Manchester Metropolitan
University

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Artificial Intelligence

Unit Handbook

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School of
Computing, Mathematics
and Digital Technology

1. Unit Staff

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2. Rationale

Artificial Intelligence (AI) has been a core topic of study within the field of Computer Science for many years, but often with a heavy theoretical component and relatively limited real-world applications. However, recent developments in research have seen things change rapidly, and AI has crept into almost every aspect of our modern lives, performing useful and increasingly important tasks with ever greater speed, reliability and subtlety (e.g., have a chat to ChatGPT if you haven't already[1] – and perhaps try asking it to write some code…). Whereas industry may once have expected Computing graduates to have only basic knowledge of the area, it is now likely that AI will be a pervasive, and perhaps dominant technology, during your professional lifetimes. Many of you may forge entire careers working specifically within the field of AI. All of you will be affected in at least some way by the rapid adoption of AI technologies across our industry and others.

The recent surge in the adoption and application of AI technologies has been driven by the impressive performance of Machine Learning (ML) algorithms (and deep learning algorithms in particular). These algorithms can learn to make intelligent, autonomous decisions by training on lots of real-world examples. When they are combined with large, high-quality datasets, ML algorithms can in certain circumstances outperform humans. Because of the impressive performance and exciting future potential of ML, we make it our focus here on this unit. Though there are many other topics we might have chosen to look at in a unit with the title "AI" – particularly if we were to look back at the history of the field – we believe that ML is the most exciting and contemporary sub-topic, deserving of our full attention.

We hope you will find learning about ML and what it is (and isn't) capable of, an interesting, challenging, and rewarding experience.

3. Course Aims and Outcomes

a. Aims

Our central aim on this unit is to develop a deep understanding of Machine Learning theory.

There are some great tools out there for applying ML algorithms to data. Using these tools in combination with good-quality free datasets, it's possible to get impressive results quickly (e.g. by following along with an online tutorial). However, if we *only* learn how to use the tools, and don't get to grips with what's going on behind the scenes – i.e., how the algorithm *actually works* – then our knowledge remains superficial and our capacity to respond to new and unexpected scenarios in future is limited.

[1] https://openai.com

For this reason we prioritise gaining a deep understanding of the theory on this unit. This should ensure our skills aren't founded only on superficial knowledge, and that we can respond appropriately to the kinds of new and unexpected scenarios we might meet in industry.

That said, you will sometimes want to try putting theory into practice in the labs and it isn't always appropriate to implement the theory from scratch. Probably the most convenient programming languages[2] with support for working on ML problems are (currently): Python, R, Matlab[3] and Julia. Because of its wide-spread use and popularity, excellent support for deep learning (via packages like Tensorflow and Pytorch), and free browser-based access via Google Colab[4], we will focus mainly on using Python. However, you are free to use any languages you wish, and all of the other options are available to you on the University lab machines.

Finally, we will encourage you to engage with the contemporary debate on ethics and safety in ML and AI. With recent developments in large language models (e.g., ChatGPT) and other powerful generative technologies (e.g., Stable Diffusion for images), industry, academia, governments and regulators are all working quickly to establish and enforce guidelines which are safe and fair, but yet practical, and supportive of innovation. We will encourage you to spend some time reviewing these efforts – particularly in the UK[5], but also across the globe[6] – and considering how they apply to real-world ML and AI development activities.

b. Specific Learning Outcomes

On successful completion of this unit, students will be able to…

1. Analyse a real-world problem and select an appropriate combination of algorithms, building blocks and techniques from AI to produce a solution.
2. Appraise and evaluate theoretical and practical issues underpinning AI and justify design choices for AI problem solving strategies.
3. Design, execute and evaluate an experimental plan to create and optimise a small real-world system incorporating AI techniques.

4. Format and Procedures

This unit consists of 11 weeks of scheduled teaching activities, outlined in a tentative course schedule[7]. Each week has two hours of lectures plus two 2-hour labs, and we typically recommend around 3-4 hours of self-directed study to stay on top of things. Tutors also have weekly office hours and drop-in slots. The days and times of your lectures and labs can be found on your timetable, which is accessed through the MyMMU website[8].

