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91908

NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 3 Digital Technologies and Hangarau Matihiko 2025

91908 Analyse an area of computer science

Credits: Three

Achievement	Achievement with Merit	Achievement with Excellence
Analyse an area of computer science.	Analyse, in depth, an area of computer science.	Critically analyse an area of computer science.

This assessment has TWO parts. Complete BOTH parts of the assessment.

Ensure that you have Resource Booklet 91908R.

You should aim to write **800–1,500 words** in total.

Achievement

TOTAL 04

Page 1

Make sure you have the paper Resource Booklet 91908R.

INSTRUCTIONS

This assessment has TWO parts. Complete BOTH parts of the assessment.

You should aim to write **800–1,500 words** in total.

Part One contains questions on three areas of computer science:

- Computer graphics
- Computer vision
- Complexity and tractability.

Choose only ONE area of computer science on which to answer questions. Enter the name of your selected area of computer science in the box below.

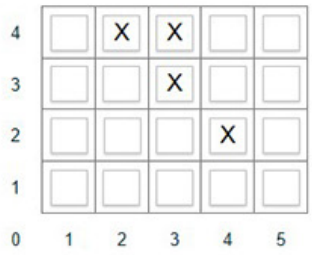
Computer Vision

Part Two has four questions. Answer all four questions.

Read both parts of this assessment before you begin your responses.

OR:

COMPUTER VISION



Consider that the matrix above has pixel values as follows:

[[10, 5, 5, 0, 0], [10, 10, 5, 0, 0], [10, 10, 10, 5, 0], [10, 10, 10, 10, 10]]

Use the pixel matrix provided above to answer part (a).

(a) (i) Illustrate the edges by marking them with Xs.

(ii) Describe how the change in pixel values facilitates edge detection in this specific instance.

You can see how the change in pixel values goes from 10 then to 5 then all the way down to 0. When this happens you can tell that there is a steep decline in the pixels value telling us that there is a edge present there.

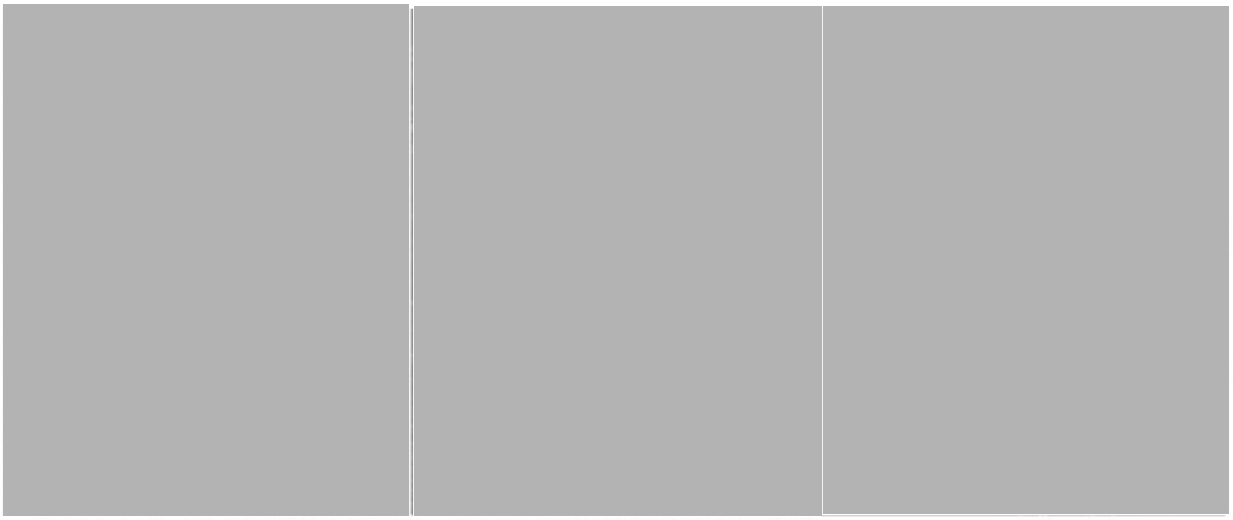
Two images are taken simultaneously from a stereo camera set-up – one from the **left camera** and one from the **right camera**. These images capture the same scene from slightly different horizontal perspectives.

