A Survey Paper on Classification Techniques for Automatic Face Annotation

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Abstract: *Exact identification and naming of face has been significant in various regions of computer science. A tremendous number of photos are shared over the social passages, a portion of these photos are marked with appropriate names yet immense quantities of them are unlabelled. So, it ends up being hard to understand the name of the individual from the image if any sporadic individual sees it. In this paper, we discuss the phases of the automatic face annotation and surveyed various techniques of classification.*

Key Words: *automatic image annotation, automatic face annotation, feature extraction, Classification, Similarity measurement.*

1. INTRODUCTION:

With the detonative development of web photo sharing websites and social network, enormous number of pictures are uploaded and shared over the internet [3, 4, 5, 6, 7, 12, 22, 23]. Due to the great success of social web portals and social networks, web users are highly motivated to share their pictures over the internet and that permit other users to tag and comment on the pictures. Huge number of photos are shared over the social portals, some of these photos are tagged with appropriate names but many of them are unlabeled. So, it becomes difficult to understand the name of the person from image if any random person sees it. In order to overcome this problem automatic face annotation is used. Automatic face annotation is playing vital role in multimedia information. Automatic face annotation is method to detect human faces from image and assign appropriate human name. Face annotation is firmly related to the face detection and face recognition which are utilized as a part of computer vision and image processing. In this paper, section I describes the introduction part of automatic face annotation. Section II describes the concept of automatic face annotation. Section III describe the techniques for classification. Section IV describes the comparative analysis of classification techniques. Section V describes the conclusion.

2. MOTIVATION

An extensive portion of photos shared over the web are human facial pictures. Some of these facial pictures are labelled properly with names, yet the majority of them are unlabelled. In this way, this has given the inspiration for examination of automatic face annotation strategies to defeat this issue. There is some limitation of model-based techniques of face annotation. It is expensive and time-consuming to collect large amount of human facial images which are well labelled. To overcome these limitations, search based face annotation is used which aim to tackle the auto face annotation task by exploiting content-based image retrieval technique in mining number of facial images on the web. The main purpose of search-based face annotation is to assign correct name labels to a given query image [8]. Automatic face annotation can be useful to many real-world applications. Automatic face annotation is used as a piece of online photo sharing goals such as Facebook in which clients automatically annotate uploaded photos to enable online photograph search and management. Face annotation can also be utilized as a part of news video domain to recognize important people appeared in the recordings to make easier to get news video retrieval [3] [6]. Face annotation is useful in many applications such as identity verification (passports, driving licenses, employee IDs), criminal justice systems (forensics), wild landmark face annotation, and online photo album management.

3. CONCEPT OF AUTOMATIC FACE ANNOTATION:

Auto face annotation is technique to detect human faces from a photo and allocate their corresponding human names [8]. The aim of auto face annotation is to detect human faces automatically from a photo image and label the facial images with their human names. Face annotation is closely related to the face detection and face recognition which are used in computer vision and image processing [6]. Face annotation is as an extended face recognition problem in which

face classification models are trained from a collection of well labelled facial images using supervised or semi-supervised machine learning techniques [4].

Figure 1: Face Annotation [5]

Automatic Face Annotation has been dynamic examination subject over the most recent couple of years due its high effect on the web search. The framework of automatic face annotation is shown in figure 2.
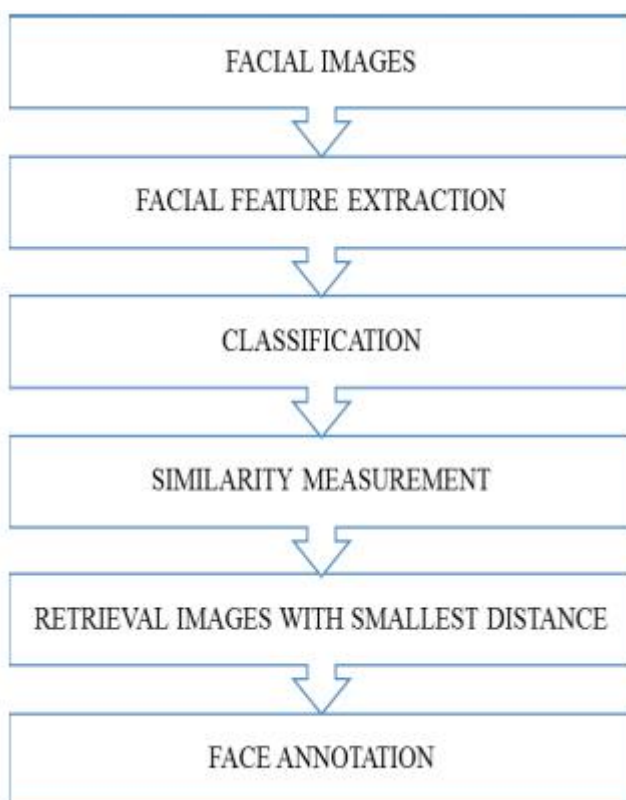

Figure 2: Process of Face Annotation

Facial Feature Extraction: Feature extraction is an essential task to collect the set of features from an image. Feature extraction include reducing the size of data that represent a large set of data. Feature extraction is the process of retrieval of valuable feature from an image. It generates the feature vector of all the features extracted from an image [15]. Facial feature extraction can be characterized as a procedure to locate particular features in a facial image. It is a process to extract the facial features. There are various feature extraction techniques which are SURF, SIFT, Convolutional neural network (CNN), Gabor Wavelet Transform, Eigenfaces, LBP.

