UNIVERSITY OF BIRMINGHAM

School of Computer Science

Second Year - BSc Artificial Intelligence and Computer Science
Second Year – BSc Computer Science
Second Year – MSci Computer Science
Second Year – MEng Computer Science/Software Engineering
Second Year – BSc Mathematics and Computer Science
Second Year – MSci Mathematics and Computer Science
Second Year – BSc Computer Science with Study Abroad
Second Year – BSc Computer Science with Business Management
Second Year – BSc Mathematics and Computer Science with Industrial Year
Second Year – MSci Mathematics and Computer Science with Industrial Year
Second Year – BSc Computer Science with Industrial Year
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Second Year – BSc Artificial Intelligence and Computer Science with Industrial Year
Second Year – BSc Computer Science with Business Management with Industrial Year
Second Year – MSci Computer Science with Industrial Year

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Computational Vision

Summer May/June Examinations 2016

Time allowed: 1 hour 30 minutes

[Answer ALL Questions]

No calculator

1. (a) 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%]

   (b) What are ON/OFF ganglion cells? Use a diagram if appropriate. [15%]

   (c) Describe the role of ON/OFF cells in the perceived enhancement of contrast in human vision. Use a diagram if appropriate. [6%]

2. (a) Filter the image raster shown below with the mask below. You need only to find an output matrix of size 3 by 4. [6%]

   Mask

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

   Image Raster

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

   (b) Outline the 4 main steps of the Canny Edge Detector. For each step, state clearly what computational operations need to be performed and how each step will optimize the edge detection [20%]

   (c) Describe one approach to filtering noise when performing edge detection. [4%]

3. A facial recognition system is a computer application capable of identifying or verifying a person from a digital image. One of the ways to do this is by comparing an image of a face with a database.

   (a) What are eigenfaces (also known as face bases)? [5%]

   (b) How are eigenfaces calculated? [10%]

   (c) How is each face stored/recognised using the calculated eigenfaces? [5%]

   (d) How can we ‘recognise’ a face? [5%]

   (e) What are the drawbacks of this technique and how can they be minimized? [10%]