianke Zhu [2] proposed the retrieval based face annotation. The paper introduces an effective Weak Label Regularized Local Coordinate Coding (WLRLCC) technique, which exploits the local coordinate coding principle in learning sparse features. It employs graph-based weak label regularization principle to enhance the weak labels of short listed similar facial images. This method overcomes two major challenges that are being faced in labeling problem: how efficiently retrieve short list of similar images and how to annotate them. This is an optimization algorithm, which boosts the performance of retrieval based face annotation. They also develop an effective sparse reconstruction scheme to perform the final face name annotation.

2.6. Content Based Image Retrieval

Content-based image retrieval (CBIR), also known as Query By Image Content (QBIC) and Content-Based Visual Information Retrieval (CBVIR) is an application of computer vision techniques to image retrieval problem, that is, the problem of searching for digital images in large databases. Content-based image retrieval is opposed to traditional concept-based approaches. Content Based Image Retrieval is an efficient technique for improving the performance of image retrieval. Various methods are used for this purpose and Support Vector Machine (SVM) is very important one in this field. This provides a supervised learning technique which analyses data and learning patterns. This has high importance in collecting relevance feedback. This approach has many drawbacks, sometimes the SVM offer small number of label examples. Another problem is that, this method does not consider the redundancy of results and therefore system selects multiple examples in relevance feedback, that may be similar (or even identical) to each other [3].

2.7. Search Based Face Annotation

One of the most efficient algorithms proposed in the field of face annotation on weakly labeled data is SBFA. Here Dayong Wang, Steven C.H. Hoi et al [4] proposed an effective unsupervised label refinement algorithm. Instead of training explicit classification models by regular model based face annotation approaches, the search based face annotation (SBFA) paradigm aims to tackle the automated face annotation task by exploiting Content Based Image Retrieval (CBIR). The main feature of this work is that SBFA is data driven and it is model free, so it can provide large scalability than the other existing techniques can provide. As per this method, whenever an image is uploaded, K similar images are retrieved and the annotation is performed by conducting a label voting on retrieved images. The work is different from all previous works. Here search based method is used and the input query is also an image. This work is related to previously discussed WLRLCC method. The work uses Locality Sensitive Hashing [5] and unsupervised face alignment technique to retrieve the GIST [6] facial features. It is an efficient method, even though the work is limited in several aspects. First, they assume each name corresponds to a unique single person. Duplicate name can be an issue in real world applications. Second, they assume the top retrieved web facial images are related to a query human name. Here the first step collects the images most of them are associated with human names, these facial images are often noisy which do not always correspond to the right human name. The second step is to pre-processes web facial images to extract face related information. The GIST features are extracted in this work. The third step is to index the extracted

features of the images. Then the labels are refined using Unsupervised Label Refinement.

3. Applications

Annotation finds its application in the field of:

- Achieve relatively high performance without user interaction.
- When user interaction is included, reduce it to an acceptable level.
- Face annotation at macro scale and micro scale.
- Wild landmark face annotation.
- Online photo album management and also in video domain.

Comparative Analysis

Algorithms used	Functions	Drawbacks
Face recognition algorithm	Automatic/semi-automatic face recognition.	The performance of face recognition algorithms becomes unacceptable due to difficult lighting/illumination conditions and large head pose variations.
Iterative Framework for face annotation	It recognize the face of same person and proposed for user confirmation.	It requires a lot of manual labeling and require user interaction for each iteration.
Pose Adaptive matching method	Uses pose-specific classifiers to deal with different pose combinations.	Pattern sampling is still manually designed.
Graph based Approach	Associate names and faces for querying people in large news photo collection.	Multi person naming task still not solved.
Content based image retrieval	Support vector machine for improving content based image retrieval.	Does not take into account the redundancy.
Search based face annotation	Unsupervised label refinement for refining the web facial images.	Duplicate name can be a practical issue in real –life scenarios.

4. Proposed System

Fig. 1 illustrates the system flow of the proposed framework of search-based face annotation, which consists of the following steps:

1) facial image data collection;
2) face detection and facial feature extraction;
3) high-dimensional facial feature indexing;
4) learning to refine weakly labeled data;
5) similar face retrieval; and
6) face annotation by majority voting on the similar faces with the refined labels.

The first four steps are usually conducted before the test phase of a face annotation task, while the last two steps are conducted during the test phase of a face annotation task, which usually should be done very efficiently. We briefly describe each step below.

