



**Coláiste na Tríonóide, Baile Átha Cliath**  
**Trinity College Dublin**

Ollscoil Átha Cliath | The University of Dublin

**Faculty of Engineering, Mathematics and Science**

**School of Computer Science & Statistics**

**Integrated Computer Science**  
**Integrated Engineering**  
**Ba (mod) Computer Science and Business**  
**Ba (mod) Computer Science and Language**  
**Year 4 examinations**

**Semester One 2019**

**CSU44053-Computer Vision**

**Monday 9 December**

**RDS SIM COURT**

**17.00-19.00**

**Dr Kenneth Dawson-Howe**

**Instructions to Candidates:**

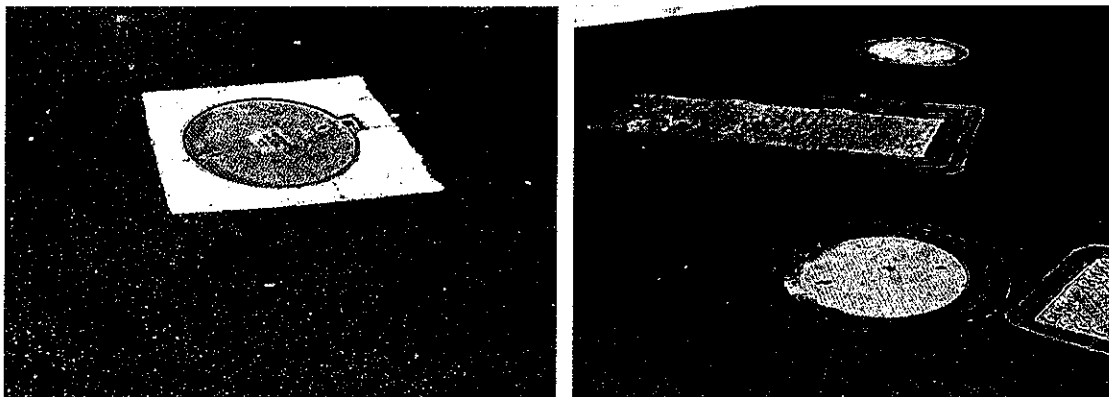
Attempt **two** questions. All questions carry equal marks. Each question is scored out of a total of 50 marks. Each question should be answered in a separate answer booklet.

The images on this paper should appear in colour (or if grayscale they will be outlined in colour). If they do not appear in colour please ask to speak to the examiner

You may not start this examination until you are instructed to do so by the invigilator.

1. (a) Using mean shift segmentation, develop a system to locate circular manhole covers in images such as those below. Your solution must consist of a series of computer vision techniques and the technical details of the techniques used must be provided.

[35 marks]



(b) Compare and contrast k-means with mean shift segmentation. You must fully describe k-means segmentation and provide a (well explained) list a differences and similarities between the two techniques.

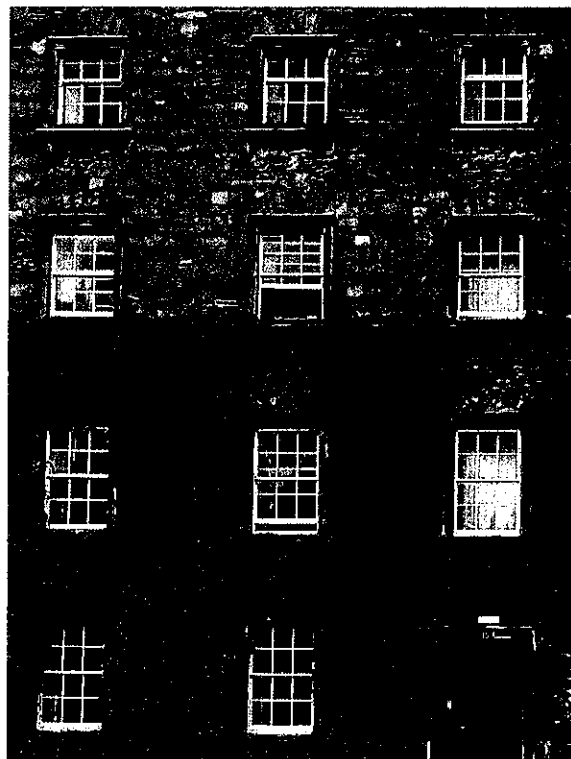
[15 marks]

2. (a) Compare and contrast RANSAC and the Hough Transformation for detecting straight lines in images.

