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An Efficient Face Recognition Feature Using Learning Compact for Adaptive Matching and Authentication

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Abstract

Face recognition is the process of identifying one or more people in images or videos by analyzing and comparing patterns. Algorithms for face recognition typically extract facial features and compare the database to find the best match. Face recognition is an important part of many biometric, security, and surveillance systems, as well as image and video indexing systems. The improvements and indiscriminativepower comes from a computational cost and with a risk of over-fitting. This paper proposes a new approach to dense feature extraction for face recognition for Learning Compact Feature Descriptor and Adaptive Matching Framework. This approach consists of two steps. First, an encoding scheme is devised that compresses high-dimensional dense features into a compact representation by maximizing the intra user correlation. Second, we develop an adaptive feature matching algorithm for effective classification. This scheme effectively converts high-dimensional dense features into a much more compact representation. Furthermore, we propose a new face matching method called the 'Adaptive Matching Framework' and conduct experiments in four different face recognition scenarios such as face recognition in the wild, aging face recognition, and matching near-infrared face images and optical face images and the FERET test.

1. INTRODUCTION

Face recognition is the process of identifying one or more people in images or videos by analyzing and comparing patterns. Algorithms for face recognition typically extract facial features and compare them to a database to find the best match. Face recognition is an important part of many biometric, security, and surveillance systems, as well as image and video indexing systems. Face recognition leverages computer vision to extract discriminative information from facial images, and pattern recognition or machine learning techniques to model the appearance of faces and to classify them.

We can use computer vision techniques to perform feature extraction to encode the discriminative information required for face recognition as a compact feature vector using techniques and algorithms.

Dense local feature extraction with SURF, BRISK or FREAK descriptors.Histogram of oriented gradients. Distance between detected facial landmarks such as eyes, noses, and lips. Machine learning techniques can applied to the extracted features to perform face recognition or classification using Supervised learning techniques such as support vector machines (SVM) and decision trees, Ensemble learning methods, Deep neural networks.

Face recognition is a natural and straightforward biometric method used by us to identify oneanother. Face recognition is a recognition process that analyzes facial characteristics of a person. The recent interest in face recognition can be attributed to the use of latest techniques insecurity and surveillances and many other commercial interests. People look for more securemethods to protect their valuable information. Password authentication, card key authentication, and biometric authentication are the most commonly used authentication types.

Face detection is an essential tool for face recognition system. Face detection locates and segments face regions from cluttered images obtained from still images.

1.1 Domain

The domain of the project was proposed by the Image Processing and Security.Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a dimensional signal and applying standard signal-processing techniques to it.

1.2Review of Literature

1.2.1 Kernel Fusion of Multiple Histogram Descriptors for Robust Face recognition

The multi kernel fusion is based on the computationally efficient regression KDA. Still keeping the essential visual appearance information for the use in recognition any system using color may not be robust in the real environment and also has a heavy computational cost

1.2.2 Local Kernel Feature Analysis (KFA) for object recognition

A new local kernel feature analysis LKFA method. The FRGC version 2 is used to evaluate the performance of the face recognition systems for face verification. The LBP& Fisher method cannot effectively use the histogram measure, which may cause the decrease of the recognition performance.

Review on common feature discriminant analysis for matching infrared face images to optical face images

Matching method is applied to resulting features to obtain final decision. Combination of PCA and LDA is used for improving the ability of LDA when a few samples of images are offered.

Simultaneous feature and dictionary learning for image set based face recognition

A simultaneous feature and dictionary learning method for image set based face recognition. The majority voting strategy is used to classify the whole testing face image set.

Leaning discriminant face descriptor for face recognition

Three probe sets including expression lighting, accessory variations are used to evaluate different methods.

