UNSW Course Outline

HDAT9500 Health Data Analytics: Machine Learning I - 2024

Published on the 12 May 2024

General Course Information

Course Code : HDAT9500
Year : 2024
Term : Term 2
Teaching Period : T2
Is a multi-term course? : No
Faculty : Faculty of Medicine and Health
Academic Unit : School of Biomedical Sciences
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course provides an introduction to machine learning in health. You will learn about the theory and application of both supervised learning methods for classification and regression, and unsupervised learning techniques including dimensionality reduction and clustering.

The course follows a hands-on approach, designed to equip you with the skills and knowledge necessary to effectively address and solve healthcare data challenges using the machine learning techniques taught throughout the course.

Course Aims

This introductory machine learning course aims to equip you with a foundational understanding of machine learning concepts, practical skills through hands-on examples, and proficiency in implementing the machine learning workflow.

Relationship to Other Courses

The formal prerequisites are "HDAT9200 Statistical Foundations of Health Data Science" and "HDAT9600 Statisticall Modelling I" and "HDAT9300 Computing for Health Data Science".

To understand how "HDAT9500 - Health Data Analytics: Machine Learning I" relates to other courses, please check "A guided tutorial in Health Data Science" on our Student Hub.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Distinguish a range of task specific machine learning techniques appropriate for Health Data Science
CLO2 : Design machine learning tasks for Health Data Science scenarios
CLO3 : Apply a machine learning workflow to health data problems
CLO4 : Explain and interpret the analyses from machine learning applications in health data

Course Learning Outcomes	Assessment Item
CLO1 : Distinguish a range of task specific machine learning techniques appropriate for Health Data Science	• Project 1 • Project 2 • Chapter Quiz
CLO2 : Design machine learning tasks for Health Data Science scenarios	• Project 1 • Project 2
CLO3 : Apply a machine learning workflow to health data problems	• Chapter Quiz • Project 1 • Project 2
CLO4 : Explain and interpret the analyses from machine learning applications in health data	• Chapter Quiz • Project 1 • Project 2

Learning and Teaching Technologies

Open Learning | Microsoft Teams

Learning and Teaching in this course

All course materials and course announcements are provided on the course learning management system.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Project 1 Assessment Format: Individual	40%	Due Date: Week 6: 01 July - 07 July
Project 2 Assessment Format: Individual	40%	Due Date: Week 11: 05 August - 11 August
Chapter Quiz Assessment Format: Individual	20%	Due Date: Week 3 and Week 8

Assessment Details
Project 1

Assessment Overview

This assessment is designed to strengthen your practical understanding of the machine learning workflow taught in our course. You will receive a health dataset and a health data science question, and you will be expected to produce a solution in the form of a computer program accompanied by a short report detailing your methodology and findings.

This assignment is an individual assessment that covers the first half of the course and is due around the mid-term of the course.

You will receive individual feedback, and there will also be overall feedback provided for the entire cohort.

Course Learning Outcomes

- CLO1 : Distinguish a range of task specific machine learning techniques appropriate for Health Data Science
- CLO2 : Design machine learning tasks for Health Data Science scenarios
- CLO3 : Apply a machine learning workflow to health data problems
- CLO4 : Explain and interpret the analyses from machine learning applications in health data

Detailed Assessment Description

Detailed information about this assessment will be provided on the course Open Learning page.

Submission notes

Short extension & Special consideration: This assessment does not have a short extension option.

Assessment information

For this assessment, Generative Artificial Intelligence (AI) is allowed with full assistance with attribution. This means that you may use AI-based software to research and prepare the coding and written parts of your assessment. Note that AI-derived code is frequently incorrect, and AI-derived text is typically generic, unhelpful or just plain wrong. Use these technologies wisely, as a handrail not a crutch.

Use of AI must be acknowledged in your assessment. Please refer to the UNSW referencing page for guidance on how to cite AI tools: https://www.student.unsw.edu.au/ai-referencing.

Assignment submission Turnitin type

Not Applicable

Project 2

Assessment Overview

This assessment is designed to strengthen your practical understanding of the machine learning workflow taught in our course. You will receive a health dataset and a health data science question, and you will be expected to produce a solution in the form of a computer program accompanied by a short report detailing your methodology and findings.

This assignment is an individual assessment that covers the whole course with emphasis on the second half of the course and is due at the end of the course.

You will receive individual feedback, and there will also be overall feedback provided for the entire cohort.

Course Learning Outcomes
- CLO1 : Distinguish a range of task specific machine learning techniques appropriate for Health Data Science
- CLO2 : Design machine learning tasks for Health Data Science scenarios
- CLO3 : Apply a machine learning workflow to health data problems
- CLO4 : Explain and interpret the analyses from machine learning applications in health data

Detailed Assessment Description

Detailed information about this assessment will be provided on the course Open Learning page.

