Computer Vision Exam

1. Problem (12 points)

Calculate the position and the orientation of the object in the image 1 using the elements of its border (denoted by stars in the image). Calculate the Fourier's coefficient a_2 for the same object while using the point P(x,y) = (1,4) as the starting point and traversing the object in the direction drawn in the image. Which characteristic object point is part of the line which represents the orientation of the object?

Atan2(y,x) function is defined as follows:

when $y \neq 0$:

$$\text{atan2}(y,x) = \begin{cases} \Theta \cdot \text{sgn}(y) \text{ if } x > 0 \\ \frac{\pi}{2} \cdot \text{sgn}(y) \text{ if } x = 0 \\ (\pi - \Theta) \cdot \text{sgn}(y) \text{ if } x < 0 \end{cases}$$

where Θ is an angle given by $\tan(\Theta) = \left|\frac{y}{x}\right|$.

when $y = 0$:

$$\text{atan2}(y,x) = \begin{cases} 0 \text{ if } x > 0 \\ \text{undefined if } x = 0 \\ \pi \text{ if } x < 0 \end{cases}$$

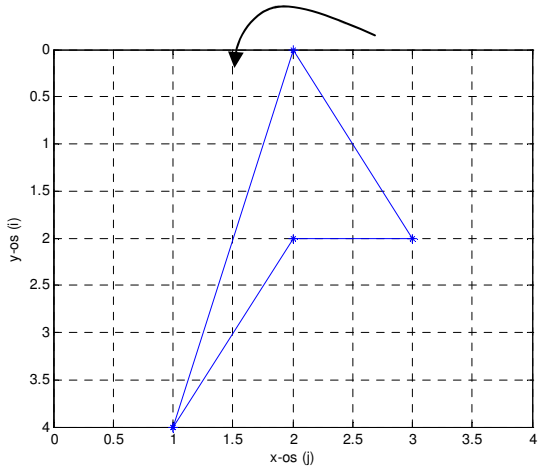

Image 1

2. Problem (6 points)

Draw the model of the perspective projection which results in a non-inverted image. Derive the equations of the perspective projection from the model.

3. Problem (8 points)

Describe the sequential component labeling algorithm.