Source: https://people.duke.edu/~ng46/topics/stereo.htm

(b) Aside from the two images, identify and explain THREE key components or pieces of information required to compute a depth map using stereo vision.

The things that are required for calculating a depth map using stereo vision is that the camera has to be at same length away from the objects on both cameras if not the depth of the object will look completely off making it look further or closer than it seems. Also knowing the FOV of the camera that you are using is also important, even this being wrong can give you inaccurate results. And finally getting a different angle of the object or objects in the image. All these things help people calculate a depth map using stereo vision.

Use the images below to answer part (c).



Source: http://bit.ly/41j2T4C

Original image	Sobel / Prewitt	Canny edge detection

(c) (i) Complete the table above by identifying which image has likely used the Canny edge detection technique, and which has likely used another algorithm, such as the Sobel / Prewitt algorithm.

(ii) Explain what led you to make this decision.

I know that that last picture from above used Canny edge detection because this algorithm uses the difference of brightness between the pixels to fins the edges and by the picture being black and white you can see the edges are being represented in white.

PART TWO

Refer to the resource booklet to answer parts (a), (b), and (c).

(a) Discuss the significance of your chosen area from Part One within the broader field of computer science. Why is it considered a critical component of the discipline?

Computer Vision is a critical component of computer science. As the world is evolving, We have started to use things like AI to make our lives easier and more efficent .By updating and improving computer vision AI can be put into things like robots, Self-driving cars, etc. Also by doing this it does not just make the lives of humans easier it helps with things such as accuracy. Because when Robots are Programmed to do something they can keep doing that same action any time and with perfect accuracy. So this can be used in things such as surgeries where a robot is able to perform the surgery without any problems or breaks. That is just one of the many ways Computer Vision can be helpful in the modern world.

(b) Identify TWO specific algorithms or mechanisms that are central to your chosen area of computer science from Part One.

Algorithm or Mechanism 1: Haar-like features

(i) Explain how your identified algorithm or mechanism functions, and discuss why it is important to the field.

Haar-like features is one of the algorithms that helps with identifying and finding objects and even faces. It uses light-dark rectangular patterns to find specific features on a object or a face. This algorithm is really accurate but can have problems in the dark because it uses light to identify those specific features. This algorithm can be really useful for things like facial recognition amongst a large amount of people because this algorithm can apply this algorithm onto people faces quickly and give back the results.

Algorithm or Mechanism 2: LiDAR

(ii) Explain how your identified algorithm or mechanism functions, and discuss why it is important to the field.

LiDAR works by shooting out many invisible lasers out and waits for the laser to bounce back onto the sensor. And this helps to find the distances between the sensor and the object. The formula to find out the distance by using LiDAR is (Speed of Light x Time Time) all divided by 2. We divide the result in the bracket by two because we only need the distance to the surface and not the distance for the travel back as well. So by doing this we can have a accurate result of the distance between the sensor and the surface of an object. LiDAR can be used in things such as autonomous driving, autonomous robots, map out large areas. This can be useful for autonomous driving to train new models to make an even safer model that they have and be able to do more features. For robots they could be able navigate throughout a warehouse where they are located and do different functions at different places.

(c) Explain how your chosen area of computer science from Part One is applied and implemented in a real-world scenario.

In your answer, provide detailed examples to show what this area of computer science can do and what its limits are.

