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A Survey on Face Identification Methodologies in Videos

Deepti Yadav

Student, M.Tech CSE ,Department of Computer Science & Engineering ,G.H.Raisoni College of Engineering & Technology for Women, Nagpur, Maharashtra, India.

Ms. Antara Bhattacharya

Assistant Professor, Department of Computer Science & Engineering ,G.H.Raisoni College of Engineering & Technology for Women, Nagpur, Maharashtra, India.

***Abstract*--- Face recognition from video presents a challenging problem in the field of image investigation and computer visualization, and as such has acknowledged a great deal of consideration over the last few years because of its many applications in various domains. The human face is a dynamic object and has a high scale of variability in its appearance, which makes face recognition a complicated problem in computer vision. A wide variety of techniques have been projected in this paper. An overview of some of the distinguished methods in each of this category is provided and some of the benefits and drawbacks of the scheme mentioned therein are examined. Furthermore, a discussion outlining the reason for using face recognition, the applications of this technology, and some of the difficulties plaguing current system with regard to this task has also been provided. This paper also mentions some of the most new algorithms developed for this purpose and attempt to give an idea of the state of the art of face recognition technology.**

***Keywords*— Face recognition, Survey, video based, dictionary.**

I. INTRODUCTION

During the past several years, face recognition from video has received significant consideration. Not only the wide series of commercial and law enforcement applications, but also the availability of feasible technologies after several decades of research contributes to the trend. Although existing face recognition systems have reached a certain level of development, their development is still narrow by the conditions brought about by many real applications. For example, recognizing images of video sequence acquired in an open environment with variations in illumination and/or pose and/or facial occlusion and/or low resolution of acquired image remains a largely unsolved problem. In other words, current algorithms are yet to be developed [1]. This paper presents an up-to-date survey of video-based face recognition research. To present a comprehensive survey, we categorize current video based recognition techniques and present detailed descriptions of representative methods within each category.

Face recognition from video is a biometric approach that employs method to verify or recognize the identity of a human being based on his/her physiological characteristics [2]. It also used in wide range of commercial and law enforcement a remarkable area in real time applications. Face recognition has several advantages over other biometric technologies: It is natural, nonintrusive, and easy to use. Face recognition from video system can help in many ways: for example some applications are checking for criminal records and detection of a criminal at public place, finding lost children's by using the videos received from the surveillance cameras fitted at some public places and detection of thief's at ATM machines, knowing in advance if some unknown person is entering at the border checkpoints and so on. A face recognition system from video can operate in either or both of two modes: (1) face verification (or authentication), and (2) face identification (or recognition). Face verification involves a one to-one match that compares a query face image against a template face image. Face identification involves one-to-many matches that compare a query face image against all the template images in the database to determine the identity of the query face [7]. The first automatic face recognition system was developed by Kanade, so the performance of face recognition systems has improved significantly.

A video-based face recognition system usually consists of three modules: one for detecting the face; a second one for tracking it; and a third one for recognizing it [5]. Most of these systems choose a few high-quality frames and then relate one of the recognition techniques for intensity images to those frames in order to identify the individual. A few of these approaches are briefly described below. Given the numerous theories and techniques that are appropriate to face recognition from video, it is clear that evaluations and benchmarking of these algorithm is crucial. We discuss related issues such as data collection, performance metrics and evaluations of system and techniques .Finally, brief summary and conclusion are given.

Most of the algorithms demonstrate promising research while dealing with still facial images, which include Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), and so on. Compared with still images, video can provide more information, such as spatio-temporal information [4]. Therefore, video-based face recognition gained more attention recently. This paper surveys video-based face recognition which is on the scene for many years In the very beginning, most of the methods were based on the still-to-still techniques which aimed at selecting good frame and did some relative processing. In recent times researchers began to truly solve such problem by spatio-temporal representations Most of the existing systems address video-based face recognition problems as follows: First, detect face and track it over time. Sometimes

selecting good frames which contain frontal faces or valued cues is necessary. Next, when a frame satisfying certain criteria (size, pose, illumination and etc.) is acquired.

II. LITERATURE REVIEW

The video based face recognition methods make use of multi-frame information to improve the accuracy of face recognition, and improve the robustness to deal with pose variations, occlusions and illumination changes. In this method both the system input and the database are in the form of videos, which is a more difficult problem to solve. So using video-video face recognition there are mainly three types of solutions of this problem, which are listed as follows:

1. Based on feature vector extracted from video input.
2. Based on probability density function or manifold to depict the distribution of faces in videos.
3. Based on generative models to describe dynamic variance of face in images.

Many techniques have been proposed in the past few decades for video based face recognition. A survey on Dictionary-based Face Recognition from Video by Chen et.al proposed the generative approach based on dictionary learning methods, which is robust to changes in illumination and pose. One major advantage of this method is that it is robust to some variations in video sequences [6]. In this dictionary based face recognition cropped face images is extracted from a video sequence, then partition the video sequence so that frames with same pose and illumination are in one partition. This step removes the temporal redundancy while capturing variations due to changes in pose and illumination .For each partition, a sub-dictionary is learned where the representation error is minimized under a sparseness constraint. These partition-specific sub-dictionaries are combined to form a sequence-specific dictionary. To illustrate the effectiveness of this approach and to evaluate the performance, experimental results on three publicly available datasets for video-based face recognition is done i.e. the Multiple Biometric Grand Challenge (MBGC), the Face and Ocular Challenge Series (FOCS) and the Honda/UCSD datasets.

