Face Detection

OpenCV uses a technique called Haar Cascades to detect objects. Haar Cascade is an object detection method that was proposed by Paul Viola and Michael Jones. This trains the machine on a series of positive and negative images to train it. This is then used to test for objects in other images.

To create an object detection, follow these steps:

To detect an object from an image:

1. Load image.
2. Grey-Scale image.
3. Equalise histogram.
4. Test against XML file which contains data machine has learned on.

As part of this project, the input was frames from a webcam and I had to test for several facial landmarks (eyes, nose, mouth and face).

The algorithm I used to detect these features are as follows:

1. Get frame from webcam.
2. Grey-scale and equalise histogram.
3. Detect for faces in image.
4. If there are faces.

Detect eyes in face region.

1. If there are no faces in image.

Check for eyes.

1. If there are eyes detected there must be a face.

If no results are still not found.

Rotate image 45 and -45 degrees and try again.

If no results, then there are no faces in the image.

The reason I rotate the image is due to haar cascade being rotation invariant. This means it will not detect a face if it is on extreme rotation from the cascade being tested against. Rotating the image means it should have a closer match and easier to find. When the image is rotated any landmarks that are detected must be translated back in the reversed rotation to ensure that it lines up with the image.

Jaw detection

After researching this area of the face not a lot of information seems to be available on how to capture jaw motion.

To improve time taken to calculate the bottom of the jaw we can narrow the area needed to be searched by finding the mouth. If the mouth and the eyes have been found, then with some simple maths to find the orientation we can find the region where the jawline should be.

Approach

The approach I have decided for detecting the jaw is by finding the chin. As the chin is normally aligned with the nose it should help provide enough information on finding jaw motion. Due to the chin being in a constrained area, the little difference from the centre should indicate the movement of the jaw.

Links

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2745713/>

<http://www.sbdmj.com/053/053-01.pdf>

<http://docs.opencv.org/2.4.13.2/doc/user_guide/ug_mat.html>

<http://stackoverflow.com/questions/7899108/opencv-get-pixel-channel-value-from-mat-image>

<http://docs.opencv.org/3.2.0/dc/d88/tutorial_traincascade.html>

<http://stackoverflow.com/questions/36259712/save-output-image-in-jpg-format-opencv>

<http://www.sciencedirect.com/science/article/pii/S188276160900009X>

http://docs.opencv.org/2.4/modules/core/doc/drawing\_functions.html