The first step is the data collection of facial images as shown in Fig. 1a, in which we crawled a collection of facial images from the WWW by an existing web search engine (i.e., Google) according to a name list that contains the names of persons to be collected. As the output of this crawling process, we shall obtain a collection of facial images, each of them is associated with some human names. Given the nature of web images, these facial images are often noisy, which do not always correspond to the right human name. Thus, we call such kind of web facial images with noisy names as weakly labeled facial image data.

The second step is to preprocess web facial images to extract face-related information, including face detection and alignment, facial region extraction, and facial feature representation. For face detection and alignment, we adopt the unsupervised face alignment technique proposed in. For facial feature representation, we extract the GIST texture features to represent the extracted faces. As a result, each face can be represented by a d-dimensional feature vector.

The third step is to index the extracted features of the faces by applying some efficient high-dimensional indexing technique to facilitate the task of similar face retrieval in the subsequent step. In our approach, we adopt the locality sensitive hashing (LSH), a very popular and effective high-dimensional indexing technique.

Besides the indexing step, another key step of the framework is to engage an unsupervised learning scheme to enhance the label quality of the weakly labeled facial images. This process is very important to the entire search based annotation framework since the label quality plays a critical factor in the final annotation performance.

All the above are the processes before annotating a query facial image. Next, we describe the process of face annotation during the test phase. In particular, given a query facial image for annotation, we first conduct a similar face retrieval process to search for a subset of most similar faces (typically top K similar face examples) from the previously indexed facial database. With the set of top K similar face examples retrieved from the database, the next step is to annotate the facial image with a label (or a subset of labels) by employing a majority voting approach that combines the set of labels associated with these top K similar face examples.

In this paper, we focus our attention on one key step of the above framework, i.e., the unsupervised learning process to refine labels of the weakly labeled facial images.

5. Performance Evaluation

In this experiments, it collected a human name list consisting of popular actor and actress names. The user submitted each name from the list as a query to search for the related web mages by Google image search engine.

The top retrieved web images are crawled automatically. After that used the OpenCV toolbox to detect the faces and to

align facial images into the same well-defined position. The no face- detected web images were ignored. As a result, it collected over 100 facial images in our database. It refer to this database as the "retrieval database," which will be used for facial image retrieval during the auto face annotation process.

For the "test dataset," we used the same testset. Specifically, we randomly chose 80 names from our name list. We submitted each selected name as a query to Google and crawled about 100 images from the top 200th to 400th search results. Note that we did not consider the top 200 retrieved images since they had already appeared in the retrieval data set. This aims to examine the generalization performance of our technique for unseen facial images. Since these facial images are often noisy, to obtain ground truth labels for the test data set, we request our staff to manually examine the facial images and remove the irrelevant facial images for each name. As a result, the test database consist of about 1,000 facial images with over 10 faces per person on average.

