Face_detection_algorithm_documentation

There are many face detection algorithms to locate human face in a scene . The list of common techniques are discussed below :

- ***Finding faces in images with controlled background***

We use images with a plain monocular background , or use them with a predefined static background .We remove the background and it gives us the face boundaries.

Disadvantages : It needs a monocular background or a predefined background which is not feasible in real time.

- ***Finding faces by colour***

We access the colour images, we use the typical skin colour to find face segments and check the shape of the region .

Disadvantages : It does not work with all kind of skin colours . RGB components are subject to the lighting conditions and the process may fail under varying lighting conditions.

- ***Finding faces by motion***

We use real time video. The principle of this algorithm is a face is always moving in reality. Here we calculate the moving area and check the shape also. Human eyes are simultaneously blinking and this can also be used to normalize faces.

Disadvantages : If there are other objects moving in the background ,then it sometimes gives false face

- ***mixture of color and depth information***

It provides detection of faces in stereo camera data. The face detector employs the OpenCV face detector (based on a cascade of Haar-like features) to obtain an initial set of detections. It then prunes false positives using stereo depth information. The depth information is used to predict the real-world size of the

detected face ,which is then preserved as a true face detection only if the size is realistic for a human face. This removes the majority of false positives given by the OpenCV detector.

- ***Weak classifier cascades***

The breakthrough in face detection happened with "**Viola & Jones object detection framework"**.In the detection phase,a window of the target size is moved over the image , and for each subsection of the image the Haar-like feature is calculated. This difference is compared to a learned threshold that separates non-objects from the objects. A haar-like feature is only a weak learner or classifier .A large number of Haar-like features are necessary to describe an object with sufficient accuracy. In Viola-Jones object detection framework ,the Haar-like features are organized into classifier cascade to form a strong learner or classifier.

The key advantage of a Haar-like feature over other features is its calculation speed.Due to the use of integral images ,a haar-like feature of any size can be calculated in constant time.

60 microprocessor instructions for a 2-rectangle feature

It also uses machine learning techniques . After excessive training ,it yields accurate results . This approach is the commonly used algorithm for face detection. A basic implementation is included in OpenCV .

- ***LPB features for object detection***

LBP-based detectors are potentially several times faster than Haar-based detectors and don't have the licensing issues that many Haar detectors have.These cascade classifier detectors are typically trained using at least 1000 unique face images and 10,000 non-face images and the training process takes a long time typically a few hour for LBP but one week for Haar.

The basic idea of the LBP-based face detector is similar to the Haar-based one, but it uses histograms of pixel intensity comparisions, such as edges ,corners and flat regions

- ***AdaBoost Algorithm Using Haar Classifier***

In this architecture ,the scaling image technique is used instead of the scaling sub-window, and the integral contains whole image during one clock cycle. The haar classifier is designed using a pipelined scheme,and the triple classifier which three single classifiers processed in parallel is adopted to accelerate the processing speed of the face detection system

The proposed architecture is implemented on Modelsim Altera 6.3 and its performance is measured and compared with an hardware implementation .T here is 35 times increase in the system performance over the equivalent software implementation.

Conclusion :

Until year 2000,there were many different techniques used for finding faces, but all of them were very slow ,very unreliable ,or both . a major change came in 2001 when Viola and Jones invented the Haar-based cascade classifier for object detection, and in 2002 when it was improved by Leinhart and Maydt. Leinhart wrote object detector that comes free with OpenCV. It works not only for frontal faces but also side-view faces,eyes,mouths,noses,logos and many other objects.This object detector was extended in OpenCV v2.0 to also use LBP features. And LBP-based detectors are potentially several times faster than Haar-based detectors.

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