Classification: Image classification analyses the numerical properties of various image features and organizes data into categories. Classification employs two phases of processing: training and testing. There are various classification algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN), k nearest neighbour.

Similarity Measurement: Similarity measurement is used to find the similarity between the database images and the query image using their features. The selection of similarity measure is vital as it can affect the performance of an image retrieval system. There are various similarity measurement distances such as Euclidean Distance, City block distance (Manhattan Distance), etc.

Nearest-Neighbour Retrieval: The database images are sorted according to the ascending order of distance to the query image and then images are retrieved from the database according to that order.

Face Annotation: After the nearest-neighbour picture retrieved from database, next task is face annotation in which facial images are annotated with a label associated with retrieved nearest-neighbours. The label of these nearest neighbour images is shared with the query image and finally face annotation task is completed.

4. CLASSIFICATION TECHNIQUES FOR AUTOMATIC FACE ANNOTATION

Classification employs two phases of processing: training and testing. There are various classification algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN), k nearest neighbour.

Support Vector Machine (SVM)

In machine learning, support vector machines (support vector network) are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked for belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier [1] [2] Support vector machine (SVM) is a supervised classifier in machine learning. Support vector machines are supervised learning models with associated learning algorithms which is analyse data and recognize patterns. SVM give high effectiveness in high dimensional data classifications, particularly when the training dataset is small. SVM can classify linear and non-linear data through kernel mapping [1].

Artificial Neural Network (ANN)

Artificial Neural Networks (ANNs) are notable classification tool for complex data. Different sorts of neural networks strategies have been distinguished for image classification on account of their generalization. The procedure of feed-forward network, back propagation network is rehashed until the output achieves the desired accuracy or until the given number of training cycles are finished. Training samples of database are utilized to train the network and the network is adjusted according to its error. Testing samples are then used to give an autonomous measure of the network performance during and after training.

An ANN is a learning network. An ANN can learn from examples and can make decision for a new sample. An ANN contains various layers of interconnected nodes, which are also known as neurons or perceptions. The first layer is the input layer in which the number of neurons is equal to the dimension of the input sample. The output layer in which the number of neurons is equal to the number of classes [1]. An ANN can be used for explicit classification of images, regions or pixels, also used for implicit assignment of fuzzy decisions on images.

Nearest Neighbour Classifier

The procedure of the nearest neighbour classifier is utilized to compare the feature vector of the input image and the feature vectors put away in the database. It is accomplished by finding the distance between the prototype picture and the database. In the nearest neighbour classifier, the class is found by measuring the distance between a feature vector of input picture and feature vectors of pictures in reference database. The Euclidean distance measurement is utilized by nearest neighbour. Other distance measurement can be also used for the nearest neighbour [19]. Let X_l, X_2, ... , X_k be the k class features vectors in the database and X_q the feature vector of the query image. The feature vector with the minimum distance is found to be the closest matching vector [19]. It is given by:

$$d(X_q, X_j) = \min_{j \in \{1,2,\ldots,k\}} \left\{ \sqrt{\sum (x_q(i) - x_j(i))^2} \right\}$$

The nearest neighbour classifier does not need any training stage. It requires a significant time to calculate all the distances between the query picture and database classes if the database is enormous.

Table 1 Comparative analysis of classifiers

Classifiers	Merits	Demerits
SVM[1][17]	+ Optimal class boundaries + Non-linear classification + Less misclassification + Robust and Faster + Required less memory + less complex than ANN + Good generalized ability	- Expensive trial and run
ANN[1][18]	+ Multiclass outputs + Suitable for complex problem. + Robust to noisy data	- Expensive training - Complex and black box classification - Sub-optimal - Time consuming
KNN[8][19]	+ Effective if the training data is large.	- Computation cost is quite high. - Give false positive image retrieval

5. SUMMERY:

The method of automatic face annotation is to recognize human appearances from pictures and appoint fitting human names naturally. Classification is vital in automatic face annotation. In this paper, we present a survey of classification techniques and discuss the phases of automatic face annotation. From the comparative study, SVM is more beneficial than another classifier. SVM is basically deals with pattern classification problem. It is used to classify linear and non-linear classification patterns. Number of misclassifications is less in SVM. It achieves optimal class boundaries by finding the maximum distance between classes. Moreover, SVM is robust, faster and required less memory. SVM is less complex than ANN. ANN is more time consuming as compare to SVM. Hence, we are going to use SVM classifier for image classification.

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