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COMP2002
Artificial Intelligence

20 CREDIT MODULE

ASSESSMENT: 100% Coursework **W1: 30% Set Exercises**
W2: 70% Report

MODULE LEADER: Dr Lauren Ansell

MODULE AIMS

- To familiarise with the underlying principles of artificial intelligence.
- To expose students to topics such as search and optimization, knowledge representation and reasoning, and machine learning.
- To instil students with an appreciation of the importance of ethical considerations behind artificial intelligence.

ASSESSED LEARNING OUTCOMES (ALO):

1. Describe and analyse a range of artificial intelligence methods and their applications.
2. Compare artificial intelligence paradigms and evaluate the appropriateness of a particular paradigm for specific application domains.
3. Choose and apply appropriate artificial intelligence methods to a chosen sample domain.

Overview

This document contains all the necessary information pertaining to the assessment of *COMP2002 Artificial Intelligence* module. The module is assessed via **100% coursework,** across two elements: *30% Set Exercises* and *70% Report.*

The sections that follow will detail the assessment tasks that are to be undertaken. The submission and expected feedback dates are presented in Table 1. All assessments are to be submitted electronically via the module DLE pages before the stated deadlines.

	Submission Deadline	Feedback
Set Exercises (30%)	**Monday 3rd of March 2025 at 15:00**	within 20 working days
Report (70%)	**Monday 31st of March 2025 at 15:00**	within 20 working days

Table 1: Assessment Deadlines

Late Submission Policy – Any work submitted after the deadline will receive a mark of 0 unless a valid extenuating circumstance form has been submitted. Please see the extenuating circumstance section below which includes a link to the policy.

All assessments will be introduced in class to provide further clarity over what is expected and how you can access support and formative feedback prior to submission. Whilst the assessment information is provided at the start of the module, it is not necessarily expected you will start this immediately – as you will often not have sufficient understanding of the topic. The module leader will provide guidance in this respect.

Available Support

Support is available during the weekly lab sessions or during my office hours every Friday 10am – 12pm either in person or online.

Set Exercises

There are two set exercises for you to complete during the course of the module. Each of these exercises should take you approximately 8 hours to complete.

Assessment 1: Set Exercises

This assignment contributes **30%** of the overall module mark for COMP2002. You must submit the deliverables to the DLE by the specified submission dates.

Set Exercise 1: worth 40% of the set exercise mark

During Lecture 1 you were asked to suggest applications of artificial intelligence. Your task is to **select <u>one</u> of these applications** and **write a blog post describing it.** The topics are available on the DLE.

Your blog post must:

- Introduce the topic – you should explain the purpose behind the AI. What will it mean we can now do that we couldn't before?
- Discuss whether the AI has been successful – what has the impact of its introduction been.
- Discuss the future of the AI – will it continue to be used? Are there any improvements required to make it better?

The word limit for your blog post is **700 words.**

For information on how to write a good blog post, please consult the resources posted on the DLE.

You must **submit your blog post in PDF format.**

Assessment Criteria

A rubric will be used to **assess** and **provide feedback** on your submission. This is provided below:

	Fail (<40%)	>=40	>=50	>=60	>=70	>=80
AI application is introduced (25%)	Requirements not met.	Vague introduction with little detail	Some introduction but some omissions	Application idea introduced but more detail on its purpose needed	Generally good introduction – AI and its purpose are discussed. Some minor omissions.	The AI and its purpose are fully introduced. No omissions.
The AI's success is discussed (30%)	Requirements not met.	Vague description of AI's impact with little detail. No discussion.	Some description of AI's impact in some detail. No discussion.	Good description of the AI's impact. Some analytical discussion.	The AI's impact is well described. Good analytical discussion but lacking detail in a few places.	Excellent discussion of the AI's impact and strong analytical discussion.
The AI's future is discussed (30%)	Requirements not met.	Vague description of the AI's future with little detail. No discussion	Some description of the AI's future in some detail. No discussion.	Good description of the AI's future. Some analytical discussion.	The AI's future is well described. Good analytical discussion but lacking detail in a few places	Excellent discussion of the AI's future and strong analytical discussion.
Style and language (15%)	Requirements not met.	Poor spelling and grammar. Inappropriate structure.	Poor spelling and grammar. Some improvements to structure required.	Some minor spelling or grammatical errors. Some improvements to structure required.	Some minor spelling or grammatical errors. A suitable structure is followed.	Excellent. Very few spelling or grammatical errors. A suitable structure is followed.

