Computação Visual Interactiva

Licenciatura em Engenharia Informática e de Computadores
Alameda

Segundo MiniTeste

18 de Maio de 2017

The test has 1h00 duration, tolerance included. **Answer the questions only in the space provided**. Identify the first sheet, and do not separate the sheets from the test! In the test there are blank pages for sketch properly identified. These will not be considered in the evaluation. During the examination, only the pen is allowed. It is also allowed the use of calculator (however not needed).

Identificação do Aluno	
Nome:	Número:

1. [6.5v] Consider the following monochromatic image (range from 0 to 255 of intensity pixels) with the corresponding matrix with its elements
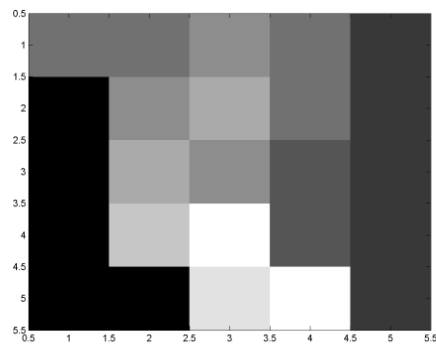
5	5	6	5	3
1	6	7	5	3
1	7	6	4	3
1	8	10	4	3
1	1	9	10	3

(a) Compute the histogram of the above image

**(b)** Consider the following histograms of the other two images

$$h_1 = \begin{bmatrix} 2 & 0 & 2 & 2 & 4 & 5 & 5 & 2 & 2 & 1 \end{bmatrix} \quad and \quad h_2 = \begin{bmatrix} 2 & 10 & 2 & 2 & 4 & 7 & 7 & 2 & 2 & 7 \end{bmatrix}$$

using the L1 metric (Manhattan distance or *city block*), given by the equation

$$d_{L1}(p,q) = \sum_{i=1}^{N} |p(i) - q(i)|,$$

determine which is the image more similar to the initial one. Present your calculations.

(c) Compute the histogram equalization at the pixel with intensity 6. (only the expression is needed!)
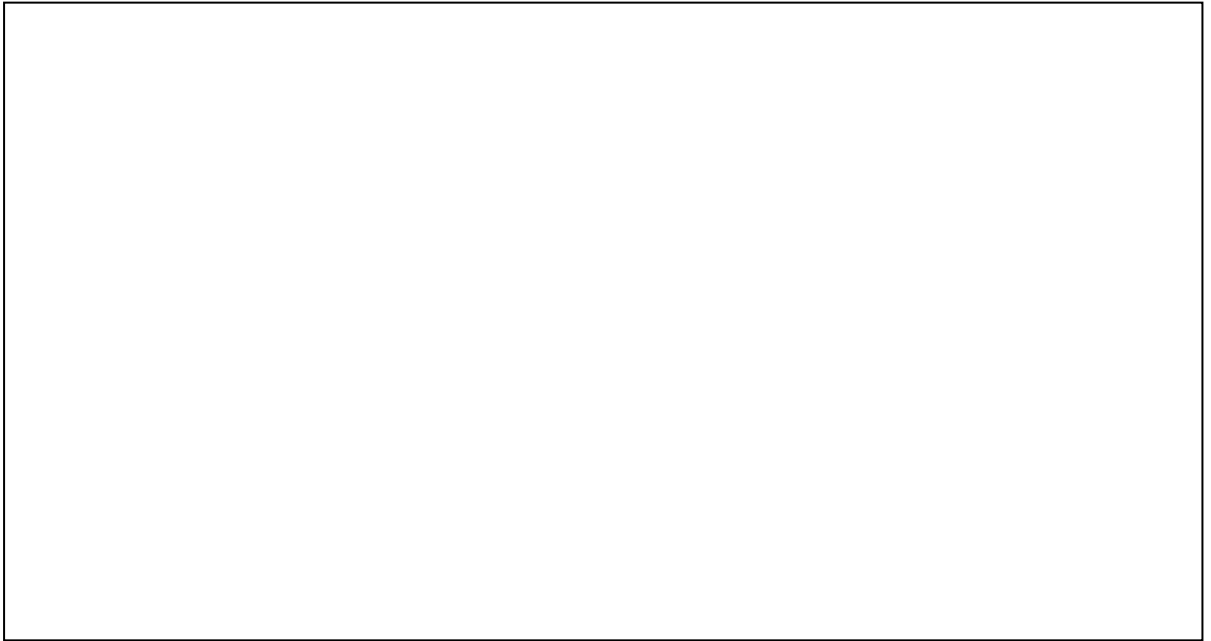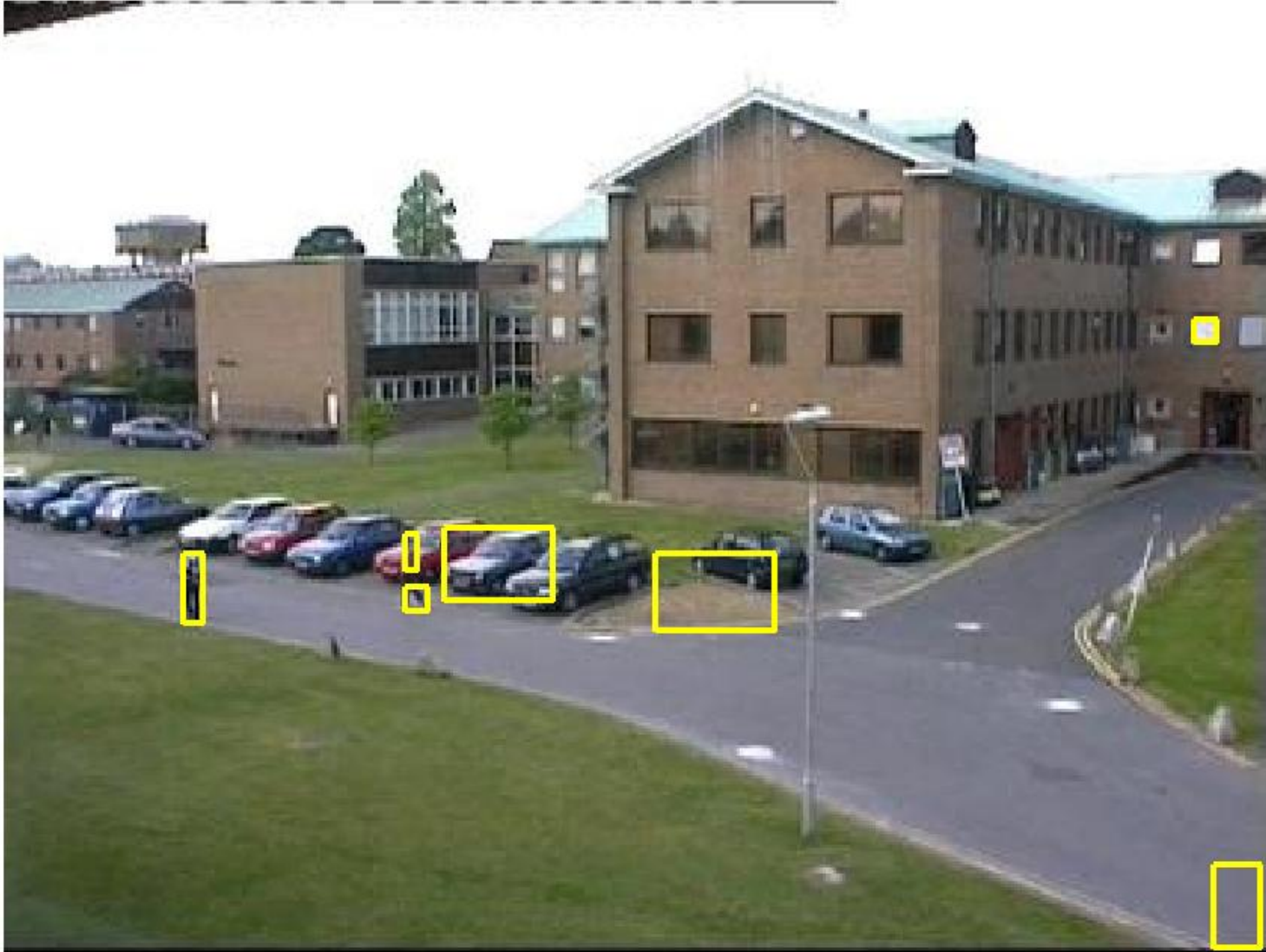
2. **[3v]** Consider the following image

