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ANALYSIS ON FACE RECOGNITION SYSTEM AND ITS ISSUES

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ABSTRACT: Face recognition has recently received a blooming attention and interest from the scientific community as well as from the general public. The interest from the general public is mostly due to the recent events of terror around the world, which has increased the demand for useful security systems. Facial recognition applications are far from limited to security systems as described above. To construct these different applications, precise and robust automated facial recognition methods and techniques are needed. However, these techniques and methods are currently not available or only available in highly complex, expensive setups. In this paper is help to solving the difficult task of robust face recognition in a simple setup. Such a solution would be of great scientific importance and would be useful to the public in general.

Keywords: [Face Recognition, Issues, Verification, Identification, Expressions, Effects.]

1. INTRODUCTION

Detection In realistic conditions, faces of people are mixed with other faces as well as with other objects in camera images. For a face recognition application to function automatically, faces should be detected and localized first to be useful for the recognition application. Face detection (Yang et al., 2002), a special case of object detection, uses a search algorithm whose goal is finding the location of a face in an image. To do this, several samples (sub-images) are cropped from the source image and analyzed by a binary classifier that decides whether an image patch contains a face. After this, the sub-images which contain a face will be returned as detected faces. A very well-known state-of-the-art face detector has been developed by Viola and Jones (2004), which uses AdaBoost as a machine learning method combined with Haar features. In this dissertation, we have used this face detector as well to obtain face images. Localization The location found by the face detector can be used for face tracking as well as for face recognition purposes, both of which require a different level of accuracy. For face recognition, the location is used to align the face. This location, if accurate enough, can be used to translationally align the face. However, if the face detector is not very robust and accurate then extra facial landmark information such as the center of a face is necessary. Besides, as will be seen in the next section, to align a face brotationally usually a single location parameter is not enough.

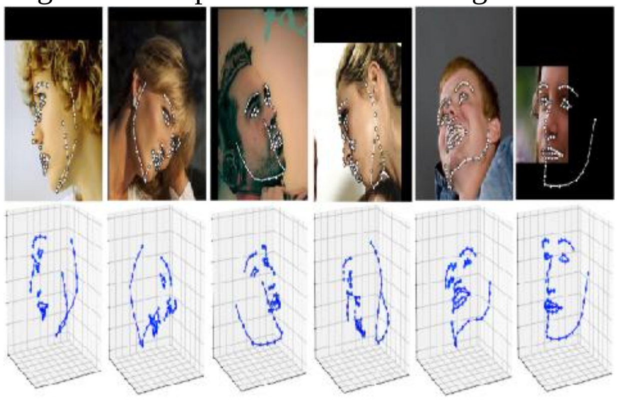

Figure 1: Different Alignments of face

Alignment Basically 2 main types of alignment can be defined: 2D and 3D alignment. In 2D face alignment, the main idea is capturing some important facial parts which can be used to compute the face position and rotation angle by means of landmark information. In one approach, called active shape models (ASM), many fiducial points are labeled and used to model a shape being composed of points. In an updated version of this approach, called active appearance models (AAM), intensities of pixel values are also used to obtain better accuracies. The main difficulty in these methods is however the labeling effort. In another approach, fiducial features of faces are modeled as local features. To extract these points, for instance, the scale invariant feature transform (SIFT) is used. After these points are acquired from the training images, they are compared against points of a test input image which are also extracted by the SIFT method.

In a third approach, a few important landmarks such as the centers of eyes and mouth can be used to estimate the positional and rotational offsets of the face i mage. For instance Hasan and Pal use Haar-like features and the AdaBoost algorithm for detecting the eyes and mouth. As Haar features are weak features, the candidate fiducial points are filtered and the best one is selected by a heuristic rule. In eyes are detected by histograms of oriented gradients (HOG) and local binary patterns (LBP) feature descriptors respectively. In 3D face alignment, not only the appearance of a face is to be aligned but also the head pose. For instance, a profile or a half profile face cannot be geometrically aligned with a 2D alignment technique which is not able to reach the depth information. In one approach, similar to ASM and AAM for 3D, landmarks containing 3D information are used for alignment. In such a work 3D data are integrated with the 2D AAM algorithm which is named as Combined 2D+3D. According to their paper, 6 times more parameters needed to model a face for AAM are required to model a 3D AAM, but at the profit of a faster convergence. In a coarse to fine 3d model fitting approach for face identification is presented. According to this, a 3D face model is roughly adjusted to the automatically segmented 3D face scan by single or multiple face components. Using multiple face components is reported to result in better accuracy for the final face identification algorithm. In a similar but a more recent paper, ASM for 3D alignment is integrated with speeded-up robust features (SURF) for texture modeling. In another recent face alignment and verification method, a generic morphable 3D face and a 3D affine camera model are used to warp the 2D appearances into the 3D space. This makes it possible to create unseen views of a face artificially.