While face recognition is a well-studied problem and several algorithms have been proposed, a majority of the literature is on matching still images and face recognition from videos is relatively less explored. Videos provide several cues in the form of multiple frames and temporal information as compared to still images. These cues can be used for improving the performance of face recognition and provide robustness to large variations in facial pose, expression, and lighting conditions.

The survey on video based face recognition by Bhatt et al. [1] proposed to compute a video signature as an ordered list of still face images from a dictionary using rank aggregation. In their approach, temporal and wide intra-personal variations from multiple frames were combined using Markov chain based rank aggregation approach and to improve this recently, the research focus has shifted and advancements in face recognition have led to a new paradigm of matching face images using a large dictionary which help to recognize faces in videos through an effective technique of face recognition from video through parallel frame processing which is intended to use in information forensics and security applications.

Recent studies in face recognition have shown that generating image signatures based on a dictionary is more efficient for matching images. Yi-Chen et al. [6] present the details of dictionary-based video face recognition algorithm. In this paper it describes how the video sequence is partitioned into sub-sequences in section, and how it builds sequence-specific dictionaries. For each frame in a video sequence, it first detects and crops the face regions. It then partition all the cropped face images into K- different partitions. Then partition the cropped faces by a k-means clustering type of algorithm that is inspired by a video summarization algorithm

In recent years, the theories of sparse representation and dictionary learning have emerged as powerful tools for efficiently processing of image and video data in non-traditional ways. Chen et al. [3] propose a novel multivariate sparse representation method for video-to-video face recognition. Our method simultaneously takes into account correlations as well as coupling information among the video frames. This method jointly represents all the video data by a sparse linear combination of training data.

The challenges of large pose variations as well as robustness to illumination and expression changes have been confronted in previous works. Schroff et al. [8] presents an approach which is based on using Doppelg¨anger lists as face signatures in which , given a pair of probes, it compute the look-alike ranked list for each probe from the Library. Then, the similarity between the probes is determined by the similarity between these two lists. This approach stems from the observation that ranked Doppelg¨anger lists are similar for similar people.

Cui et.al. [2] presents a new approach for fusing robust face region descriptors via multiple metric learning for face recognition in the wild to extract robust face region descriptors. In this approach, we divide each image (resp.video) into several spatial blocks (resp. spatial-temporal volumes) and then represent each block (resp. volume) by sum-pooling the nonnegative sparse codes of position-free patches sampled within the block (resp. volume) to effectively integrate the face region descriptors of all blocks.

III.COMPARATIVE ANALYSIS

In this section we are going to compare some of the techniques of face recognition in video.

A. Paper Name: - Pose, Illumination and Expression Invariant Pairwise Face-Similarity Measure via Doppelganger List Comparison.

- Method :- Ranked Doppelganger lists ,to show face- similarity measures
- Advantage: - This method does not require explicit training and is able to cope with large pose ranges.
- Disadvantage: - This does not use ranked list for making comparisons of frames.

B. Paper Name: - Dictionary based face recognition from video [6].

- Method: - K means clustering.
- Advantage: - A video sequence was first partitioned into sub-sequences and then sequence-specific dictionaries were learned.
- Disadvantage: - Their approach has a computational overhead of creating multiple sequence-specific dictionaries for specific pose and illumination variations.

C. Paper Name: - Fusing Robust Face Region Descriptors via Multiple Metric Learning for Face Recognition in the Wild [2].

- Method: - Bag-of-feature to extract robust face region descriptors.
- Advantage: - This method exclusively handles the alignment problem.
- Disadvantage: - Not an effective approach because real time face videos are of low quality images.

D. Paper Name: - Video-based Face Recognition via Joint Sparse Representation [3].

- Method :- Minimum class reconstruction error criteria
- Advantage: - Simultaneously takes correlation as well as coupling information between frames.
- Disadvantage: - The execution time for processing frame was more.

E. Paper Name: - On Recognizing faces using clustering-based re-ranking and fusion [1].

- Method: - discounted cumulative gain measure .
- Advantage: - it assimilates this information as a ranked list of still face images from a large dictionary.
- Disadvantage: - execution time is more because of serial processing of frames.

IV. CONCLUSION

Recent brisk progress of communication technology and computer science has made video-based face recognition to play a essential role in human-machine interface and advanced communication. This survey paper best describes a survey of video-based face recognition techniques which is used for identification of faces. Still-to-Still, Video-to-Still based methods only exploit fewer and physiological information of the face but in Video based face recognition technique has more and plentiful information. In future video-based face recognition has wide scope and therefore it has to be adopted in real application.

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