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A Survey on Face Recognition using Context-Aware Local Binary Feature Learning Method

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Abstract - *This paper propose a context-aware local binary feature learning (CA-LBFL) method for face recognition. Existing learning-based local face descriptors are discriminant face descriptor (DFD) and compact binary face descriptor (CBFD).this learn each feature code individually, Proposed CA-LBFL accomplished the contextual information of adjacent bits by constraining the number of shifts from different binary bits, so that more robust information can be exploited for face representation. Firstly, extract pixel difference vectors (PDV) in local patches, and learn a discriminative mapping in an unsupervised manner to project each pixel difference vector (PDV) into a context-aware binary vector. Then, perform clustering on the learned binary codes to construct a codebook, and extract a histogram feature for each face image with the learned codebook as the final representation. In order to exploit local information from different scales, we propose a context-aware local binary multi-scale feature learning (CA-LBMFL) method to jointly learn multiple projection matrices for face representation.*

Key Words Face recognition, binary feature learning, context-aware, multi-feature learning.

1. INTRODUCTION

A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video frame from a video source. There are multiple methods in which facial recognition systems work, also numerous face recognition methods have been proposed over the past three decades, they can be mainly classified into two categories: holistic feature representation and local feature representation. Most existing local feature descriptors are hand-crafted which usually require strong prior knowledge and are heuristics. While learning-based methods such as DFD and CBFD learn feature representations from raw pixels directly, they only learn each feature code individually and are more susceptible to noise. Contextual information is an effective manner to address the limitation of such unstableness because context provides strong prior knowledge, which enhances the robustness and stableness of various visual analysis tasks to improve the robustness of binary codes, a context aware local binary feature learning (CA-LBFL) method is proposed for face recognition.

A variety of face representation methods have been proposed in recent years and they can be mainly classified into two categories: holistic feature representation and local feature representation. Representative local features include local binary patterns (LBP) [7], Gabor descriptor [1], discriminant face descriptor (DFD) [8] and compact binary face descriptor (CBFD) [9].

Generally, local features achieve better performance than holistic features due to their stableness and robustness to local changes in feature description.

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2. LITERATURE SURVEY

Chengjun Liu and Harry Wechsler introduce a novel Gabor-Fisher Classifier (GFC) [2] for face recognition. The GFC method, which is robust to changes in illumination and facial expression, applies the Enhanced Fisher linear discriminant Model (EFM) to an augmented Gabor feature vector derived from the Gabor wavelet representation of face images.

Peter N. Belhumeur, Joao P. Hespanha, and David J. Kriegman develop a face recognition algorithm [4] which is insensitive to large variation in lighting direction and facial expression. Taking a pattern classification approach, considered each pixel in an image as a coordinate in a high-dimensional space. they take advantage of the observation that the images of a particular face, under varying illumination but fixed pose, lie in a 3D linear subspace of the high dimensional image space—if the face is a Lambertian surface without shadowing.

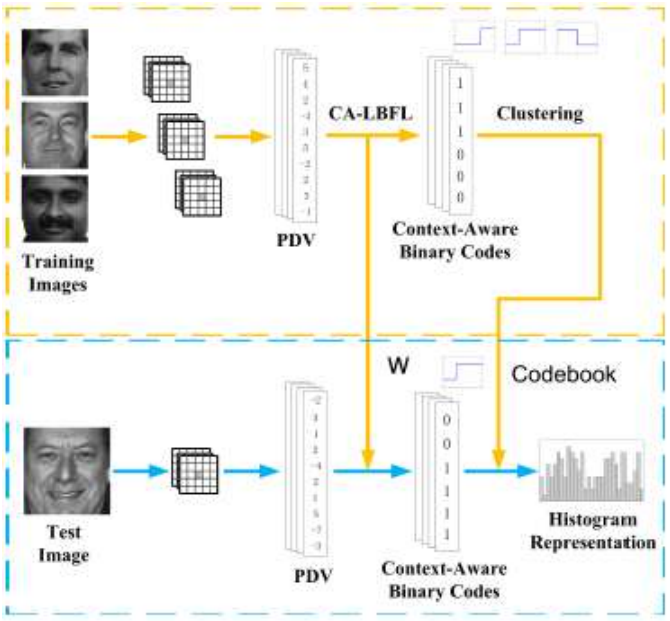
Wenchao Zhang1, Shiguang Shan2, Wen Gao1,2, Xilin Chen1,2, Hongming Zhang proposes a novel non-statistics based face representation approach, Local Gabor Binary Pattern Histogram Sequence (LGBPHS) [5], in which training procedure is unnecessary to construct the face model, so that the generalizability problem is naturally avoided. In this approach, a face image is modeled as a "histogram sequence" by concatenating the histograms of all the local regions of all the local Gabor magnitude binary pattern maps. For recognition, histogram intersection is used to measure the similarity of different LGBPHSes and the nearest neighborhood is exploited for final classification.