Submission notes

Short extension & Special consideration: This task does not have a short extension option.

Assessment information

For this assessment, Generative Artificial Intelligence (AI) is allowed with full assistance with attribution. This means that you may use AI-based software to research and prepare the coding and written parts of your assessment. Note that AI-derived code is frequently incorrect, and AI-derived text is typically generic, unhelpful or just plain wrong. Use these technologies wisely, as a handrail not a crutch.

Use of AI must be acknowledged in your assessment. Please refer to the UNSW referencing page for guidance on how to cite AI tools: https://www.student.unsw.edu.au/ai-referencing.

Assignment submission Turnitin type

Not Applicable

Chapter Quiz

Assessment Overview

This assessment consists of two multiple choice quizzes with equal weight, designed to evaluate your understanding of the concepts covered and to identify areas that may require further clarification or improvement.

The first quiz will be conducted during the early part of the course, while the second will take place in the second half of the course.

You will receive individual feedback, as well as class-level feedback. We will discuss and review this feedback during subsequent class sessions.

Course Learning Outcomes

- CLO1 : Distinguish a range of task specific machine learning techniques appropriate for Health Data Science
- CLO3 : Apply a machine learning workflow to health data problems
- CLO4 : Explain and interpret the analyses from machine learning applications in health data

Detailed Assessment Description

Detailed information about this assessment will be provided on the course Open Learning page.

<u>Submission notes</u>

Short extension & Special consideration: This task does not have a short extension option.

<u>Assessment information</u>

Additional information about this assessment will be provided on the course Open Learning page.

<u>Assignment submission Turnitin type</u>

This is not a Turnitin assignment

General Assessment Information

Detailed instructions regarding assessments for this course are provided on the course page.

For student information on results, grades, and guides to assessment see: https://student.unsw.edu.au/assessment

Adopting a critical approach to your assignments

It is important that you adopt a critical approach to the material that you source for assignments, to the required readings, and to other resources you are presented with during the course. Think about and evaluate the material which you are reading and which you are presenting in assignments. Attempt to cast aside your assumptions and biases and attempt to assess the logic and consistency of the material in light of the supporting evidence. Wide reading on a topic facilitates this.

Referencing

All additional resources used should be properly cited and attributed.

Students should use either APA or Vancouver referencing styles for all assignments for this course.

It is your responsibility to learn either APA or Vancouver referencing and use it consistently to acknowledge sources of information (citing references). Failure to reference correctly may limit marks to PS or below. Guidelines for acknowledging sources of information can be found on the following websites:

- UNSW Library: http://subjectguides.library.unsw.edu.au/elise
- UNSW Academic Skills and Support: https://student.unsw.edu.au/skills

Word limits

All word limits are to be strictly adhered to (i.e. there is no 10% leeway). Word limits include all text (e.g. headings, title, main text) and exclude tables and figures, in-text citations (if you are using APA) and reference lists.

Grading Basis

Standard

Requirements to pass course

Achieve a composite mark of at least 50 out of 100.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Introduction to Machine Learning.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming • Machine Learning algorith: K-Nearest Neighbours. This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 2 : 3 June - 9 June	Lecture	Linear Prediction: • Standard Linear Regression. • Logistic Regression. • Reguralization: Ridge and Lasso. Hyperparemeters.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 3 : 10 June - 16 June	Lecture	Model Evaluation and Improvement: • Evaluation metrics. • Cross-validation. • Hyperparameter tuning.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 4 : 17 June - 23 June	Lecture	Tree-based methods: • Decision Tree. • Ensemble Learning and Random Forests.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 5 : 24 June - 30 June	Lecture	Tree-based methods: • Ensemble Learning and Random Forests. • Gradient Boosted Decision Trees.

	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 7 : 8 July - 14 July	Lecture	Introduction to Artificial Neural Networks: • Feed Forward Neural Network.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 8 : 15 July - 21 July	Lecture	Introduction to Artificial Neural Networks.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 9 : 22 July - 28 July	Lecture	Unsupervised Learning: • Clustering. • Dimensionality Reduction.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.
Week 10 : 29 July - 4 August	Lecture	Unsupervised Learning: • Clustering. • Dimensionality Reduction.
	Laboratory	Health Data Science Activity In this laboratory exercise, students will engage in a practical application of health data science. A specific research question within the field of health will be presented, and participants will collaboratively work towards formulating solutions. This activity is designed to integrate theoretical knowledge with practical skills in machine learning and health data analysis. Resources : • Dataset. • Google Colab: A cloud-based Python programming environment that facilitates code writing, running, and sharing. • Python Programming This lab provides an opportunity for hands-on experience, fostering both individual and collective problem-solving abilities in real-world contexts.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The times and locations of classes can be found on myUNSW under Class Timetable.