[15 marks]

(b) Using first derivative edge detection (among other techniques) develop a system which determines the extent to which each sash window (such as those shown below) is open. You may assume that you are given the coordinates of the four corners of each window and a sample image of each window when it is closed. Your solution must consist of a series of computer vision techniques and the technical details of the techniques used must be provided.

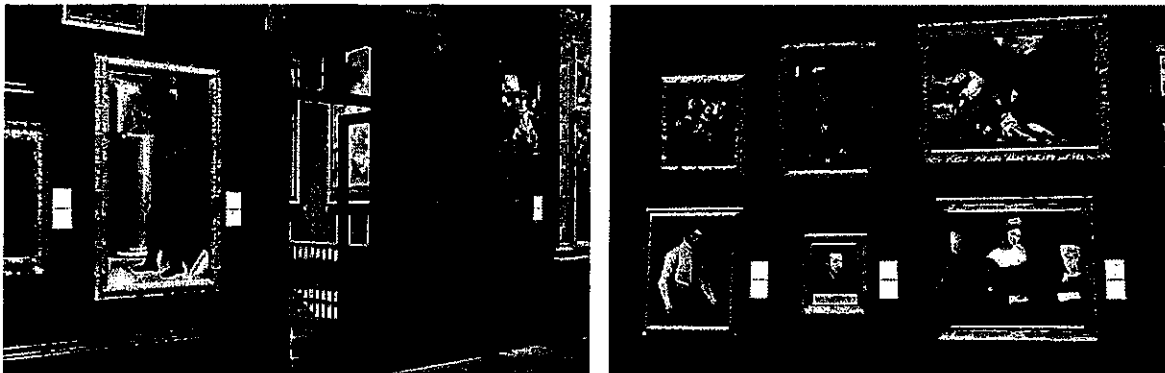
[35 marks]



3. (a) Using SIFT describe a system to recognise paintings in a gallery. Your solution must consist of a series of computer vision techniques and the technical details of the techniques used (including details of how SIFT features are extracted and described and how they can be recognised).

[30 marks]

Sample gallery images:

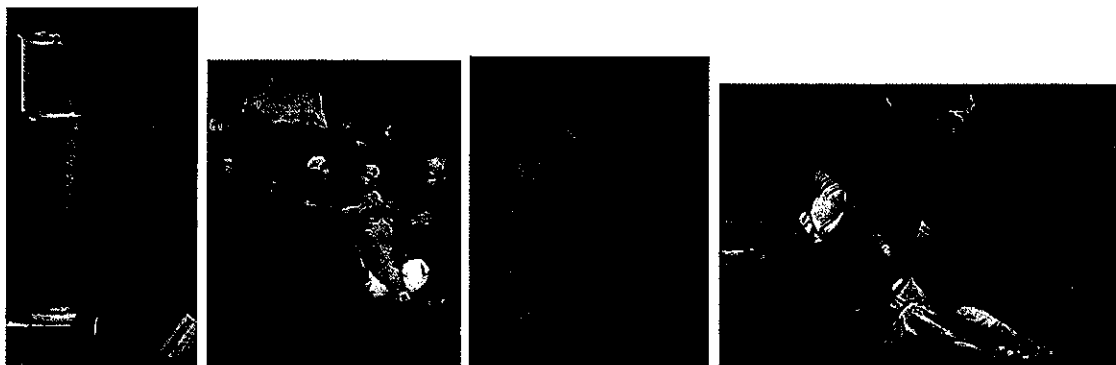


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(b) Assuming a potential match has been found from part (a) describe how you would validate the match by transforming the gallery image so that it could be directly compared with known painting. You must include full technical details of the transformation you apply and the method of comparison

[20 marks]

Sample known painting images:



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