A21572

No calculator permitted in this examination

UNIVERSITY OF BIRMINGHAM

School of Computer Science

Second Year – Degree of BSc with Honours
Artificial Intelligence and Computer Science
Computer Science

Third Year – Degree of BEng with Honours
Electronic Engineering with Year in Computer Science

Third Year – Degree of MSci with Honours
Physics with Astrophysics with Year in Computer Science
Mathematics with Year in Computer Science

Undergraduate Occasional
Computer Science/Software Engineering

Degree of MSc
Computer Science

06 19339

Computational Vision

Summer Examinations 2011

Time allowed: 1 ½ hours

[Answer ALL Questions]

Turn Over

No calculator

1. (a) Convolve the Image Raster with the Mask shown below. You will only need to find the output corresponding to the sixteen highlighted central elements of the original image raster. [16%]

Mask

0	1	0
1	-4	1
0	1	0

Image Raster

1	2	2	2	3	1
0	2	2	2	2	0
0	0	1	1	0	0
0	0	1	1	0	0
0	2	2	2	2	0
1	2	2	2	2	1

(b) What type of edge detector is the Mask in part (a) and why is it better at finding edges as compared to a Sobel or Roberts filter? [4%]

(c) In the presence of noise within an image, how does the edge detector in part (a) perform, and how can the effects of noise be minimized? [4%]

(d) Describe how the computational speed of applying a 2D Gaussian filter to an image raster can be improved. [6%]

2. (a) Discuss the evolution of Light Capturing Devices (photocells) to allow the progress of detection of light from 1D to 2D. [16%]

(b) Use schematics and diagrams to illustrate this evolution where appropriate. [5%]

(c) Describe the visual pathway in human vision. Give detail of each component and state how the received electromagnetic signal is processed or transmitted by each. [14%]

3. You are asked to design and implement a visual vehicle identification system by the University of Birmingham to allow easy access to its main campus car park. The system must be able to identify each individual car entering or leaving through an authorised access point and based on the vehicles registration number to associate the vehicle with registered users. You should describe the technique that you would apply together with the problems you believe you would encounter in such a system so that you can:

   (a) Gather the required information for processing. [5%]

   (b) Identify each individual vehicle. You need to outline the details of your chosen method that will make this possible. [20%]

   (c) Determine the drawbacks of the suggested technique, and explain how they can be minimised. [10%]