Search-Based Face Annotation using CBIR and K-means Clustering-based Algorithm

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ABSTRACT

Face recognition is very challenging area of research. The number of the images are available on the internet among them most of the images are human facial images which shared by the users. Some human facial images are not properly tagged with right name. So, Search-Based Face Annotation (SBFA) framework aims to deal with auto face annotation task and uses Content-Based Image Retrieval (CBIR) technique for face annotation. The main motive behind the SBFA is to assign right name label to a given query facial image. So K-means clustering-based algorithm used to improve scalability. This work also introduces the user is validated by their email. The efficiency of system improved by performing the verification of email, last login session of particular user, total counts of login etc. and finally the user account status is accomplished.

Keywords— Face recognition, content-based image retrieval, face annotation.

ARTICLE INFO

I. INTRODUCTION

Every day a large number of image data are generated such as photographs, medical images and also satellite images. In recent times with rapid growth of social media sites and web photo sharing portals, big amount of photos have been uploaded and shared on the web. In day today life many persons use the advance digital cameras, so they captured, stored and shared their personalized photos on the internet.

Due to the speedy growth of the digital accessories like digital camera and many social media tools, users clicked photos and shared that image on the social media sites. The social media sites are Facebook, Twitter, Instagram, Google+ and so on. On those sites persons are automatically tagged with their respective names, by the use of auto face annotation technique. But many times it may happened the facial images are not tagged with proper name. So SBFA framework [1] solves the problem of automated face annotation. When searching a particular images and downloaded it, then some images not labelled properly. This auto face annotation technique aims to automatically annotate facial images of person from photo album. The face annotation is also used in the news video domain in which identification of person realized [2] and also online

photo sharing applications, hence face detected in the news videos as well as other applications.

However, many users get difficulties in searching massive amount of images in database due to network, hardware problems etc. Basically the current commercial database systems are designed for text data and these systems are not well suited for digital images. Image retrieval system is grouped into two types, one is Text Based Image Retrieval and other is Content Based Image Retrieval. Text Based Image Retrieval is having some cons such as lose of information, more expensive task and time consuming [3]. Content Based Image Retrieval (CBIR) system overcomes these problems for image retrieval.

Face annotation means a process of naming a person from his/her photo or a person involved in video domain also. Face annotation in images and videos enjoys many potential applications in multimedia information retrieval and computer vision. Due to the increasing growth of photos there is a need for automatic indexing which has been emerged. One who might be knows that who is in that photo which is very essential.

One of the approaches in annotation is search-based face annotation. This framework is used to interact with social networks. In this work, a search-based face annotation scheme investigated by mining a human facial images that are freely available over the Internet. In particular, given a query image for annotation, first retrieves subset of similar images from a local facial image database using content-based image retrieval technique and then assign a correct label for annotation. The number of users uploads their image for annotation. The CBIR technique firstly retrieves a short list of top-n most similar facial images from a web facial image database based on texture feature and then annotates facial image.

CBIR is an automatic image retrieval process in which desired number of images gets back from database and to search query image based on user input. This technique first decompose the existing image and convert into compatible image then extracts the image features and stores the texture features efficiently. After that it compares with images from the database and returns the number of images. Feature extraction and similarity measure are dependent on the features (texture) used in the experiment.
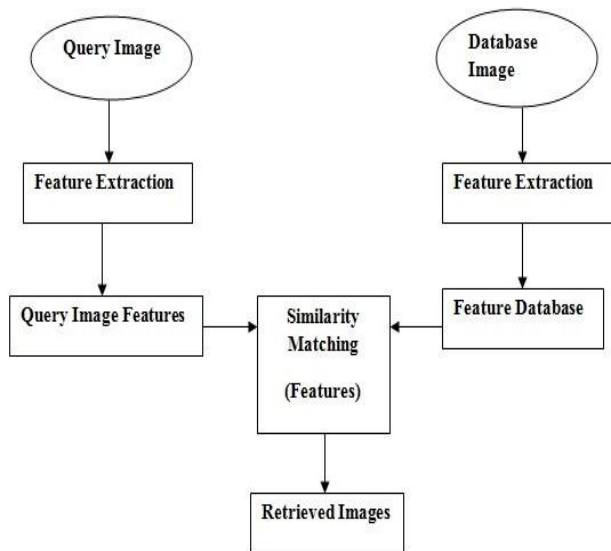

Fig.1: Block diagram of CBIR system

In the system adding metadata (keywords) annotation of facial images performed. In which a user manually enter keyword (metadata) while uploading images and stored in the local database. Thus a system provides better indexing and gives accurate result.

II. LITERATURE SURVEY

There are many different studies which are performing face annotation in many applications.

