

# A Review on Content Based Image Retrieval and Search Based Face Annotation on Weakly Labeled Images

Krishna Prasanth I B<sup>1</sup>, Anoop S<sup>2</sup>

<sup>1</sup>PG scholar, Department of Computer Science, College of Engineering Perumon, Kerala, India

<sup>2</sup>Assistant Professor, Department Of Information Technology, College Of Engineering Perumon, Kerala, India

**Abstract**—The face annotation has many real world applications. The challenging part of search based face annotation task is management of most familiar facial images and their weak labels. To tackle this problem, different techniques are adopted. The efficiency and performance of annotating systems are improved tremendously by using these methods. Here this paper proposes a review on different techniques used for this purpose and check the pros and cons of each technique.

**Keywords**— Face Annotation , Facial Recognition, Face Detection

## I. INTRODUCTION

The popularity of social Medias brought a boom in the size of data especially images uploaded to internet. Most of the images uploaded to internet are facial images. Efficient face annotation scheme can recognize the faces and annotate them properly. The images uploaded to internet are actually a treasure to future generations. But there is a problem that the efficient methods to retrieve all the images properly are not available. The main reason behind this is that most of the images are not properly tagged.

There are different methods are used for this face recognition and annotation task. These methods will help in application such as facebook, flicker, instagram etc and other photo sharing sites to automatically annotate the faces uploaded to it. At the same time, the face recognition method can be used to identify the wrong labels assigned to a particular image. It can be corrected by replacing with right labels. This will help to increase the search efficiency. There are two problems in classic models of facial annotation. First, it is time consuming and expensive to create a training set which contains the images and exact labels. Second, it is difficult to generalize the models when new images are added.

Different techniques are proposed to overcome these issues and thereby making facial annotation in an efficient way up to an extent. Here, we are going to discuss different methods and pros and cons of each of the method used for face recognition and auto face annotation. The advanced method in this field is Unsupervised Label Refinement technique where system uses a search based face annotation with correct labels assigned to a given query image.

## II. RELATED WORKS

Different techniques are used in retrieving facial images based on search query. Most of the users use person's name as the search query. So it is effective to label the images with their exact names. The automatic face recognition techniques can annotate the faces with exact labels and it also help to improve the search more efficiently.

### A. Classic Model of Face Annotation

This model of face recognition can be done either by comparing the features of two input images or by comparing an input image with the training data set. This is a straight forward method that reduces the workload of user when searching for same person's image. The face recognition is a challenging part of all time since the actual face recognition efficiency is affected by many factors such as illumination, lighting, camera quality, pose of photo taken etc. So most of the face recognition algorithms can perform well in controlled conditions [7].

### B. Repetitive Framework For Face Annotation

This method proposes that facial annotation should be conducted in an iterative manner. Here the user uploads some images and gives labels to it. These labels are used to find the labels of succeeding images and then provide them for user conformation. If the user agrees with the labels provided by the system, then it will be added to the data base and the work continues in iterative manner [9].

### C. 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, AnnoSearch, 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.

#### D. 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 efficiency of generative models are very low but graph based method is very efficient.

#### E. 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 (WLRCC) 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.

#### F. 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].

#### G. 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 WLRCC 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.

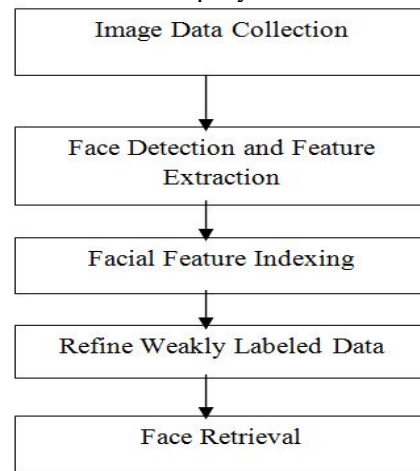


Fig. SBFA

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.

#### H. Unsupervised Label Refinement

The SBFA method provides some efficient techniques for annotation task. The scope of that work is improved by

Unsupervised Label Refinement. The technique is proposed to refine the weakly labeled images which are available on the WWW. The Unsupervised approach provides the opportunity of scalability and it aims to find the weakly labeled images and annotate them with original label by performing Content Based Image Retrieval on each query image.

**I. Unsupervised Face Name Association**

This method is to find the face name association in images with captions. Specifically, the task of face-name association should obey the following three constraints: (1) a face can only be assigned to a name appearing in its associated caption or to null; (2) a name can be assigned to at most one face; and (3) a face can be assigned to at most one name. Many conventional methods have been proposed to tackle this task while suffering from some common problems. In this work they design a novel framework named face-name association via commute distance (FACD), which judges face-name and face-null assignments under a unified framework via commute distance (CD) algorithm. To improve the efficiency of this work Anchor Based commute Distance (ACD) method is implemented.

**Comparative Study Of Different Methods**

Algorithm Used	Working	Drawbacks
Pose Adaptive Face matching	Use efficient methods to overcome the issues of different pose, light illumination etc	Pattern Sampling is created manually
Retrieval Based Face Annotation	Local coordinate coding method is used.	Multi person naming is not considered
Content Based Image Retrieval	Support Vector Machines are used	The redundancy is not considered and the labeled examples are low.
Search Based Face Annotation	Unsupervised Label Refinement is used	Duplicate name issue is not considered.
Classic Model Of Face Annotation	Supervised and semi supervised learning techniques are used.	Different light conditions or pose is not considered
Graph Based Approach	Find face name association	Multi person naming task is not considered
Repetitive framework	System assigns label and provide it for user conformation.	Lots of manual work is required.

**III APPLICATIONS**

- It can be used in social networks for auto tagging.
- Online photo album management and news video summarization.
- Face annotation at macro scale and micro scale.
- Reduce weak labels and thus have application in efficient online search

**IV CONCLUSION**

This paper analyses various techniques used for auto face annotation on weakly labeled images. Many research works and new methods are being proposed in this field. The research in this field demands importance as it is very useful in online searching and social Medias. The future work will focus on multi person naming task and thereby increasing efficiency and accuracy of result. If the techniques are implemented properly, then the weak label problem will be smoothened.

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