



Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can require you to write in legible script or have it typed and the expense of typing is charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
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1	Student Number	1901291
2	Title of Examination Paper	Artificial Intelligence
3	Module Code	ACCA7026
4	Date and Time of Examination	09/01/2025 15:00
5	Examination Venue	310
6	Seat Number	5
7	Number of Answer Books handed in	1

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

68%

7042 January 2025

Question 1**[18]**

a)

Function	Definition	Role of Weak AI	Technology
Perception	Perception encompasses the ~~AV's~~ AV's ability to perceive its surroundings. Using sensors	Weak AI's role ~~in~~ ^{with} the perception function is to ~~perceive~~ ^{perceive} objects like signs, as well as people and other vehicles	The technology used for perception are sensors such as cameras and IR Sensors
Prediction	The prediction function allows an AV to ^{interpret} ~~actually~~ what the input from the sensors means. ~~It is~~	The AV can predict ~~travel~~ ^{time} ~~the road~~ , which road markings and signs mean ^{and} what ^{if} they can predict the next best course of action based on ~~what's~~ ^{what's} happening around the AV	The ~~technology~~ ^{technology} that enables prediction is the same sensors used for perception as well as the AI onboard the AV.

ML models for prediction

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Function	Definition	Role of Weak AI	Technology
Planning	The planning function allows an AV to plan the most efficient and the fastest route ✓	Weak AI will use its input data from the sensors to determine the most time cost and fuel efficient route based on factors like the distance to the goal, the time it could take, and if there are any obstacles like road works and traffic jams	The AV will use technologies like GPS/Maps as well as a pathfinding algorithm to find the best route for travelling based on information from things like the GPS to plan a route around a traffic jam
Control	The control function is responsible for ~~the~~ operating the vehicle in accordance to the data fed from the other functions. Such as acceleration, braking etc.	The weak AI will drive the AV using the information about the route, the local laws and regulations as well as potential obstacles and hazards in the area	The technology used to carry out this function is everything used in the other functions as well as the vehicle itself, like the steering, wheels and brakes. Feedback control, Adaptive Cruise Control

3) b) If ~~an~~ AV were powered by a Strong AI its capabilities would be greater than that of the currently available vehicles powered by weak AI. Firstly, a strong AI would be able to not only carry out the basic functions of perception, prediction, ~~planning~~ and control, but it would be able to do so at an advanced level. For example, unlike weak AI, Strong AI would have the ability to predict and react like a human can, however much faster. This is especially useful for avoiding collisions and casualties. Another thing it could do better than weak AI is it would be able to deal with edge cases much better and it would not need human ~~input~~ input to do so as it would be fully automatic.

⇒ interacting/managing
⇒ navigating through mapped route

4) c) Some examples of complex driving situations where strong AI would offer advantages is ~~off road~~ driving where there is no clearly marked road, markings or signs. Another situation would be on a busy motorway where there are many human operated vehicles. This is because a strong AI could more accurately and efficiently predict the potential hazards and risks that the other drivers pose, reducing the chance of a collision. This is important because the vast majority (around 90%) of collisions and fatalities happen due to human error.

Question 3

16

a) NLP is an effective way to deal with automated customer service systems as it makes dealing with large volumes of general ~~queries~~ queries much more efficient. It uses ~~methods~~ methods like segmentation and sentiment analysis to determine what are a customer's needs. For example, if a large call center with many departments utilises NLP, the model can do things like determine if a customer needs to speak to a human operator in the first place. If someone has a general query, the NLP model can often provide the answer, ~~saving~~ cutting down on the amount of calls coming through. Another function an NLP model can perform is it can direct a customer to a relevant department, saving someone the time they would spend transferring the call.

b) Entity recognition allows a model to deal with ~~informal~~ things like informal language or slang in order to provide an answer, based on already predefined meanings of things such as abbreviations. Sentiment analysis determines the emotion behind a message. It does so by rating ~~on~~ a scale of how positive/negative specific a text is, rather than labelling emotions like happy, sad or angry. Language translation can deal with customers written in foreign languages to either provide an answer, or translate the original message. An ~~example~~ example usage of these 3 is a website or a call center as mentioned in the previous

not fully correct. It is to clarify named entities.

Question. The NLP model can be used to either cut down transfers by putting a customer through to a relevant department, or by answering general queries on its own without the need for a human agent.

Ability to provide answer in a diverse range of ways.

c) Some of the key advantages of NLP in customer service is the efficiency it provides by saving time on transfers, ~~cut down~~ call / ~~query~~ query volumes and call times. Furthermore it can also help by answering certain queries on its own, or even helping with customers who are experiencing a language barrier between themselves and an ~~adviser~~ advisor.

d) Ensemble learning is beneficial for NLP models as it can improve the accuracy of the answers provided. This is because interactions with thousands of customers may vary significantly. By combining the data from multiple models, an NLP model can be trained on larger volumes of data in a shorter time span relatively speaking, to provide much more desirable results.

a) Convolutional Layer:

Using a kernel of ~~a~~ predefined size, it will analyse the input using weights, feature values and a dot product to recognise edges, shapes, then an entire object.

expect more detail

Activation Layer:

Using activation functions, like ReLU it will reduce generalisation by introducing non-linearity, for a more accurate object detection.

①

Pooling layer:

Reduces the feature map while ~~preserving~~ essential features in order to reduce the computational complexity. It does so using methods like segmentation.

Fully connected layer:

Connect every node from the previous layer to ~~every~~ every node in the fully connected layer. It serves as a translation or a bridge in a certain way between the pooling layer and the output layer.

Output layer: Loss function

Using the data from the fully connected layer it classifies the information into things like edges, shapes and their full objects.

b)

Amount of ~~pixels~~ Pixels: $(128 \times 128) \times 3 = 49,152$ pixels ✓

Pixels covered by 32 3×3 kernels: $32 \times (3 \times 3) = 288$ pixels

0 ✓ $49,152 \div 3 = 16384$

$\sqrt{16,384 \times 288} = 36,864$

~~$\sqrt{36,864}$~~ $\sqrt{36,864} = 192$

Final dimensions: 192×192 ✓

c) A pooling layer is beneficial for AV's as it reduces the ~~amount~~ feature map of the detected objects. This is extremely important as it reduces the computational complexity of the detection system and therefore allows for detection and recognition to be faster. If the detection and recognition is faster and also more accurate, it could make a big difference in certain scenarios, even a difference between life and death in an accident.

Translational invariance ✓

d) The role of depth comes in the form of analysing the pixels in an image. A pixel will have a specific value from its Red, Green and blue channels, and ~~on~~ the depth alongside the channel values allow for the object detection. The stride defines the ~~the~~ speed/amount of pixels that a filter/kernel will move ~~along~~ ^{along} on ~~the~~ ^{an} image to detect ~~an~~ ^{an} object. The padding defines if ~~an~~ ^{an} end of an image will be filled in, then a sense is order for a kernel to explore every pixel. Padding ~~of~~ ^{can} either have the values of 0 or 1, depending on kernel and ~~the~~ ^{the} image ~~size~~ ^{size} and whether they are even or odd. Similarly with the stride it is ~~of~~ ^{important} ~~to~~ not to make it too big as it can lead to skipped pixels and therefore data loss.

Filter & to detect feature.