After some processing, the algorithm provides the following region detections:

(a) What kind of events are presented in the above image **?**

_____   _____

_____   _____

_____   _____

b) What could be the reason for obtaining the empty rectangle (i.e. foreground region) between the cars ?

_____

_____

3. **[1.5v]** When computing the optical flow, some image derivatives should be taken into account. For instance computing the x-derivatives or y-derivatives. Write a 3x3 matrix capable of computing diagonal derivatives in a given image.

4. **[3v]** Let us consider the Canny algorithm.

(a) What are the main steps of this algorithm

1————————————————————

2————————————————————

3————————————————————

4————————————————————

(b) What is the most disadvantage of this algorithm ?

————————————————————————————————

5. **[3v]** When computing the Hough transform, we have to compute the angle and the distance from de column and row derivatives. Consider the following column and row matrix derivatives:

Column gradient

0	150	150	0	0
0	170	170	0	0
0	0	100	0	0
0	100	0	0	0
0	0	0	0	0

Row gradient

0	0	0	0	0
0	0	0	0	0
0	50	0	100	100
0	0	75	200	200
0	0	0	0	0

Compute the angle and the distance images from the above column and row gradients

Angle "Theta"

Distance "D"

6. **[3v]** Consider the following Quadtree:

M
    M   M   M   M
M E E F   E M E M   E E F E   F E E M
F E E F   E F E E   E E E F   E E E F
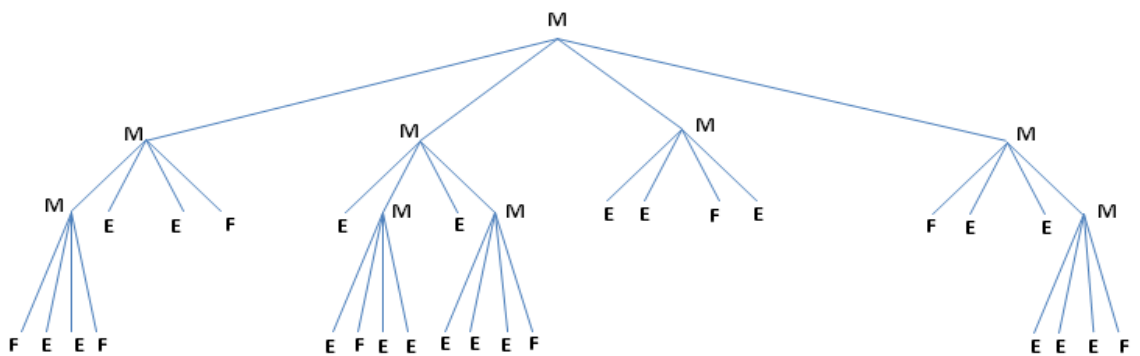
Draw the corresponding binary image of the above tree. (NOTICE: follow the rule top-left, top-right, bottom-left, bottom-right). In the above tree consider the following notation: M- Mix, F- Full, E- Empty.