Classic model of face recognition studied in many papers and gives some problems of face recognition with limited training data. The semi supervised methods used to annotate person from video frames [4]. Bayesian framework [5] used to automate the process of face annotation in family photo albums. In this paper, the facial and contextual features used and they are extracted from the region. But it is time consuming process to collect training data. The face recognition (identification) is a most challenging part of all

time. The actual face recognition efficiency is affected by illumination, lighting, camera quality, pose of photo taken etc. The authors proposed the framework of an interactive face annotation and used unsupervised learning method that is partial clustering. This study focused on annotation task on personal photos which contains timestamps, geotags and so on [6]. Ozkan and Duygulu [7] proposed a model which is based on graph-based approach. The approach used in this paper text-based image retrieval search results which mainly considered as name as input query. The face alignment technique is used in [1]. After the face detection step, human-face patches are extracted from images. Directly using these patches for face recognition have some disadvantages, first, each patch usually contains over 1000 pixels, which are too large to build a robust recognition system1. Second, face patches may be taken from different camera alignments, with different face expressions, illuminations, and may suffer from occlusion and clutter.

III. SYSTEM ARCHITECTURE

The proposed framework of search-based face annotation (SBFA) which consists of the following steps (modules):

(1) Collection of facial images:
On the first stage, collect the human facial images from the internet. Any user uploads the images with a label (name) given to image as they manually entered to images for annotation and then stored on the local database for recognition/identifying.

(2) Facial image decomposition and feature extraction:
The second step is to pre-processes the human facial images consist of image decomposition, extract the facial image features as texture. Basically, the color images are having the standard color is RGB color. RGB color model is used. Color is a pixel that integrated with texture feature. In our system, texture feature is extracted from the facial images. We used a method for color image decomposition named Haar wavelets. After decomposition resulting decomposition coefficients are used to perform image feature extraction and similarity match with F-norm theory.
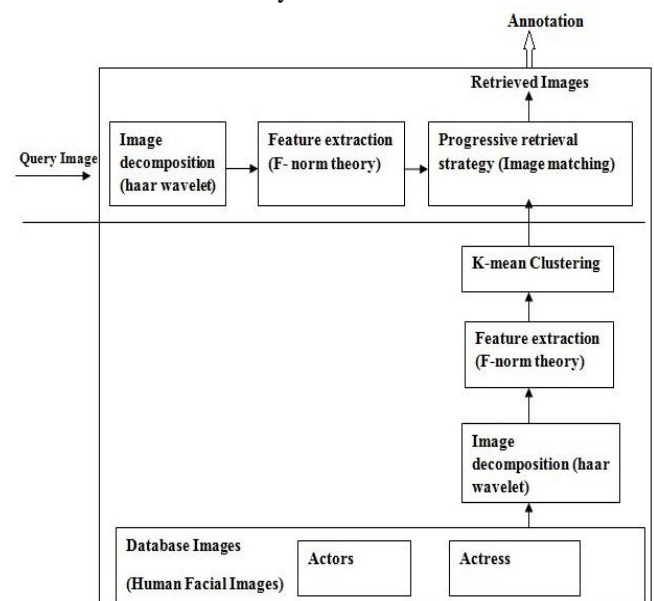

Fig.2: System Architecture of proposed SBFA scheme

(3) Facial feature indexing:
After decomposition of image and feature extraction, this step is to index the extracted features of the faces by applying K-means clustering-based algorithm in which distance of the images calculated.

(4) Similar face retrieval:
Besides the indexing step, when a query image given for face annotation then similar facial images retrieved from the indexed facial image database.

(5) Face Annotation and validate user:
Finally, the annotation of face performed based on a threshold value. The system shows the name of a particular (relevant) user's image. Admin validate the user by verification of email.

IV. ALGORITHM

K-means Clustering-based Algorithm:
K-means clustering algorithm is a partitioning algorithm so it is also called as Bisecting K-means Clustering-based Approximation Algorithm. K-mean clustering is used to form the cluster. K-means clustering is a method of cluster analysis which aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean.

Input:
$X = \{X_1, X_2, \ldots, Xn\}$ //set of n data points
K = Number of desired clusters
Output:
A set of K clusters i.e. 2 clusters

Steps:
1. Randomly select k data points from X as the initial centroids.
2. repeat
3. Assign each point Xi to the cluster which has the closest centroid.
4. Calculate the new mean for each cluster.
5. until the centroids don't change.

K-means clustering is an unsupervised learning method of cluster analysis. In this algorithm, partition n data points into k clusters in which each data point belongs to the cluster with the nearest mean. Given a set of data points $(X_1, X_2, \ldots, Xn)$, where each data point is a d-dimensional real vector. Calculate the distance between each cluster centroid and each data point.

$$d = \left(\sum_{j=1}^{k} \sum_{i=C_j} (x_i - z_j)^2 \right)^{1/2}$$

where, Cj is the jth cluster and Zj is the centroid of the cluster Cj and Xi is data point or an input pattern. So, the K-means clustering algorithm is an iterative algorithm and this algorithm finds a suitable partition.

Mathematical Model:

Let us consider a set S where,
S = {U, SER, I, O, N}

Here, S: System which includes:
Input I: Image X= {X1, X2,...., Xn}
Output O: Person Name Y = {Y1, Y2,...., Yn}
U: Set of Users where U = {U1, U2,....,Un}
A: Admin
SER: Server
N: Number of cluster

Upload image:
$$\sum_{i}^{n} Ui \longrightarrow Xi \text{ where, } Ui \,\epsilon\, U \text{ and } Xi \longrightarrow X$$

K-means (N): It is the algorithmic part of the system, where N is number of cluster that is 2.

