A21572 *No calculator permitted in this examination*

UNIVERSITY OF BIRMINGHAM

School of Computer Science

Second Year – BSc Artificial Intelligence and Computer Science
First Year – UG Computer Science/Software Engineering
Second Year – BSc Computer Science
Second Year – MSci Computer Science
Second Year – BSc Computer Science with Industrial Year
Second Year – BSc Artificial Intelligence and Computer Science with Industrial Year
Second Year - MSci Computer Science with Industrial Year
MSc Robotics

06 19339

Computational Vision

Summer Examinations 2015

Time allowed: 1 hour 30 minutes

[Answer ALL Questions]

No calculator

[Answer ALL Questions]

1. (35 Marks Total)

(a) What are Photocells and where in the primate eye can they be found? [3%]

(b) Describe the role and behaviour of the following in the primate visual system:

(i) Rod Photoreceptors [6%]

(ii) Cone Photoreceptors [5%]

(c) What are Ganglion cells? Name two types of Ganglion cells. [6%]

(d) Within the primate vision, what is a 'receptive field'? What is the difference between the centre and periphery of the receptive field? [5%]

(e) Within the primate vision, how did the formation of the lens help maximise the spatial resolution and intensity of the captured vision? [10%]

2. (30 Marks Total)

(a) Filter the image raster shown below with the mask below. You need only to find an output matrix of size 4 by 5. [10%]

Mask

-1	1
-1	1

Image Raster

0	0	0	0	0	1
0	0	0	0	1	1
0	0	0	2	1	1
0	0	2	1	1	1
1	1	1	1	1	1

(b) In what direction does this mask detect intensity change? What does the sign of the output signal tell us? [5%]

(c) Describe one approach to filtering noise when performing edge detection. [9%]

(d) Consider the following operator:

1	0
0	-1

If this Roberts mask produces an estimate of the horizontal component of the gradient G_y and its transpose produces and estimate of the horizontal component of the gradient G_x then write down the formula for combining G_x and G_y so as to find the gradient in the direction of maximum change. [6%]

3. (35 Marks Total)

You are asked to design and implement a visual vehicle identification system by a superstore, which needs to track vehicle traffic to its 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 the arrival and departure time from the car park. 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 allow make this possible [20%]

(c) Determine and minimize the drawbacks of the suggested technique. [10%]