



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
Computer Science and Business
Computer Science and Language
Year 4

Michaelmas Term 2020

Computer Vision

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Instructions to Candidates:

Attempt two questions. All questions carry equal marks. Each question is scored out of a total of 50 marks.

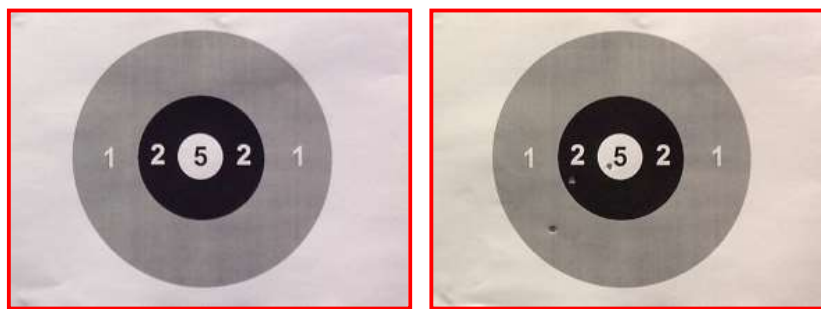
For Application questions, a series of computer vision operations must be detailed to solve the application problem. The input to and output from each technique used must be clearly and precisely stated. How each technique is used within the context of the application must also be described including the setting of any parameters.

For Compare and Contrast type questions marks will only be awarded for the detailed comparison of techniques. No marks will be awarded for separate descriptions of the techniques.

In all questions you must describe computer vision theory and should not refer to code or library calls (OpenCV or any other library).

1. (a) **[APPLICATION QUESTION]** Describe two approaches to the location of target in the images below as follows: (1) using edge detection and (2) using region detection. For each approach, your solution must consist of a series of computer vision techniques and you must provide details of how the techniques will be applied including expected input and output for each technique.

[35 marks]



(b) **[APPLICATION QUESTION]** Given a video of a (shooting) target (sample frames shown above) taken from a static camera, describe how you would locate the target and score any shots which appear on the target. Your solution must consist of a series of computer vision techniques and you must provide details of how the techniques will be applied including expected input and output for each technique.

[15 marks]

2. (a) **[COMPARE & CONTRAST QUESTION]** Compare and contrast:

- tracking using SIFT
- tracking using mean shift.

Also comment on which technique would be more appropriate for tracking the moving objects in the road scene shown below.

You must provide a list of the differences and similarities between the techniques.

Each of the differences and similarities must be clearly explained. **NOTE:** Marks will only be awarded for the detailed comparison of techniques. No marks will be awarded for separate descriptions of the techniques.

[30 marks]



(b) **[APPLICATION QUESTION]** One of the problems with tracking is locating the objects to track. Given a video of a road scene like that shown above describe how you would locate individual moving objects (which could then be tracked). Your solution must consist of a series of computer vision techniques and you must provide details of how the techniques will be applied including expected input and output for each technique.

[20 marks]

3. (a) **[APPLICATION QUESTION]** Using backprojection (and other techniques) describe how you could locate the square blue signs in the images below and how you could then transform them to a standard size square image. Your solution must consist of a series of computer vision techniques and you must provide details of how the techniques will be applied including expected input and output for each technique.

[25 marks]



(b) **[COMPARE & CONTRAST QUESTION]** Compare and contrast:

- Chamfer Matching
- Statistical Pattern Recognition
- Robust object detection using a cascade of Haar classifiers

You must provide a list of the differences and similarities between the techniques. Each of the differences and similarities must be clearly explained. **NOTE:** Marks will only be awarded for the detailed comparison of techniques. No marks will be awarded for separate descriptions of the techniques.

[25 marks]