Assessment 1: Set Exercises

Set Exercise 2: worth 60% of element mark

Your task here is to produce a technical poster about the design of an AI-based assistant to be used within a care home. You must outline the AI components that will go into the assistant and explain how a user will interact with it.

Your poster post must:

- Describe the AI components – how will you use machine learning, evolutionary computation, knowledge representation and NLP. (You might not use all of these, it's up to you to decide). How and why will each be used?
- Indicate how the components are assembled into the final system.
- Outline the UI – how does the user input requests, and how is the information presented?
- Include any ethical considerations.

The poster must be submitted as a PDF file to the DLE and you may use a single page only. A template has been provided for you on the DLE.

For information on how to write a good scientific poster, have a look at the resources posted on the DLE.

Assessment Criteria

A rubric will be used to **assess** and **provide feedback** on your submission. This is provided below:

	Fail (<40%)	**>=40**	**>=50**	**>=60**	**>=70**	**>=80**
Selection and justification of AI components (50%)	Not clear which AI will be used or how, no rationale behind their selection.	Some of the AIs' use is described but there is little rationale.	The AI to be used is mostly described. Some aspects are justified but more detail is needed.	The AI to be used is described. Most areas are justified but justification could be strengthened in places.	The AI to be used is described and is mostly justified.	All of the AI to be used is described and the rationale behind the choices is clear.
UI design (30%)	Little consideration to the UI is given, and there is no rationale behind the design.	There is some consideration to the UI and some reasonable choices have been made. No justification.	Reasonable UI choices have been made and justification has been attempted.	The UI is mostly well designed. The design is generally justified but more depth is needed.	The UI is well designed. The rationale behind the design is mostly clear but could be enhanced in one or two areas.	The UI is well designed and the rationale behind the design is clear.
Style and language (20%)	Poor spelling and grammar. Inappropriate structure. Poster content is too brief.	Some spelling and grammar errors. Inappropriate structure. Poster content is too brief.	Some spelling and grammar errors. Minor improvements to structure required. Poster content is too brief.	Some minor spelling or grammatical errors. Minor improvements to structure required.	Some minor spelling or grammatical errors. A suitable structure is followed.	Excellent. Very few spelling or grammatical errors. A suitable structure is followed.

Table 1: Feedback for Assessment 1

Assessment 2: Machine Learning and Optimisation

This assignment contributes **70%** of the overall module mark for COMP2002 and is an **individual assignment.** You must submit the deliverables to the DLE by the specified submission dates.

The coursework has two parts – one is a **machine learning exercise** and the second is about **evolutionary computation**. You must **complete and submit both parts**. Each part is worth 50% of the coursework mark. Both a Jupyter notebook and RMarkdown file have been placed on the DLE for you to use. You should download one of them and use it to implement the code you need to complete the tasks below.

PART 1 – MACHINE LEARNING

You have been provided with datasets relating to *glass*. Your task is to train and assess classification models that predict the type of glass based on 9 inputs.

You must complete the following tasks:

Task 1.1 – Data preparation (10% of total mark)

The first phase of the work requires you to load the data you have been provided with into your selected program. Before the data can be used to train and test your models you must first prepare it – this means that the inputs must be converted to a suitable format. There is no missing data in the dataset.

Task 1.2 – Classification (20% of total mark)

Having prepared the data you must now build a classification tool that can predict new points. Use the following regression implementations within the respective program packages to construct predictors for the dataset:

- kNN
- SVM

For each of the models, you must investigate the optimal number of neighbours and an appropriate kernel shape from linear, polynomial and radial. You must demonstrate that each classifier can provide a prediction for a given input.