Key Features

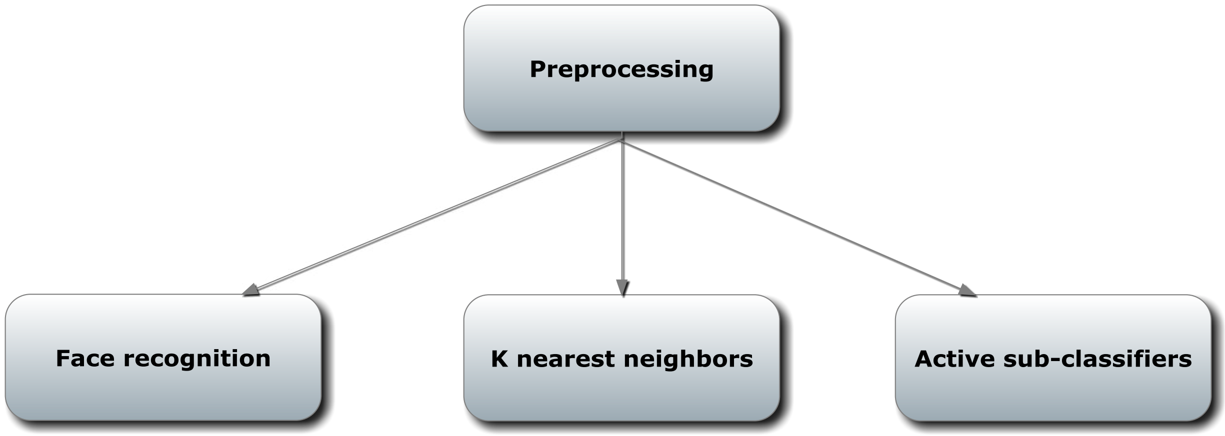
- High-level language for technical computing
- Development environment for managing code, files, and data
- Interactive tools for iterative exploration, design, and problem solving
- Mathematical functions for linear algebra, statistics, Fourier analysis

MODULE SPECIFICATION

- Preprocessing
- Feature Extraction
- Feature Encoding
- Classification
- Performance Analysis

Preprocessing:

Note that the parameters K and bwere determined by experimental validation using 30% of the training data. Specifically, we increased the value gradually and for each K value, we determined an optimal b value that achieved the highest verification accuracy on the validation data.



Feature extraction:

High-dimensional facial features can be extracted using both dense sampling landmarks and multi-scaletechniques.High-dimensional facial features contain much more information than low-dimensional ones, which is important for boosting recognition performance, but this benefit comes at the expense of computational complexity.

Feature encoding:

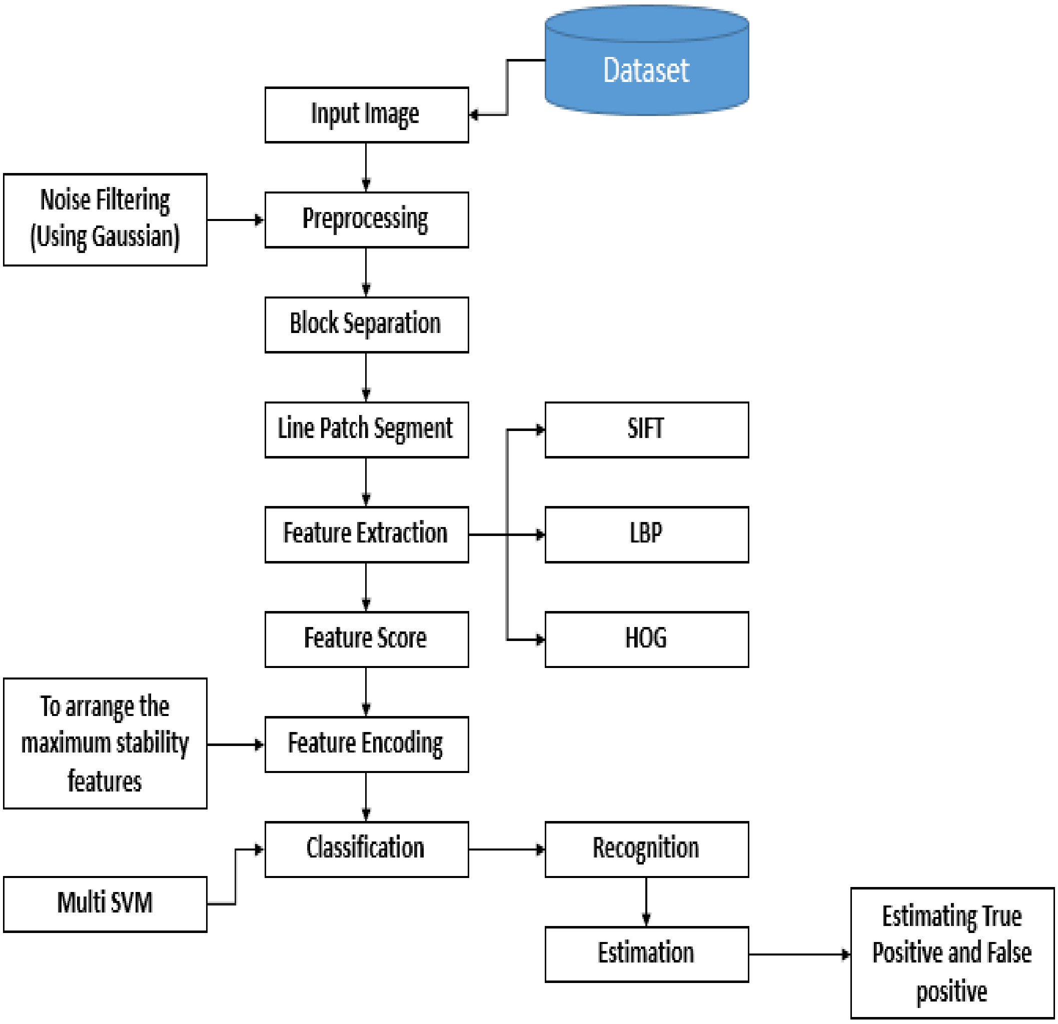
Face recognition is a complicated task that requires efficient handling of complex variations in facial appearance caused by a range of factors, such as changes in lightningconditions, expression, and aging effects.

