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Search based face annotation Approach for Mining Weakly labeled Web facial Images: A Review

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Abstract— This paper investigates search based face annotation (SFBA) framework with the help of mining weakly labeled web facial images which are freely available on World Wide Web (WWW). The drawback as a problem in SBFA is how to perform effectively annotation by considering ordered list of most similar facial images which are weakly labeled that are often noisy and incomplete. To overcome this problem we present the most effective unsupervised label refinement (ULR) method for refining the labels of web facial images using machine learning techniques. We consider the learning problem as a convex optimization and develop effective optimization algorithms to solve the large-scale learning task efficiently. For the fast processing, we also propose a clustering-based approximation algorithm which can develop the scalability

Keywords- Face annotation, content-based image retrieval, machine learning, label refinement, web facial images, weak label**.**

I. INTRODUCTION

With the huge explosion of images available from World Wide Web, various multimedia devices, effective technologies for organizing, searching and browsing these images are urgently required by common users. Because of the popularity of various digital cameras and the rapid growth of social media tools for internet-based photo sharing, recent years have showed an explosion of the plenty of digital photos captured and stored by consumers. Generally, these types of images should be indexed by semantic descriptions so that traditional information retrieval techniques may be used for image search. But it is impossible to manually annotate so many images; automatic image annotation (AIA) might be a promising solution. Auto face annotation can be advantageous to many real world applications. For example, with auto face annotation techniques, online photo-sharing sites (e.g., whatsapp, facebook, and tweeter) can automatically annotate user's uploaded photos to provide online photo search and management. The aim of an automatic image annotation is assigning with some pre-trained image models. One of the challenges is the need for tools that automatically analyze the visual content with semantically meaningful annotations. Now days, some recent studies have tried to explore a promising search-based face annotation process for facial image annotation by mining the Wide Web (WWW), wherever an large range of weakly labeled facial images square measure freely offered. Rather than coaching specific classification models by the model-based face annotation approaches, the search-based face annotation (SBFA) paradigm goals to overcome the automatic face annotation process by exploiting Content-Based Image Retrieval (CBIR) techniques in mining huge weakly labeled facial pictures on the net. Face annotation is related to face detection and recognition, a long-standing research challenge which has been extensively studied for years in computer vision and image processing. Generally, face annotation can be described as a data classification problem from a machine learning and data mining perspective.

II. RELATED WORK

SEARCH BASED FACE ANNOAION

This annotation approach consists of following steps as illustrated in fig. 1:

A. Facial image data collection;

B. Face detection and facial feature extraction;
C. High-dimensional facial feature indexing;
D. Learning to refine weakly labeled data;
E. Similar face retrieval;

Before the test phase of a face annotation task, the first four steps are conducted. The last step is conducted during the test phase of face annotation task.

A. FACIAL IMAGE DATA COLLECTION

In this step 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 an output of this process we shall obtain a collection of facial images, each of them is associated with some human names. 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.

B. FACE DETECTION AND FACIAL FEATURE EXTRACTION

This 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. For facial feature representation, we extract the GIST texture features [2] to represent the extracted faces. As a result, each face can be represented by a d-dimensional feature vector. The caption-based annotation scheme is only applicable to the scenario where both images and their captions are available, and cannot be applied to our SBFA framework [1] due to the lack of complete caption information. This Step studies of purifying web facial images, which aims to leverage noisy web facial images for face recognition applications.

