# Artificial Intelligence
## Exercises week 7- Computer Vision

Maryam Hashemi

COMP3411/9814

## Question 1: Histogram Equalization

Consider an image $\mathbf{X}$ with $N = 8$ pixels and $L = 4$ intensity levels (0 to 3). The intensity values and corresponding pixel counts are provided in the table below. Calculate the equalized histogram and show all of your calculations.

| Intensity Level $(i)$ | Pixel Count $(f(i))$ |
|:---:|:---:|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 2 |

## Question 2: Averaging

Consider the binary image with dimension $7 \times 16$ shown in Figure 1. Use the averaging method with a threshold $\epsilon = 3$ and a $3 \times 3$ sliding windows. Show the resulting image.

## Question 3: Convolution

A digital image $(I)$ is given to you as follows. We apply a convolution operation with a kernel presented as $K$ with **1 layer of zero padding**, stride equals to 2 for width and stride 1 for height, and max pooling with $2 \times 2$ filters. Finally, pass it through a flattening layer. Calculate the final output.
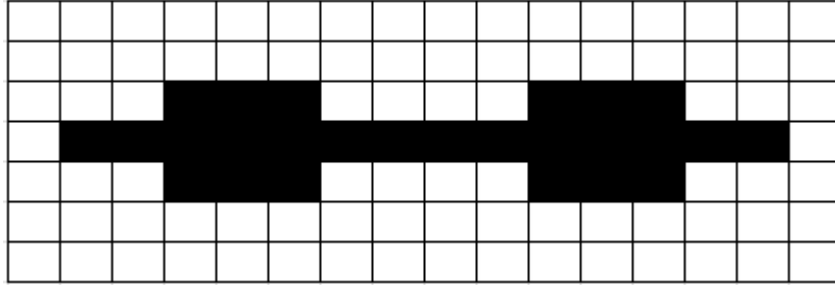
Figure 1: Original image.

$$I = \begin{pmatrix} 255 & 100 & 100 & 0 \\ 10 & 100 & 200 & 0 \\ 200 & 255 & 0 & 10 \\ 10 & 0 & 30 & 50 \end{pmatrix}$$

$$K = \begin{pmatrix} 0 & 2 & 0 \\ 2 & 10 & 2 \\ 0 & 2 & 0 \end{pmatrix}$$