Classification:

Our approach is based on the following two observations: 1) that difficult samples are better classified using a classification model trained from nearby samples; and 2) samples in the local region of anon linear structure are linear and can therefore be efficiently classified using existing linear classifiers, thereby avoiding the kernel space and its inherently high risk of over-fitting.

Performance analysis:

Our compact feature representation achieves superior performance and demonstrates the advantages of our compact feature descriptor. We then compared our adaptive matching framework with its non-adaptive version. Unlike the AdaptiveMatching framework, its non-adaptive version uses all the training samples to learn the subspace model for classification. Our adaptive matching framework consistently outperforms its on-adaptive version across the three datasets, demonstrating the effectiveness of the proposed adaptive scheme.



*** SOLUTION TECHNIQUES**

Techniques

- Histogram of oriented gradients
- Scale invariant feature transform
- Local binary pattern
- Support vector machine

Histogram of oriented gradients

The **histogram of oriented gradients (HOG)** is a feature descriptor used in computer vision and image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy.

Scale Invariant Feature Transform

Scale Invariant Feature Transform (SIFT) is an image descriptor for image-based matching and recognition developed by David Lowe (1999, 2004). This descriptor as well as related image descriptors is used for a large number of purposes in computer vision related to point matching between different views of a 3-D scene and view-based object recognition. The SIFT descriptor is invariant to translations, rotations and scaling transformations in the image domain and robust to moderate perspective transformations and illumination variations. Experimentally, the SIFT descriptor has been proven to be very useful in practice for image matching and object recognition under real-world conditions.

In its original formulation, the SIFT descriptor comprised a method for detecting interest points from a grey-level image at which statistics of local gradient directions of image intensities were accumulated to give a summarizing description of the local image structures in a local neighborhood around each interest point, with the intention that this descriptor should be used for matching corresponding interest points between different images.

Local Binary Pattern

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. Due to its discriminative power and computational simplicity, LBP texture operator has become a popular approach in various applications. It can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis. Perhaps the most important property of the LBP operator in real-world applications is its robustness to monotonic gray-scale changes caused, for example, by illumination variations. Another important property is its computational simplicity, which makes it possible to analyze images in challenging real-time settings.

A. Datasets The LFW Dataset [23]:The LFW database contains
13,233 images from 5,749 different subjects, with each face labeled with the name of the person pictured. The number of images for each subject varies from 1 to 530. All the images are collected from the Internet and have large intra-personal variability. In our experiments, we followed the imagerestricted protocol, with no outside training data used ***CUHK***.

* CONCLUSION AND FUTURE WORK

In this project, the system has proposed an effective method for face recognition. That is adaptive matching method. Its merits are two-fold: first, by combining locally linear sub-classifiers, this approach can account for nonlinear variations without resorting to kernel tricks, which are computationally expensive for large datasets, difficult to tune, and prone to over-fitting. And then by selecting a small subset of training samples for adaptive face matching, the system can improve accuracy, since samples falling in that vicinity usually better reflect the statistical characteristics of a given testing sample. The merits of the proposed new approach are: it is easy to implement; it significantly reduces the dimension of face feature representation, with resulting improved computational efficiency without sacrificing recognition performance, it achieves superior performance to current state-of-the-art methods across different face recognition scenarios; it is a general approach that can be easily incorporated into many existing methods to further boost performance. This approach has performed in matching faces in the wild, cross-age face recognition, near-infra red face recognition, and the standard face recognition task.

FUTURE WORK

- Color model transformation from the RGB model to YCbCr or HSV has been studied to locate the potential skin regions.
- To improve the accuracy of the process, we use the feature extraction algorithm which is named as adaptive histogram which is along with the YCbCr color transformation.
- Color model transform is needed because various lighting conditions have a larger effect on the pixel value in the RGB color model than the others.
- Map must be an M-by-3 array. YCbCr map is an M-by-3 matrix that contains the YCbCr luminance (Y) and chrominance (Cb and Cr) color values as columns.
- Each row in YCbCr map represents the equivalent color to the corresponding row in the RGB color-map, map.

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