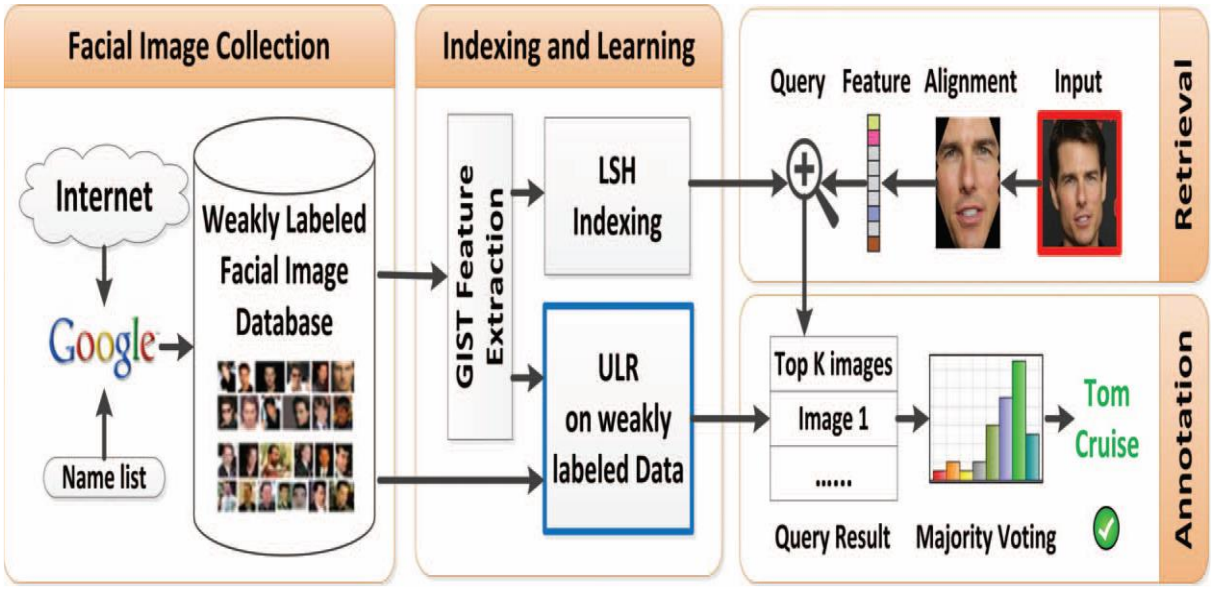

Figure 1: The system flow of the proposed search-based face annotation scheme.

C. HIGH-DIMENTIONAL FACIAL FEATURE INDEXING

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 theory, we adopt the locality sensitive hashing (LSH) [3], a very popular and effective high-dimensional indexing technique.

D. LEARNING TO REFINE WEAKLY LABELED DATA

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.

E. SIMILAR FACE RETRIVAL

In this step 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**.**

III. LITURATURE SURVEY

UNIFIED SCHEME OF MINING WEB IMAGES FOR FACE ANNOTATION

In this overview we introduced the proposed framework of Unified transductive and Inductive Learning (UTIL) for auto face labeled facial images. For each and every weakly labeled image in database the pre-processing step is applied and no face detected images are removed. We applied the state-of-the-art Weak Label Regularized Local Coordinate Coding (WLRLCC) [4] algorithm from search based face annotation paradigm for "transductive learning" step. It aims to annotate the query image by fully exploring the top-n similar images and their corresponding labels. The two key factors affect its final annotation performance for this problem: (1) Generating more represented feature for re-ranking as all the top ranking images are close to each other in the original feature space; (2) Enhancing the initial weak label.