2. LITERATURE SURVEY

JoernWuebker, Spence Green, John DeNero, SašaHasan, Minh-ThangLuong proposed COPRE framework(Constraint Based Prefix) is developed based on three metrics below that score translations by the characteristics that are most relevant in an interactive setting: the accuracy of the first words of the suffix and the overall quality of the suffix. Each metric takes example triples (f, ep, e∗) produced during an interactive MT session in which ep was generated in the process of constructing e ∗ . A simulated corpus of examples can be produced from a parallel corpus of (f, e∗) pairs by selecting prefixes of each e ∗ . An exhaustive simulation selects all possible prefixes, while a sampled simulation selects only k prefixes uniformly at random for each e ∗ . Computing metrics for exhaustive simulations is expensive because it requires performing suffix prediction inference for every prefix: |e ∗ | times for each reference. phrase-based and neural translation approaches can be used to complete partial translations. The recurrent neural system provides higher word prediction accuracy, but requires lengthy inference on a GPU. The phrase-based system is fast, produces diverse n-best lists, and provides reasonable prefix-Bleu performance. The complementary strengths of both systems suggest future work in combining these techniques.

Alessandro Dal Pal`u, Agostino Dovier proposed COPRE framework (Constraint Based Prefix) is developed based on fast and inexpensive methods, it is possible to retrieve accurate information about a DNA sequence, its methylation (used for epigenetic studies), his tones modifications, and gene and protein expression. The process can be repeatedly applied to the same sample over years, for instance, before and after a set of pharmacological therapies. The evolution of an organism and/or a specific sample of cells at genomic scale can be tracked when observing such biological properties. The cancer cells include features such as fast changing genome and cross combination of different off springs of tumoral cells. Work-in-progress research, we briefly discussed the initial modeling of the evolutionary haplo type inference problem; the problem is tied to investigation of genome evolution in cancer (e.g., as result of pharmacological interventions). The problem is combinatorial in nature, and suitable for modeling and analysis using logic programming techniques.

WenshengGan, Jerry Chun-Wei Lin, Philippe Fournier-Viger , Han-Chieh Chao, Senior Member, IEEE and Philip S. Yu, Fellow, IEEEGarg, proposed Fuzzy Sequential Pattern Summarization is developed based on various kinds of patterns from various types of databases. At the same time, in recent decades, data mining has been studied extensively and applied widely .These techniques perform well on small datasets, however, due to the limited memory capacity and computation capability of a single node, these data mining methods become inefficient over big data. The memory requirements for handling the complete set of desired results increase quickly, and the computational cost can be expensive on a single machine. All aforementioned methods are serialized. When handling large-scale data, these methods are fundamentally inappropriate due to many reasons, including the huge amounts of data, infeasibility of bandwidth limitation, as well as the fact that larger inputs demands parallel processing, and privacy concerns. The main contributions are that we investigate recent advances in parallel sequential pattern mining and provide the status of the field in detail, including sequential pattern mining (SPM), parallel frequent itemset mining (PFIM), and parallel sequential pattern mining (PSMP). Both basic algorithms and advanced algorithms for parallel sequential pattern mining are reviewed in several categories, the key ideas, advantages and disadvantages of each approach are also pointed out in details. We further provide some related open-source software of PSPM, that may reduce barriers from research and algorithm implementation. Finally, we briefly point out some challenges and opportunities of parallel sequential pattern mining for future research.

Vinay Kumar Khare,VedantRastogi, proposed Fuzzy Sequential Pattern Summarization is developed based on Mining Positive & Negative Sequential pattern from databases is useful for knowledge discovery. The patterns were mined only from the Existing transaction database. New upcoming transactions databases cannot be merged into existing transaction database. So every time new transactions database is mined separately.

In this approach we can easily update existing transaction database with the appended transaction database. The Merged transaction database (updated database) will be mined to get the Positive & Negative Sequential patterns. Merging of Existing and Appended database is performed by using the updated compact pattern tree approach. Proposed model is Mining Positive and Negative Sequential patterns in incremental transaction Databases. To mine Positive and Negative Sequential patterns in incremental transaction database in this Approach we can update, existing transaction database with appended transaction database by the use of Updated Compact pattern tree approach then according to their support the new updated transaction database table is maintained and we can mine positive and negative sequential patterns with the help of CPNFSP algorithms proposed by Weimin Quyang and Qinhua Huang.

