UNIVERSITY OF BIRMINGHAM

School of Computer Science

Third Year Undergraduate

06-30213

30213 LH Computer Vision and Imaging

Main Summer Examinations 2022

[Answer all questions]

30213 LH Computer Vision and Imaging

Answer ALL questions. The paper will be marked out of 60, which will be rescaled to a mark out of 100.

(a) Feature detection as used for objection recognition and tracking needs to be robust to different types of invariance.

(i) Explain how the following types of invariance can be achieved (state all applicable algorithms):

i. Illumination [2 marks]

ii. Scale [2 marks]

iii. Rotation [2 marks]

(ii) Corner detection is frequently used in motion detection and image registration.

i. Explain why a corner is a better feature as compared to edges. [2 marks]

ii. Explain and outline how Moravec operator can be used for corner detection. [8 marks]

(iii) Motion Correspondence can be used to match features in one image with those in another, to estimate motion. State and explain the THREE principles of motion correspondence. Specifically state how an algorithm is designed to ensure features adhere to these principles. [4 marks]

[20 marks]

(b) (i) What is the difference between Machine Learning and Deep Learning? Please list (≥ 3) commonly used applications of Deep Learning in Computer/Robot Vision. [8 marks]

(ii) Please choose below (all) the activation functions used in Deep Neural Networks: [6 marks]

A. Sigmoid

B. Logistic

C. ReLU

D. Softmax

E. Cosine

F. Leaky ReLU

G. dying ReLU

(iii) What does 'overfitting' mean in the context of Deep Learning? What are activation functions? What does loss function do? [6 marks]

[20 marks]

(c) You are asked to design and implement a secure entry devise to the School of Computer Science, based on facial detection and recognition of each student and staff. The system must be able to identify each individual member and allow appropriate access through secure doors. 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:

(i) Gather the required information for processing. [2 marks]

(ii) Identify each individual member. You need to outline the details of your chosen method that will allow make this possible. [10 marks]

(iii) Determine and minimise the drawbacks of the suggested technique. [8 marks]

[20 marks]