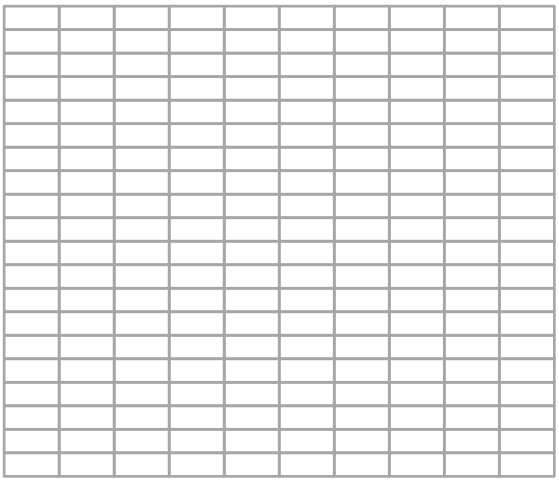
Imperial College London

COMP70058 Computer Vision

Tutorial 2 – Hough Transform and Fourier Methods

1. The following points appear in an edge map (differentiated image):
[0, 5.5], [1, 6], [2.5, 6.5], [3.5, 7], [4.5, 7.5], [6, 8], [7.5, 8.5], [9, 9], [11.9, 9.5], [14.3, 10]

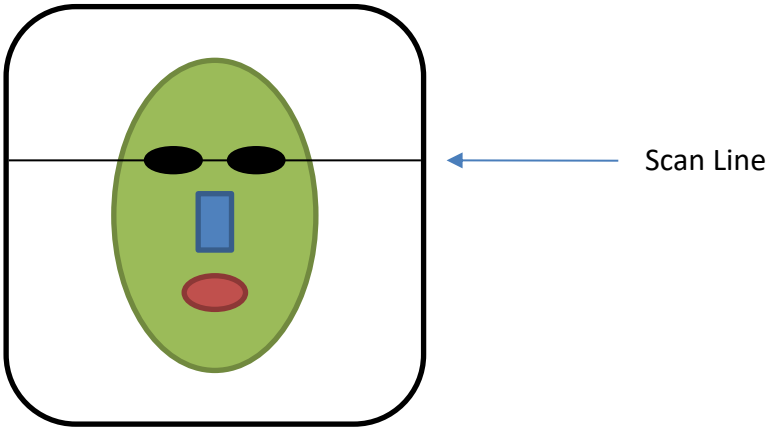
   Sketch the corresponding lines in m-c space, using the range [0..10] for c and [0..1] for m. You can use a figure similar to the one below to do this.



   Comment on the result and how best to estimate the line in image space to which the points belong.

2. Process the image below (or any image you want) directly in the frequency domain as follows:
   - Create a smoothed image
   - Detect edges

3. A face recognition system is based on taking the Fourier transform of individual scan lines of a face image as shown schematically in the diagram.

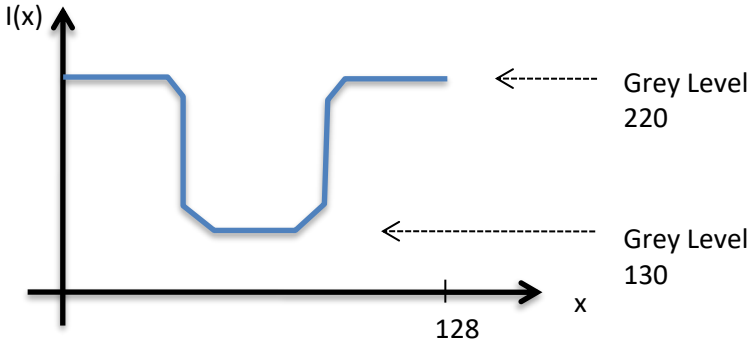


The transformation is from the intensities of the pixels along the scan line $l(x)$ to the coefficients of the harmonic components a_i and b_i given by the equation:

$$I(x) = a_0 + a_1 \cos(\alpha x) + b_1 \sin(\alpha x) + a_2 \cos(2\alpha x) + b_2 \sin(2\alpha x) + \cdots$$

a) Assuming that the image has a resolution of 128 by 128 pixels, calculate the value of α.

b) At a fairly featureless place in the face, the intensity profile along a scan line looks like this:



Estimate roughly the coefficients a_0, a_1 and b_1 in the transform of the line.