Computer Vision is or can be implemented in Logistics. By using computer vision in the logistic field it because easier to find packages and help optimise the wait time for those packages. By using things like some edge detection algorithms we are able to scan a bar-code or even a QR code that are put on to these packages to keep the details of the package and not mix the shipping up with another package by doing this to makes it a lot easier for delivery drivers to find the right package and when it is off to. But the bad thing about this is that By using computer vision in these types of jobs they still will need supervision from a human to make sure they are doing the right thing and also the start up cost of all these things would be really expensive because they would need to buy new equipment to be able to use these things.

(d) Sometimes, technologies in this area of computer science can benefit certain groups of people while disadvantaging or negatively impacting others, either directly or indirectly.

Discuss how the issues and opportunities associated with your chosen area can impact society.

Computer vision has some benefits but also has some disadvantage to it. Such as they can be biased, Because when they train the model they might not have enough training data and could have some similar response but to fix this people can increase the amount of data gathered to feed it into the model and also getting diverse data such as things like facial recognition different cultural people might have different features from other people. also low lighting can cause problems such as some algorithms that need light such as Haar-like features if the face it not lit up properly it can cause inaccurate results cause it to not detect the face. But the Advantages for using computer vision in some fields are the increase accuracy compared to humans. Humans even though if they are really trained they are still prone to make some simple mistakes but lets a robot when it is programmed and given a model it can perform that action many times without any problems and still keep that same accuracy.

Achievement

Subject: Level 3 Digital Technologies

Standard: 91908

Overall grade: 04

Part	Question		Marker commentary
One (Computer vision)	(a)	(i)	*Illustrate the edges by marking them with Xs* • Identified some correct edge locations where pixel values change. • Edge marking was partially correct, with some missed edges or inconsistencies. • Showed recognition that edges relate to changes in pixel values. • Accuracy was sufficient to demonstrate understanding, but more detail was required for it to be comprehensive enough for Merit.
		(ii)	*Describe how the change in pixel values facilitates edge detection* • Stated that edges occur when pixel values change or when brightness is different. • Used everyday language rather than algorithmic terminology. • Demonstrated basic conceptual understanding of edge detection. • Needed to explain how algorithms detect edges, or refer to gradients, convolution, or direction to attain Merit.
	(b)		*Stereo vision – components required to compute a depth map* • Recognised that two images from different viewpoints are required. • Identified that comparing the images allows depth to be calculated. • The core idea of stereo vision was present. • Key variables (e.g. focal length, baseline, disparity) needed further clarification, identification, or explanation for Merit.
	(c)	(i)	*Identify which image used Canny vs Sobel/Prewitt* • Correctly identified the Canny edge detection image. • Identification was correct, but not supported by detailed reasoning. • The candidate's decision appears to have been based on general appearance, rather than algorithmic features.
		(ii)	*Explain what led to the decision* • Stated that one image has clearer or stronger edges than the other. • Explanation was brief and descriptive. • The candidate needed to reference specific stages or properties of the algorithms to reach a higher grade.
Two (A broader computer science context)	(a)		*Significance of computer vision* • Stated that computer vision allows computers to see or recognise images. • Demonstrated awareness of the purpose of computer vision. • Explanation was simple; a discussion of the broader significance or impact was required for Merit.

	(b)	(i)	*Algorithm 1* • Named a relevant algorithm (e.g. edge detection). • Gave a brief description of what it is used for. • Correct identification of an algorithm related to computer vision. • Minimal explanation of how it works; greater detail was needed for Merit.
		(ii)	*Algorithm 2* • Identified a second relevant algorithm or technique. • Described its use in a basic real-world context. • Demonstrated relevance to the chosen area. • Greater detail about internal operation or efficiency was needed for Merit.
	(c)		*Real-world application and limitations* • Provided a real-world example where computer vision could be used. • Mentioned at least one limitation or issue. • Application was appropriate but briefly explained, and limitations were identified but not explored or justified.
	(d)		*Societal impacts – benefits and disadvantages* • Identified a benefit and a disadvantage of using computer vision technology. • Addressed the requirement to consider impacts on people or society. • The discussion was simple and largely descriptive.