GowthamAtluri , AnujKarpatne , Vipin Kumar, proposed Fuzzy Sequential Pattern Summarization is developed based on a data mining algorithm operates upon is called a data instance. In classical data mining settings, a data instance is unambiguously represented as a set of observed features with optional supervised labels. However, in the context of ST data, there are multiple ways of defining instances for a given data type, each resulting in a different STDM formulation. In this section, we review five common categories of ST instances that one encounters in STDM problems, namely, points, trajectories, time series, spatial maps, and ST rasters. A basic approach for representing ST rasters is using N-way arrays also called as tensors. In a tensor representation of an ST raster data, some dimensions are used to represent the set of locations while the remaining dimension is used to represent the set of time stamps available in the ST grid. For example, precipitation data is represented as a 3-dimensional array where the first two dimensions capture 2D space and the third dimension captures time. Similarly, fMRI data is represented as a 4-dimensional array where the first three dimensions capture 3D space and the third dimension captures time. A tensor representation of an ST raster data can then be summarized using space-time subspaces that have similar values, which are the equivalent of image segmentation in ST domains.

Fredrik Robertsen, proposed Progres Lattice Miner(PLM) is developed based on the lattice Boltzmann method is a method for computationally simulating fluid dynamics. It has been used for simulations of fluid phenomena at many scales, from microscopic porous media flows , to blood flows in vascular systems and large even aerodynamics dimulations . It can be used for both single and multicomponent fluid simulations, and allows even more complex phenomena with particle suspensions and liquid crystals to be simulated . The method is well suited for parallel computation and has been demonstrated to work well on distributed clusters utilizing regular commodity CPUs , as well as on more specialized hardware with GPUs . The lattice Boltzmann method works by discretizing the entire simulation domain with a regular lattice, with the kinetic model equation for the fluid approximated only at the lattice sites. Within each lattice site, particle velocity space is further discretized into a finite set of velocities. This is referred to as a D2Q9 discrete velocity set [60], all except the center one of these points to a neighboring lattice site. The lattice Boltzmann method and how it behaves on current accelerated supercomputer systems. We have shown the benefit of using computational accelerators and that they offer great performance for running LB solvers. While the solver is not relying on the computational performance of GPUs and manycore accelerators, they do provide significantly higher memory bandwidths than regular CPU systems. With the performance of the LB method being highly reliant on the memory bandwidth of a system, accelerators provide an excellent platform for high speed LB solvers.

3. FACE RECOGNITION (VERIFICATION & IDENTIFICATION)

After the detection, localization and alignment steps are finished, the face image is ready for a face recognition algorithm. There are two kinds of recognition problems: face verification and face identification. While in the former, the goal is to find whether two input faces belong to the same person, in the latter given an input face image the purpose is assigning the correct identity. After the first working face recognition system was developed by Turkand Pentland , who employed the eigen faces approach, a lot of research has been carried out to handle this task. There are many different approaches and methods in the field. In the following paragraphs, some ofthe most recent approaches are briefly explained. Usually aligning of faces is a preprocessing step which should be done before the recognition phase. In the aligning process sometimes some information, which could also possess some identity information, is removed due to the nature of the process. To address this problem in, an identity based alignment method, also called Tom vs Pete classifier, is proposed. In their algorithm, aligning is done pair wise(for 2 faces) by taking into account the identity information, so that only the redundant information is kept during the alignment which results in a better accuracy.

In recent years, algorithms that utilize multi-layered neural network architectures named deep learning are beginning to become state-of-the-art for face verification. These algorithms use many layers of feature detectors which work hierarchically to obtain general features and remove the noise existing in high-dimensional image data. Deep belief networks (DBN) and especially convolution neural networks (CNN) are attracting a lot of attention from the researchers. In multiple CNNs are trained for face identification by employing more than 10K subjects to make general face representations which are to be used for face verification. In this work they even do not use a special aligner in order to test the performance of their method in a more challenging condition. In faces are first aligned using 6 fiducial points in 2D and then frontalized using a 3D warping technique which makes use of 67 fiducial points to localize. They use a deep neural network which is composed of more than 120 million parameters without weight sharing properties.

Boltzmann machines are used to disentangle factors of variations such as pose, identity and/or expression. This framework is applied to expression, digit recognition as well as face verification efficiently (30% performance boost is reported for face verification). In, inspired by the primate brain, which is considered to model view and identity separately, a deep multi-view perceptron is proposed for face recognition. It contains 6 main layers of identity neurons and 3 layers of view layers. The proposed model is also able to create unseen views. In an industrial paper a naive version of CNN for face verification is built and trained. In this work, according to their result the human face verification performance is surpassed with 99.5% accuracy. Although deep learning algorithms are now seen as state-of-the-art solutions to many face recognition problems, prerequisites to train a deep network are powerful computers and a large amount of training data (which should also be in high resolution) and also a long training time is not uncommon.