Course Resources

Prescribed Resources

All course materials and course announcements are provided on the course learning management system.

Recommended Resources

All course materials and course announcements are provided on the course learning management system.

Additional Costs

There are no additional costs associated with this course.

Course Evaluation and Development

Student feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

We use student feedback from myExperience surveys to develop and make improvements to the course each year. We do this by identifying areas of the course that require development from both the rating responses and written comments. Please spare a few minutes to complete the myExperience surveys for this course posted at the top of the Moodle page at the end of term.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Oscar Perez Concha					No	Yes

Other Useful Information

Academic Information

As a student of UNSW Medicine & Health you are expected to familiarise yourself with the contents of this course outline and the UNSW Student Code and policies and procedures related to your studies.

Student Code of Conduct

Throughout your time studying at UNSW Medicine & Health, you share a responsibility with us for maintaining a safe, harmonious and tolerant University environment. This includes within the courses you undertake during your degree and your interactions with the UNSW community, both on campus and online.

The UNSW Student Code of Conduct website provides a framework for the standard of conduct expected of UNSW students with respect to both academic integrity and your responsibility as a UNSW citizen.

Where the University believes a student may have breached the code, the University may take disciplinary action in accordance with the Student Misconduct Procedure.

The Student Conduct and Integrity Office provides further resources to assist you to understand your conduct obligations as a student at UNSW.

Academic Honesty and Plagarism

Academic integrity

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to the principle of academic integrity, and ethical scholarship of learning is fundamental to your success at UNSW Medicine & Health.

Plagiarism, contract cheating, and inappropriate use of generative AI undermine academic integrity and are not tolerated at UNSW. For more information see the Academic Integrity and Plagiarism toolkit.

In addition to the information you are required to review in your ELISE training, UNSW Medicine &

Health strongly recommends that you complete the Working with Academic Integrity module before submitting your first assessment task.

Referencing

Referencing is a way of acknowledging the sources of information that you use to research your assignments. Preferred referencing styles vary among UNSW Medicine & Health disciplines, so check your course Learning Management System (e.g. Moodle or Open Learning) page for information on preferred referencing styles.

For further information on referencing support and styles, see the Current Student Referencing page.

Academic misconduct and plagiarism

At UNSW, academic misconduct is managed in accordance with the Student Misconduct Procedure. Allegations of plagiarism are generally handled according to the UNSW Plagiarism Management Procedure. Plagiarism is defined in the UNSW Plagiarism Policy and is not tolerated at UNSW.

Use of Generative AI and other tools in your assessment

UNSW has provided guiding statements for the use of Generative AI in assessments. This will differ, depending on the individual assessment task, your course requirements, and the course stage within your program.

Your course convenor will outline if and how you can use Generative AI in each your assessment tasks. Options for the use of generative AI include: (1) no assistance; (2) simple editing assistance; (3) planning assistance; and (4) full assistance with attribution.

You may be required to submit the original generative AI responses, or drafts of your original work. Inappropriate use of generative AI is considered academic misconduct.

See your course Moodle (or Open Learning) page for the full instructions for individual assessment tasks for your course.

Submission of Assessment Tasks

Special Consideration

In cases where illness, misadventure or other circumstances beyond your control will prevent you from submitting your assessment by the due date and you require an extension, you need to formally apply for Special Consideration through myUNSW.

UNSW has a **Fit to Sit/Submit rule**, which means that by sitting or submitting an assessment on the scheduled assessment date, you are declaring that you are fit to do so and cannot later apply for Special Consideration.

Timed online assessment tasks

If you experience a technical or connection problem during a timed online assessment, such as a timed quiz, you can apply for Special Consideration. To be eligible to apply you need to contact the Course Convenor and advise them of the issue immediately. You will need to submit an application for Special Consideration immediately, and upload screenshots, error messages or other evidence of the technical issue as supporting documentation. Additional information can be found on: https://student.unsw.edu.au/special-consideration

Examinations

Information about the conduct of examinations in your course is provided on your course Moodle page.

Other assessment tasks

Late submission of assessment tasks

UNSW has standard late submission penalties as outlined in the UNSW Assessment Implementation Procedure, with no permitted variation. All late assignments (unless extension or exemption previously agreed) will be penalised by 5% of the maximum mark per calendar day (including Saturday, Sunday and public holidays).

