UNIVERSITY OF BIRMINGHAM

School of Computer Science

First Year - MSc in Computer Science
First Year – Undergraduate Affiliated Computer Science/Software Engineering
Second Year – BSc in Artificial Intelligence and Computer Science
Second Year – BSc Computer Science
Second Year – BSc Computer Science with Industrial Year
Third Year – BSc Physics with Year in Computer Science
Third Year – BSc Accounting and Finance with Year in Computer Science
Third Year – BSc Archaeology and Anthropology with Year in Computer Science
Third Year – BSc Psychology with Year in Computer Science
Third year – BSc Biochemistry with Year in Computer Science
Third Year – MSci Mathematics with Year in Computer Science
Third Year – BSc Economics with Year in Computer Science
Third Year – BSc Geography and Economics with Year in Computer Science
Third Year – BA Political Science & Philosophy with Year in Computer Science
Third Year – MSci Physics & Particle Physics Cosmology with Year in Computer Science

06 19339

Computational Vision

Summer Examinations 2013

Time allowed: 1 hr 30 min

[Answer ALL Questions]

[ANSWER ALL QUESTIONS]

1. (30 marks)

    (a) Convolve the Image Raster with the Mask shown below. You will need to find the output corresponding to the 25 highlighted elements of the original image raster. [25%]

Mask

0	-1	0
-1	4	-1
0	-1	0

Image Raster

1	4	5	4	1
4	16	20	16	4
5	20	25	20	5
4	16	20	16	4
1	4	5	4	1

    (b) Why are second derivative operators not frequently used in machine vision? Describe one way to overcome this problem. [5%]

2.   (35 Marks)

(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 details of each component and state how the received electromagnetic signal is processed or transmitted by each.   [14%]

3. (35 Marks)

    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 and minimize the drawbacks of the suggested technique.
                                                                                  [10%]