[2] Though note that they all typically depend on extra packages or toolboxes to support specific ML techniques
[3] Matlab is perhaps more controversial, because it is not free (however the University has excellent licensing arrangements in place)
[4] https://colab.research.google.com/
[5] https://www.gov.uk/guidance/understanding-artificial-intelligence-ethics-and-safety
[6] https://www.gov.uk/government/news/uk-to-host-first-global-summit-on-artificial-intelligence
[7] Section 10
[8] http://my.mmu.ac.uk

It is expected that you will complete all self-directed study and attend all lecture/lab sessions, and where you cannot attend in exceptional circumstances, that you endeavour to catch up on the work you have missed **prior** to the following week's sessions, which will build on the work from the previous week. If you need help with this, you should contact one of the tutors **as soon as possible**, preferably before the next week.

5. Our Assumptions

All students enrolled on this unit are on degree programmes where AI and ML is right at the heart of those contemporary techniques employed in both research and industry. We assume that students come to the unit with a strong desire to learn more about these areas, and a readiness to devote their time and effort to make a success of their studies. Specifically, we assume that all students will spend *upwards of* 2 hours per week on self-directed study for this unit (as a rule of thumb we suggest 3-4). In many cases, it may be necessary to take more time, for example if you are finding a particular topic difficult.

Although the unit does require some hard work, we hope you'll find it interesting and rewarding, and that it will stand you in good stead for the next steps in your career.

6. Course Requirements

To pass this unit successfully, you will need to demonstrate that you have met all of the Specific Learning Outcomes (Section 3b). To be assessed in these, you will complete one piece of coursework (1CWK100), worth 100% of the unit's final mark. To review the requirements for passing an individual unit, or your year, please check the university's assessment regulations.

It is important that you read the coursework specification, detailed separately and released on Moodle in due course, thoroughly, and discuss with your tutor any questions you have regarding the specification. Time will be made available for this during labs later in the semester, and you're always welcome to get in direct contact with your tutors (Section 1).

7. Academic Integrity

Each student on this unit is expected to abide by the Manchester Metropolitan University student Code of Conduct[9]. Any work submitted by a student on this unit for academic credit will be the student's own work.

You are encouraged to study together and to discuss information and concepts covered in lectures with other students. You can give "consulting" help or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all, or part of, work done by someone else, in any form.

Issues of suspected copying will be treated as plagiarism, using the university's assessment regulations and procedures for handling academic misconduct, available from the Manchester Metropolitan University website.[10] Note in particular that passing off output from generative AI models (like ChatGPT) *as your own work*, is treated as a form of contract cheating.

[9] Available from the Manchester Metropolitan University website, http://www.mmu.ac.uk/

[10] https://www.mmu.ac.uk/student-case-management/guidance-for-students/academic-misconduct/

8. Accommodations for Students with Disabilities

In compliance with Manchester Metropolitan University policy and equal access laws, we are available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations should be made as soon as possible, so that arrangements can be made. Students are encouraged to register with Disability Support[11] to verify their eligibility for appropriate accommodations.

9. Inclusivity Statement

We understand that our students represent a rich variety of backgrounds and perspectives. The Computing and Digital Technology Network is committed to providing an atmosphere for learning that respects diversity. While working together to build this community, we ask all members to:

- Share their unique experiences, values and beliefs
- Be open to the views of others
- Honour the uniqueness of their colleagues
- Appreciate the opportunity that we have to learn from others in this community
- Value each other's opinions and communicate in a respectful manner
- Keep confidential discussions that the community has of a personal (or professional) nature
- Use this opportunity together to discuss ways in which we create an inclusive environment in this course and across Manchester Metropolitan University

[11] https://www.mmu.ac.uk/student-life/wellbeing/disability/

10. Tentative Course Schedule

The plan for the unit is as follows. The tutors may deem it necessary to move, or adjust, the topics based on their observations as the unit progresses, but the latest schedule will always be available via Moodle.

Week Beginning	Topics
02/10/2023	Introduction, Ethics and Safety, Supervise Learning Recipe I
09/10/2023	Supervised Learning Recipe II, k-Nearest Neighbours Classification
16/10/2023	Feature Space Visualisation and other classifiers
23/10/2023	Ensembles, Regression
30/10/2023	Logistic Regression, Artificial Neural Networks
06/11/2023	Deep Learning, Feature Extraction I
13/11/2023	Recurrent Neural Networks, Attention and Transformers
20/11/2023	Unsupervised Learning I, Feature Extraction II
27/11/2023	Unsupervised Learning II
04/12/2023	Deep Unsupervised Learning, Reinforcement Learning
11/12/2023	[Slip, requests, formative feedback]
18/12/2023	Christmas Break
25/12/2023	Christmas Break
01/01/2024	Christmas Break
08/01/2024	Assessment Week
15/01/2024	Assessment Week

With thanks to the Cornell University's Centre for Teaching Excellence for the template on which this handbook is based.