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CPRE 583 Mini survey

Face Recognition Intrusion Detection Systems

Human's facial expressions play a significant role in communication. Face expresses many motions or positions of the muscles of the face. These movements convey the emotional state of the individual to observers. In recent years facial expression recognition has become an active research topic and it is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems.

Detection accuracy

For recognizing the face, some algorithms identify faces by extracting landmarks from an image and analyze the position, size, shape etc. These features can use to match other images in database. Other algorithms normalize a gallery of face images and compress the data only saving the useful data for face detection.

Discrete Wavelet Transform (DWT)

The Haar DWT illustrates the desirable properties of wavelets in general. First, it can be performed in O(n) operations; second, it captures not only a notion of the frequency content of the input, by examining it at different scales, but also temporal content, i.e. the times at which these frequencies occur. Combined, these two properties make the Fast wavelet transform (FWT) an alternative to the conventional Fast Fourier Transform (FFT).

Cerebellar Model Articulation Controller (CMAC)

The Cerebellar Model Articulation Controller (CMAC) is a type of neural network based on a model of the mammalian cerebellum. It is also known as the Cerebellar Model Arithmetic Computer. It is a type of associative memory.

Firstly, the facial expression features are automatically extracted and preprocessed to obtain the frontal view of faces. A 2D DWT IP is then used to decrease the size of images. Thirdly, a block size of the lower frequency of DWT coefficients is rearranged as input vectors with binary manner to send into the proposed CMAC IP that can rapidly obtain output using non-linear mapping with look-up table in training or recognizing phase. Finally, the experimental results demonstrated recognition rates with a block size of coefficient in lower frequency to recognize six expressions, including happiness, sadness, surprise, anger, disgust and natural to show promising recognition results.

Markovian stochastic mixture approach

In probability theory and statistics, a Markov process, named after the Russian mathematician Andrey Markov, is a time-varying random phenomenon for which a specific property (the Markov property) holds. In a common description, a stochastic process with the Markov property is one for which conditional on the present state of the system and its future and past are independent.

A Markovian stochastic mixture approach for combining bottom-up and top-down face recognition: face recognition is performed from the results of face alignment in a bottom-up way, and face alignment is performed based on the results of face recognition in a top-down way. By modeling the mixture face recognition as a stochastic process, the recognized person is decided probabilistically according to the probability distribution coming from the stochastic face recognition, and the recognition problem becomes that “who the most probable person is when the stochastic process of face recognition goes on for an infinite long duration”.

Face Detection Based on Half Face-template

The face detection method based on template matching chooses full face feature as the matched template, with which the burden of computing of face search is relatively large. However, most human faces are symmetry obviously. So we can choose half of the full face-template that is choosing the left half face or the right half face as the template of face matching which can reduce the burden of computing of face search.

The quality of template immediate influences the effect of matching detection. To reduce the chanciness of local density of the template, the template based on the information of average face is constructed, such as average eye template and average face template. This method is very easy. At the instance of the affine transformation of the template, the face detection efficiency will be very certifiable.

KLT tracking algorithm

The Kanade–Lucas–Tomasi (KLT) feature tracker is an approach to feature extraction. KLT algorithm has been widely used in the registration process for natural features tracking in augmented reality (AR) systems. However, KLT is vulnerable by surrounding environments, and the feature points on screen borderlines or once be occluded may not be tracked persistently.

The most important part of tracking natural features is detecting and tracking feature points from frame to frame [3]. KLT algorithm has become the most commonly used method in selecting and tracking feature points due to its high efficiency.

References

- Facial Expression Recognition Based on Field Programmable Gate Array, Jzau-Sheng Lin*, Shao-Han Liou*, Wu-Chih Hsieh*, Yu-Yi Liao*, HongChao Wang**, and QingHua Lan**, 2009 Fifth International Conference on Information Assurance and Security.
- Markovian Mixture Face Recognition with Discriminative Face Alignment, Ming Zhao, Tat-Seng Chua, Automatic Face & Gesture Recognition, 2008.
- Face Detection Based on Half Face-template, Wei Chen, Tongfeng Sun, Xiaodong Yang, Li Wang, The Ninth International Conference on Electronic Measurement & Instruments
- A Registration Method Based on Nature Feature with KLT Tracking Algorithm for Wearable Computers, Teng Fei, Liang Xiao-hui, He Zhi-ying, Hua Guo-liang, International Conference on Cyberworlds 2008