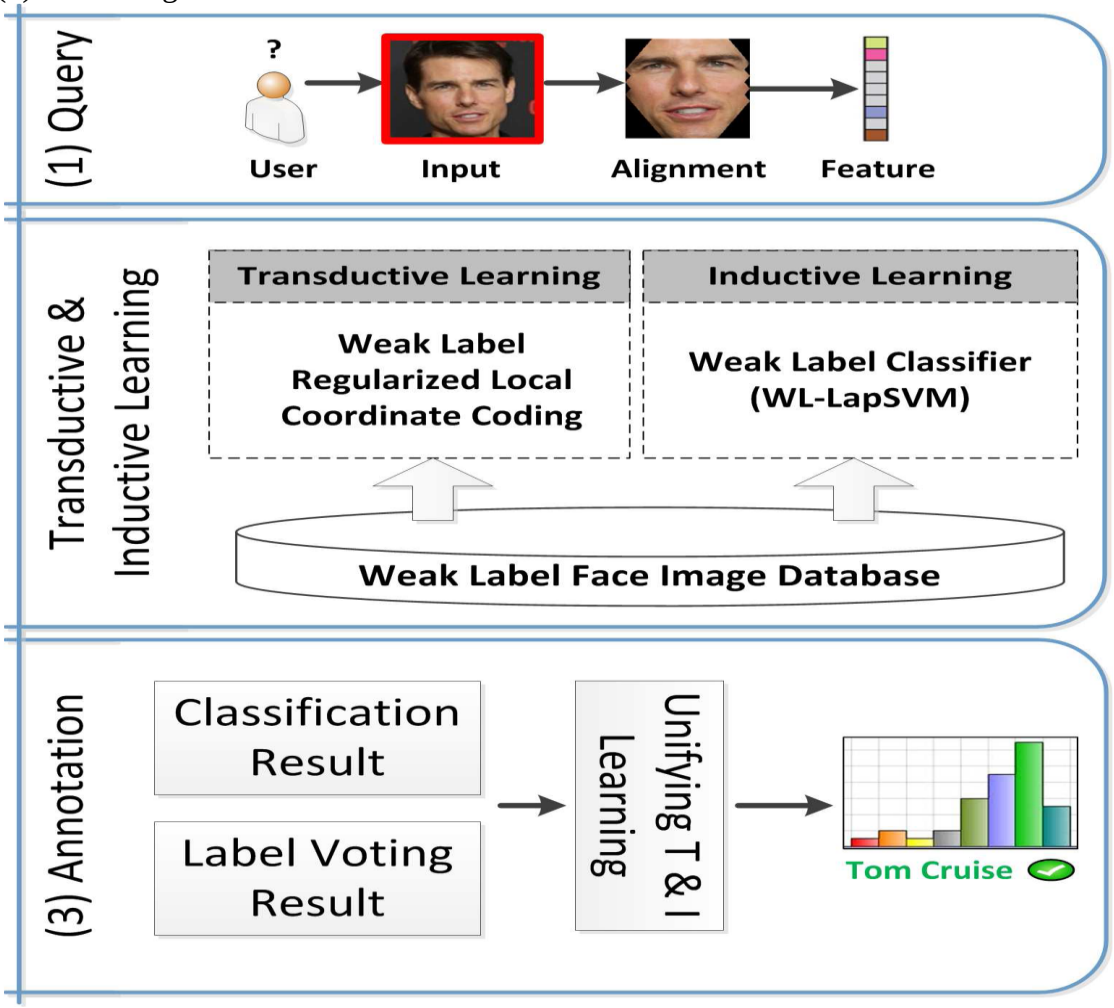

Figure 2: The Unifying Transductive and Inductive Learning (UTIL) framework for auto face annotation problem

Figure 2 illustrates the system flow of the proposed framework, which consists of the following three stages: (1) Preprocess the query facial image, including face detection, face alignment and facial feature extraction; (2) Apply "transductive learning" and "inductive learning" respectively on the weakly-labeled face image database; and (3) Combine the annotation results from the "transductive learning" and "inductive learning" steps, and output the final annotation. The details of each stage are described as follows.

The first stage, as shown in Figure 2 (1), is to pre-process a query facial image, including face detection, face alignment, and facial feature representation. For facial region detection and alignment, we adopt the unsupervised face alignment technique.

The second stage, as shown in Figure 2 (2), consists of two independent learning steps: (i) annotation by "transductive learning" and (ii) annotation by "inductive learning." Both are applied on the same web facial image database [5]. To build such a large-scale facial image database, we can choose a list of desired human names and submit them to some existing web search engine (e.g., Google in our approach) for crawling their related web facial images. As the Output of this crawling process, we obtain a collection of web facial images; each of them is associated with a human name.

The third step is about the combination of the annotation results of the previous trasductive and inductive learning stages. To this purpose, we evaluate several last fusion schemes to merge the two annotation results. We also proposed entropy based weighting combination scheme, which achieve fairly good fusion result with less computation effort.

IV. CONCLUSION

This paper represents a promising search-based face annotation framework, in which we focused on overcoming the critical problems of enhancing the quality of label and proposed a ULR algorithm. To improve the scalability, we also proposed a "clustering-based approximation solution". It successfully accelerated the task of optimization without introducing much performance degradation. From a huge set of experiments, we found that the proposed technique achieved promising results under a variety of settings. Our results of experiments also presented that the proposed ULR technique mostly surpassed the other regular approaches in literature. Future work will address the issues of duplicate human names and explore supervised/semi-supervised learning techniques to further enhance the label quality with affordable human manual refinement efforts.

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