Zhen Lei, Dong Yi, and Stan Z. Li Proposed a Local Gradient Order Pattern for Face Representation and Recognition[6] This system propose a novel face descriptor, namely local gradient order pattern (LGOP), taking into account the ordinal relationship of gradient responses in local region to obtain robust face representation. After pattern encoding, a 2-D histogram is consequently adopted to calculate the occurrence frequency of different patterns and multi-scale histogram features are extracted to represent the face image. [7] Baochang Zhang, Shiguang Shan, Xilin Chen, Wen Gao Presents A Novel Object Representation Approach for Face Recognition a novel object descriptor, histogram of Gabor phase pattern (HGPP), is proposed for robust face recognition. In HGPP, the quadrant-bit codes are first extracted from faces based on the Gabor transformation. Global Gabor phase pattern (GGPP) and local Gabor phase pattern (LGPP) are then proposed to encode the phase variations. GGPP captures the variations derived from the orientation changing of Gabor wavelet at a given scale (frequency), while LGPP encodes the local neighborhood variations by using a novel local XOR pattern (LXP) operator. They are both divided into the nonoverlapping rectangular regions, from which spatial histograms are extracted and concatenated into an extended histogram feature to represent the original image. Finally, the recognition is performed by using the nearest-neighbor classifier with histogram intersection as the similarity measurement.

Timo Ahonen, Abdenour Hadid, and Matti Pietik¨ ainen, Face Description with Local Binary Patterns [8] Application to Face Recognition This system presents a novel and efficient facial image representation based on local binary pattern (LBP) texture features. The face image is divided into several regions from which the LBP feature distributions are extracted and concatenated into an enhanced feature vector to be used as a face descriptor.

3. ARCHITECTURE

Face Recognition system Begins with training a image. For each training image firstly pixel difference vector (PDV) is extracted. Then discriminative mapping to W is learned to project each pixel difference vector into context aware binary codes.



In this mapping adjacent bits are enforced as equal as possible to enhance the robustness of the descriptor. Then a code book is learned by clustering for feature encoding.
For each test image the pixel difference vectors are extracted and then projected into context aware binary code using the learned feature mapping. At last, a histogram feature descriptor is extracted from binary codes with the learned codebook.

4. APPLICATION

4.1 Prevent Retail Crime:

Face recognition is currently being used to instantly identify when known shoplifters, organized retail criminals or people with a history of fraud enter retail establishments. Photographs of individuals can be matched against large databases of criminals so that loss prevention and retail security professionals can be instantly notified when a shopper enters a store that prevents a threat. Face recognition systems are already radically reducing retail crime.

4.2 Unlock Phones

A variety of phones including the latest iPhone are now using face recognition to unlock phones. This technology is a powerful way to protect personal data and ensure that, if a phone is stolen, sensitive data remains inaccessible by the perpetrator.

4.3 Smarter Advertising

Face recognition has the ability to make advertising more targeted by making educated guesses at people's age and gender. Companies like Tesco are already planning on installing screens at gas stations with face recognition built in. It's only a matter of time before face-recognition becomes an Omni-present advertising technology.

4.4 Find Missing Persons

Face recognition can be used to find missing children and victims of human trafficking. As long as missing individuals are added to a database, law enforcement can become alerted as soon as they are recognized by face recognition—be it an airport, retail store or other public space. In fact, 3000 missing children were discovered in just four days using face recognition in India

4.5 Aid Forensic Investigations

Facial recognition can aid forensic investigations by automatically recognizing individuals in security footage or other videos. Face recognition software can also be used to identify dead or unconscious individuals at crime scenes.

4.6 Identify People on Social Media Platforms

Facebook uses face recognition technology to automatically recognize when Facebook members appear in photos. This makes it easier for people to find photos they are in and can suggest when particular people should be tagged in photos.

4.7 Diagnose Diseases

Face recognition can be used to diagnose diseases that cause detectable changes in appearance. As an example, the National Human Genome Institute Research Institute, uses face recognition to detect a rare disease called DiGeorge syndrome, in which there is a portion of the 22nd chromosome missing. Face recognition has helped diagnose the disease in 96 % of cases. As algorithms get even more sophisticated, face recognition will become an invaluable diagnostic tool for all sorts of conditions.

5. CONCLUSION

In this paper, a context-aware local binary feature learning (CA-LBFL) method for face recognition is proposed. In order to exploit more specific information from different scales, a context-aware local binary multi-scale feature learning (CA-LBMFL) method is presented. This methods achieve better or very competitive recognition performance on four widely used benchmark face databases compared with the state of-the-art face descriptors. As this methods are general feature learning methods, it is reasonable and interesting to apply them to other computer vision applications such as object recognition and visual tracking in the future.

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