Midterm Practice Questions

CPSC 425 2023

Question 7: [6 marks]

A rectange in the plane $Y = 1$ is defined by the points

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \\ a \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \\ a \end{bmatrix}$$

Compute the mapping of the points to the image plane under the projection equation

$$s \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}$$

Sketch the appearance of the projected rectange for $a = 2$. Describe what happens as $a \to \infty$.

Question 9: [8 marks]

Below are a 3×3 filter and a 6×6 image. Your task is to apply the filter to the image as a correlation.

Filter (3×3):

-1	0	1
-2	0	2
-1	0	1

Image (6×6):

0	0	0	1	1	1
0	0	0	1	1	1
0	0	0	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1

(a) [4 marks] Let the result of the correlation be a 4×4 image (defined only at locations where the filter fits entirely within the original image). Show your result here:

(b) [4 marks] What sort of structure does this filter detect? The filter can be written as a product of row and column filters. Write down these filters and give an interpretation for their action if individually applied.

Question 11: [6 marks]

(b) [4 marks] A location in an image has Harris matrix

$$\mathbf{H} = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$$

Is this likely to represent a corner? Explain why or why not. By computing eigenvalues or otherwise, deduce what kind of image structure is likely.