Late submissions penalties are capped at five calendar days (120 hours). This means that a student is not permitted to submit an assessment more than 5 calendar days (120 hours) after the due date for that assessment (unless extension or exemption previously agreed).

Failure to complete an assessment task

You are expected to complete all assessment tasks for your courses. In some courses, there will be a minimum pass mark required on a specific assessment task (a "hurdle task") due to the

need to assure clinical competency.

Where a hurdle task is applicable, additional information is provided in the assessment information on your course Moodle page.

Feedback on assessments

Feedback on your performance in assessment tasks will be provided to you in a timely manner. For assessment tasks completed within the teaching period of a course, other than a final assessment, feedback will be provided within 10 working days of submission, under normal circumstances.

Feedback on continuous assessment tasks (e.g. laboratory and studio-based, workplace-based, weekly quizzes) will be provided prior to the midpoint of the course.

Any variation from the above information that is specific to an assessment task will be clearly indicated in the course and assessment information provided to you on your course Moodle (or Open Learning) page.

Faculty-specific Information

Additional support for students

The university offers a wide range of support services that are available for students. Here are some links for you to explore.

- The Current Students Gateway: https://student.unsw.edu.au

- Academic Skills and Support: https://student.unsw.edu.au/academic-skills

- Student support: https://www.student.unsw.edu.au/support

- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing

Mind Smart Guides are a series of mental health self-help resources designed to give you the psychological flexibility, resilience and self-management skills you need to thrive at university and at work.

- Mind Smart Guides: https://student.unsw.edu.au/mindsmart

- Equitable Learning Services: https://student.unsw.edu.au/els

- Guide to studying online: https://www.student.unsw.edu.au/online-study

Most courses in UNSW Medicine & Health use Moodle as your Learning Management System. Guidance for using UNSW Moodle can be found on the Current Student page. Difficulties with Moodle should be logged with the IT Service Centre.

- Moodle Support: https://student.unsw.edu.au/moodle-support

The IT Service Desk is your central point of contact for assistance and support with remote and on-campus study.

- UNSW IT Service Centre: https://www.myit.unsw.edu.au/services/students

Course evaluation and development

At UNSW Medicine & Health, students take an active role in designing their courses and their overall student experience. We regularly seek feedback from students, and continuous improvements are made based on your input. Towards the end of the term, you will be asked to participate in the myExperience survey, which serves as a source of evaluative feedback from students. Your input to this quality enhancement process is valuable in helping us meet your learning needs and deliver an effective and enriching learning experience. Student responses are carefully considered, and the action taken to enhance educational quality is documented in the myFeedback Matters section of your Moodle (or Open Learning) course page.

School-specific Information

Laboratory or practical class safety.

For courses where there is a laboratory or practical-based component, students are required to wear the specified personal protective equipment (e.g., laboratory coat, covered shoes, safety glasses) indicated in the associated student risk assessments. The student risk assessments will be provided on the course Moodle page and must be read and acknowledged prior to the class.

Master of Science in Health Data Science courses

Courses in the Master of Science in Health Data Science are hosted through Open Learning. Additional resources are available on the Health Data Science Student Hub.

Recording of lectures, tutorials and other teaching activities (MSc. HDS only)

Lectures, tutorials and other teaching activities may be recorded. Students should be advised that they are consenting to the recording by their enrolment in the course or participation in the activity. The purpose of audio and video recordings is to enhance the student experience by supporting engaged learning in an online teaching environment and ensure equitable access to all course resources for our students. If you have concerns about accessing course recordings, or being recorded, please contact the Course Convenor.

School Contact Information

School guidelines on contacting staff:

Course questions

All questions related to course content should be posted on Moodle (or Open Learning) or as directed by your Course Convenor.

In cases where email communication with course convenors is necessary, we kindly request the following:

- Use your official email address for any correspondence with teaching staff.

- We expect a high standard of communication. All communication should avoid using short-hand or texting language.

- Include your full name, student ID, and your course code and name in all communication.

Our course convenors are expected to respond to emails during standard working hours of Monday to Friday, 9am-5pm.

Administrative questions

If you have an administrative question about your program of study at the School please submit

your enquiry online at UNSW Ask Us.

Complaints and appeals

Student complaints and appeals: https://student.unsw.edu.au/complaints

If you have any grievances about your studies, we invite you to address these initially to the Course Convenor. If the response does not meet your expectations, you may then contact:

School Grievance Officer, Prof Nick Di Girolamo (n.digirolamo@unsw.edu.au)

Health Data Science programs: School Grievance Officer, Dr Sanja Lujic (s.lujic@unsw.edu.au)