Note: for the polynomial kernel, restrict your investigation to polynomials of degree 2 and 3.

Task 1.3 – Assessment of classification (20% of total mark)

After identifying the best model parameters in the previous task, the classification models you have implemented must be assessed. To do this you are required to assess the *accuracy* for each model. You may use the accuracy implementation available to do this. It is not sufficient to report a single accuracy score. You must use cross-validation to report training results and report these values using a plot. You will also need to write a summary analysing your results and findings.

PART 2 – OPTIMISATION

The second part of this assignment requires you to construct an algorithm that can optimise single-objective optimisation problems. The problems are as follows:

Problem	Formulation
Schaffer function N. 2	$f(x,y) = 0.5 + \frac{\sin(x^2 - y^2)^2 - 0.5}{[1 + 0.001(x^2 + y^2)]^2}$
Modified Ackley function	$f(x,y) = -20\exp\left[-0.2\sqrt{0.5(x^2 + y^2)}\right] - \exp[0.5(\cos(2\pi x) + \cos(2\pi y))] + 20$
Easom function	$f(x,y) = -\cos(x)\cos(y)\exp\left(-((x-\pi)^2 + (y-\pi)^2)\right)$

Each solution should have *D* = 2 continuous decision variables that can take any value (you are recommended to start with random values between -5 and 5 for all three problems).

Task 2.1 – Generation of random solutions (10% of total mark)

You must use an evolutionary algorithm (EA). When evaluating an EA it is standard to compare against randomness. Generate 500 random solutions to the problem and plot their fitness values. You should plot the *x* and *y* values and colour the solutions according to their fitness value.

Task 2.2 – Algorithm implementation (25% of total mark)

You should implement a population-based evolutionary algorithm as described in the lectures. Your algorithm must have the following features:

- A crossover operator that performs uniform crossover.
- A mutation operator that performs an additive Gaussian mutation.
- A selection operator that combines a generation's parent and child populations and identifies the parent solutions for the next generation.

Task 2.3 – Visualisation of results (15% of total mark)

Modify your optimiser to record the average fitness at each generation. Then, after your optimiser has run, produce a plot showing the change in average fitness over the runtime of the algorithm.

Your visualization code must be separate from the optimiser.

COURSEWORK DELIVERABLES

Both a Jupyter notebook and RMarkdown file have been provided on the DLE for you to use for this coursework. You should implement your code in it and submit **ONE FILE** to the DLE ahead of the deadline specified in the submission dates earlier in this document. **Please indicate which task each section of your submission refers to using either a Markdown cell or a new heading.**

Work that is uploaded as a zip folder, as more than one file or in the incorrect file format will be penalised.

Please check your submitted files are correct by downloading them again and checking that they work. **You will receive a confirmation receipt by email when your work has been properly submitted** – if you do not receive this email then your work has not been submitted.

ASSESSMENT CRITERIA

Your work will be assessed according to the rubric found in Tables 2 and 3. Your mark for this piece of coursework will be based on an aggregation of the marks for each category. Marks will be awarded based on **both the set exercises and the report**.

Category	Fail (<40%)	>=40%	>=50%	>=60%	>=70%	
Data preparation (10%)	Data is badly loaded into the program and there is no real preparation of the data.	The data is loaded correctly, though inefficiently, but there is no preparation.	The data is efficiently loaded into the program and there is an attempt at normalisation.	The data is loaded and normalised, with some inefficiencies.	The data is loaded and normalised, and the code to do so is efficiently written.	/10
Classification (20%)	Very little or no attempt at training or testing regression models. Poor organisation of code.	There has been an attempt at training one or more of the models, but there is no testing. The organisation of the code is poor.	Both models are trained, but there are problems with the testing. The organisation of the code is poor.	Both models are trained and tested correctly. The code to do so is repetitive and not well organised.	Both models are trained and tested correctly. The code used to do so is well organised and efficient.	/20
Assessment of results (20%)	Very little or no attempt at assessing the classification results. No analysis of the results.	There has been an attempt at using mean absolute error, but little or no use of cross-validation. Limited analysis of the results.	Mean absolute error is used in combination with cross-validation. The presentation of results should be improved. Basic analysis of the results.	Mean absolute error is used in combination with cross-validation, and the results are presented with a boxplot. Some inefficiencies in the code organisation. Analysis of the results is somewhat complete and some understanding is shown.	Mean absolute error is used in combination with cross-validation, and the results are presented with a boxplot. The code is efficient and well organised. Analysis of the results is complete and well understood.	/20