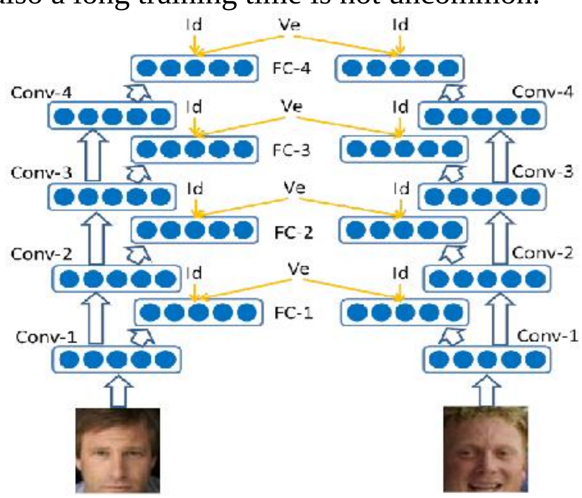

Figure 2: Face verification & Identification

Usually high-dimensional data are said to contain noise which can harm the discrimination power of a classifier. However, a high-dimensional data vector is not always harmful as showned. Here, a very high dimensional feature vector creation method based on LBP features is presented. The size of the vector is 100K that proves high dimensionality helps to improve performance of face recognition algorithms significantly. Here, a joint Bayesian approach is used as a classifier which is said to obtain the best results according to the paper. In a Gaussian process and a multi-source based learning algorithm is applied to the face verification problem for the labeled faces in the Wild (LFW) dataset. According to their results, human performance is surpassed for the first time. That is a very remarkable result since the human face recognition ability is known to be always better than machines for decades. Generally full face images are required to feed into a face recognition algorithm. However, in face parts instead of full face images are used as data. These face patches are processed by Gabor ternary patterns (GTP) and SIFT to create feature vectors. These vectors are used to create a dictionary which becomes an input for a face recognition algorithm employing a sparse coding scheme. In a simple generative Bayesian transfer learning method is developed for face verification which shows promising results. In transfer learning, the idea is using a source dataset (source-domain, usually large in number)in combination with a target dataset (target-domain, usually limited in number) to improve the performance of a classifier. Similar to, a very high dimensional LBP filter is used as the feature vector and the Joint Bayesian method is used as the classifier.

4. ISSUES IN FACE RECOGNITION PROCESS

Intrinsic factors are due to the human nature and are responsible for both, the differences in the facial appearance of the same person (intra subject factors) and the variation in the facial appearance of different subjects (inter subject factors). Some examples of intra subject factors are growing and being age, degenerative diseases, facial expressions, blocked effects and facial look (glasses, cosmetics, hairstyle and facial hair, tattoos, piercings…etc, which also produce occlusions in major cases), whereas sex, race and identity are clear examples of inter subject factors.

Extrinsic factors are directly related with the acquisition conditions (lighting conditions, distance and camera viewpoint, resolution and noise introduced by the image sensor, blur effects…etc) and also contribute to increase the differences in the facial appearance of the same person (intra subject factors). Most of these factors will be viewed in the following chapters paying special attention on the defocusing effect.

Facial Expressions Variations produced by this factor are due to the inherent dynamic nature of the faces and arise in daily life during interactions and conversations introducing distortions regarding the neutral expression.

Viewing Geometry(camera viewpoint) An image of a subject that is simultaneously viewed from frontal and profile points of view, revealing no any practical difference between both viewpoints. Unfortunately, this is a strong exception of the reality.

Blocked Effects Also known as occlusions refers to any usual or unusual objects (outside ones or of the own subject) that partially or fully blocks face image limiting face-at-a-glance scenarios. Accessories such as glasses and sunglasses as well as head wearing objects as hats, caps, scarfs or helmets and burkes as the most extreme ones, are the most usual objects that causes this effect.

Lighting Conditions Since the radiance sensed by a camera at a given face location is proportional to the product of face reflectance (also known as albedo as we will further see in the next Chapter) and incident light, the effect of such lighting on face images can leads to one of the strongest distortions in facial appearance.

CONCLUSION

Face Recognition in generally presents a summary of the history of face recognition. The different commercial face recognition systems, the general face recognition process and the different considerations regarding facial recognition. An assessment of the central tasks of face recognition identified which include face detection, preprocessing of facial images and feature extracting. Documents the design, development and testing of the Multiple Individual Discriminative Models face recognition algorithm. Furthermore, preliminary work in retrieval of depth information from one 2D image and a statistical shape model of 3D faces are presented. The main objective of the research is to discuss and summarize the process of facial recognition To look at currently available facial recognition techniques and to design and develop a robust facial recognition algorithm. The algorithm should be usable in a simple and easily adaptable setup

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