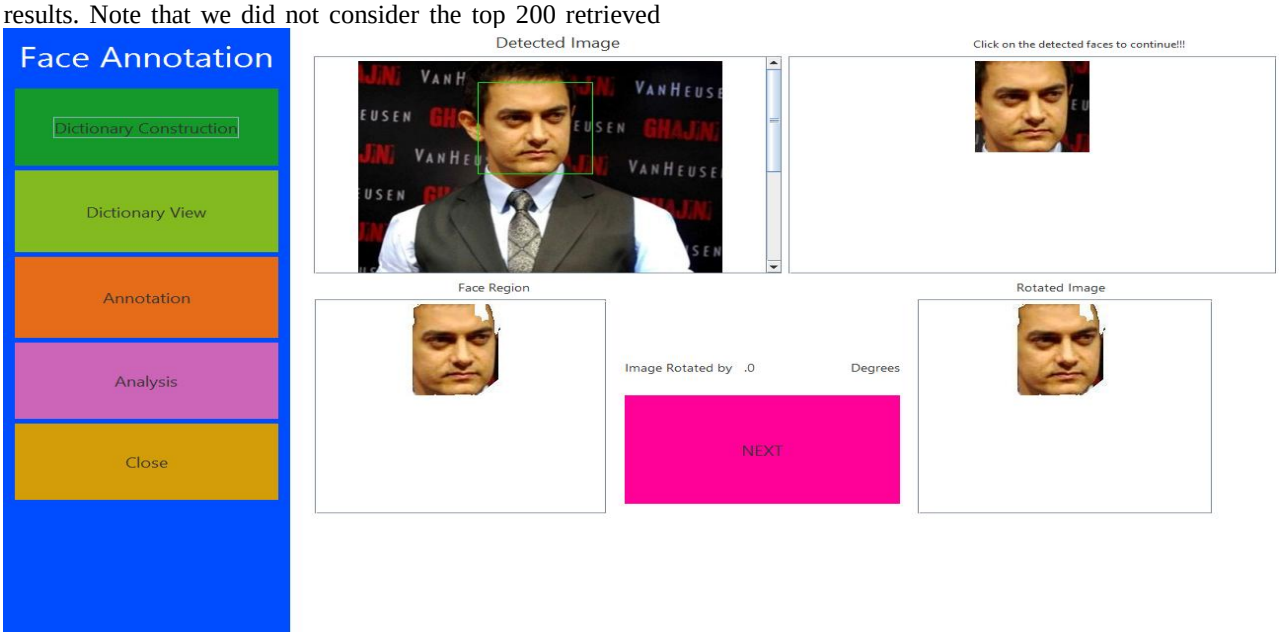

Figure 2: face detection

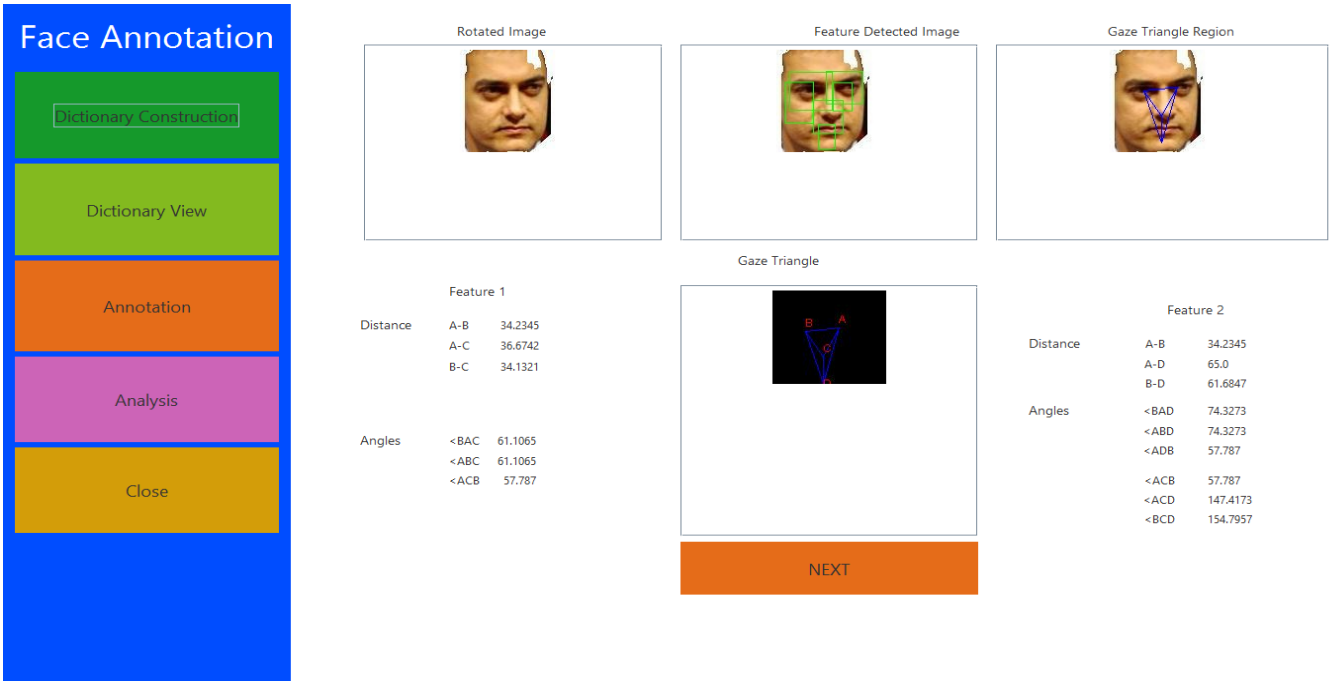

Figure 3: Feature extraction

6. Conclusion

This paper investigated a promising search-based face annotation framework, in which it focused on tackling the critical problem of enhancing the label quality and proposed a ULR algorithm. To further improve the scalability, it also proposed a clustering-based approximation solution, which successfully accelerated the optimization task without

introducing much performance degradation. From an extensive set of experiments, it found that the proposed technique achieved promising results under a variety of settings.

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