Table 2: Feedback Template for Assessment 2 (Machine Learning part)

Category	Fail (<40%)	>=40%	>=50%	>=60%	>=70%	
Generation of random solutions (10%)	The fitness function is incorrect. Poor attempt at loading the data. Generation of random solutions does not work.	The data is loaded. There has been an attempt at the fitness function, but it is incorrect. Generation of random solutions does not work	The data is loaded and the fitness function is close to correct. Generation of random solutions does not work.	The data is loaded and the fitness function is close to correct. Solution generation is close to working. Code is inefficiently designed.	The data is loaded and the fitness function is correct. Random solutions are generated correctly. The code to do so is efficiently structured.	/10
Algorithm implementation (25%)	Mutation operators are mostly incorrect or missing. The algorithm is incorrect – selection is missing or not working and the fitness archive is missing.	One mutation operator has been attempted. Some of the algorithm is present, but it is incomplete or incorrect. The fitness archive has been attempted.	Two mutation operators have been attempted but are incomplete or incorrect. The algorithm is partially correct and the fitness archive works correctly.	The mutation operators work and the algorithm is mostly implemented correctly. The fitness archive stores fitnesses correctly.	The mutation operators and algorithm have been implemented correctly. The fitness archive stores fitnesses correctly. The code is efficiently structured and well organised.	/25
Visualisation of results (15%)	No attempt at producing a plot, or the plot is incorrect. Experiments are not run for the correct number of repeats.	A graph shows the partial results required. The experiment was run incorrectly.	A graph shows the correct results required but the experiment was run incorrectly.	A graph shows the correct results and the correct experimental setup has been followed.	A graph shows the correct results and the correct experimental setup has been followed.	/15

Table 3: Feedback Template for Assessment 2 (Evolutionary Computation part)

General Guidance

Extenuating Circumstances

There may be a time during this module where you experience a serious situation which has a significant impact on your ability to complete the assessments. The definition of these can be found in the University Policy on Extenuating Circumstances here.

Plagiarism

All of your work must be of your own words. You must use references for your sources, however you acquire them. Where you wish to use quotations, these must be a very minor part of your overall work.

To copy another person's work is viewed as plagiarism and is not allowed. Any issues of plagiarism and any form of academic dishonesty are treated very seriously. All your work must be your own and other sources must be identified as being theirs, not yours. The copying of another persons' work could result in a penalty being invoked.

Further information on plagiarism policy can be found here:

Plagiarism: https://www.plymouth.ac.uk/student-life/your-studies/essential-information/regulations/plagiarism

Examination Offences: https://www.plymouth.ac.uk/student-life/your-studies/essential-information/exams/exam-rules-and-regulations/examination-offences

Turnitin (http://www.turnitinuk.com/) is an Internet-based 'originality checking tool' that allows documents to be compared with content on the Internet, in journals and in an archive of previously submitted works. It can help to detect unintentional or deliberate plagiarism.

It is a formative tool that makes it easy for students to review their citations and referencing as an aid to learning good academic practice. Turnitin produces an 'originality report' to help guide you. To learn more about Turnitin go to:
https://guides.turnitin.com/01_Manuals_and_Guides/Student/Student_User_Manual

AI Statement

As per the plagiarism section, any work submitted must be your own. The Faculty AI Policy is available for you on the DLE page to refer to. You may use AI to help structure your blog post and poster and to aid in generating ideas for the blog and poster. In the coding exercise, all code submitted must be your own.