The distance is calculated by using formula which is given below.

$$d = \left(\sum_{j=1}^{k} \sum_{i=C_j} (x_i - z_j)^2 \right)^{1/2}$$

where, Cj is the jth cluster and Zj is the centroid of the cluster Cj and Xi is data point or an input pattern.

V. PERFORMANCE EVALUATION

Figure shows the performance evaluation of proposed system and comparison with existing system. It is clear that the larger the number of facial images per person collected in our database, the better the average annotation performance can be achieved. Here, face annotation performance with respect to time can be performed.
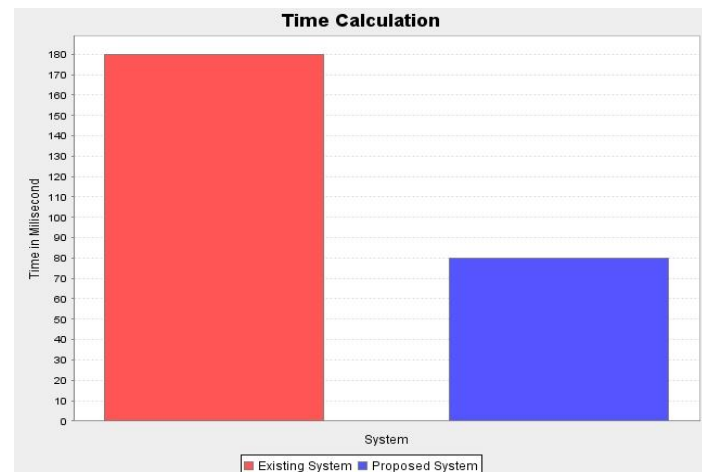

Fig.3: Performance evaluation graph

The time required to annotate face is better than existing system. The proposed system takes less time for annotation of face.

VI. EXPERIMENTAL RESULTS

To perform the experiment, the general flow starts with the decomposition of database image. With F-norm theory, extracted the image features and vector matrix formed which stored in index file and performed image matching. The

progressive retrieval strategy used to balance between computational complexity and retrieval accuracy.

The database contains 50 color images containing actors and actress images to perform the experiment. Database images are stored in JPEG, jpg, png and also gif format. Sample database images are shown in the Fig.4. We have shown some sample query image for annotation. For perfect match image, threshold value set as 1.
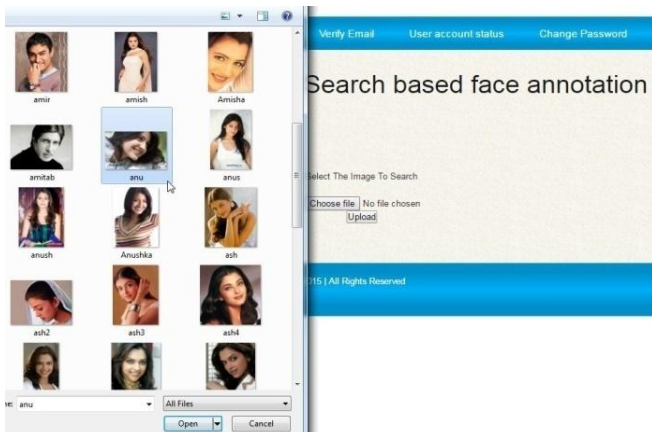

Fig.4: Image data collection

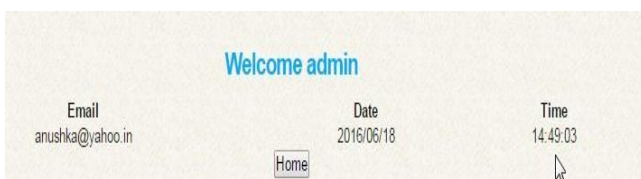Fig.5: Select the image to search

Fig.6: Face annotation

Fig.7: Last login of user

Fig.8: User account status

VII.   CONCLUSION

It can be concluded that the annotation of face from human facial image implemented. Search-Based Face Annotation (SBFA) scheme used to assign correct name label to given query image. We implemented the annotation of face with the use of Content-Based Image Retrieval (CBIR) technique to retrieve the desired images from local database with the different mechanisms such as image decomposition, facial feature extraction and similarity measure of images computed with K-means clustering-based algorithm for face annotation. The efficiency of system improved by performing verification of email and computes total counts of login and view the last login sessions also.

The limitation of proposed system is that it only working on the images not on videos. In future scope, videos will be used instead of facial images to annotate faces from videos using search-based face annotation technique. Also, it will be useful in Android based application. In future this work will adopt different machine learning techniques such as supervised and semi-supervised methods can be use for face annotation. The future work will focus on multi person naming task and thereby increasing efficiency and accuracy of result. The proposed framework does not take into consideration of high resolution images.

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