UNSW Course Outline

ACTL5305 Actuarial Data Science Applications - 2024

Published on the 26 Aug 2024

General Course Information

Course Code : ACTL5305
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : UNSW Business School
Academic Unit : School of Risk and Actuarial Studies
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course covers the actuarial professional associateship syllabus for the actuarial data science principles. It combines data analytics and modelling concepts with the practical applications of modern analytical tools and techniques, as well as their actuarial

applications. This course covers the key iterative steps involved in building a model - business understanding, data understanding and preparation, modelling, evaluation, communication and deployment. Particular focus will be on the selection of appropriate predictive modelling techniques for a stated situation and how to evaluate the suitability of a model, taking into account business context and objectives, as well as on the communication of modelling results to a range of business decision making audiences.

Course Aims

The aim of this course is to provide students with understanding and ability to handle actuarial data in order to solve actuarial problems.

Course Learning Outcomes

Course Learning Outcomes	Program learning outcomes
CLO1 : Explain the key iterative steps involved in building a model, including business understanding, data understanding and preparation, modelling, evaluation, communication, and deployment.	• PLO1 : Business Knowledge • PLO2 : Problem Solving • PLO3 : Business Communication
CLO2 : Explain the features and recognise the limitations of predictive analytics techniques and apply each technique in practice.	• PLO1 : Business Knowledge • PLO2 : Problem Solving
CLO3 : Evaluate critically the appropriateness of predictive analytics models in practice, emphasising business understanding.	• PLO1 : Business Knowledge • PLO2 : Problem Solving • PLO5 : Responsible Business Practice
CLO4 : Communicate effectively and appraise critically the modelling results through presentations, discussions, and written reports.	• PLO3 : Business Communication • PLO4 : Teamwork • PLO7 : Leadership Development
CLO5 : Discuss and identify the ethical considerations in data science and algorithm development.	• PLO5 : Responsible Business Practice

Course Learning Outcomes	Assessment Item
CLO1 : Explain the key iterative steps involved in building a model, including business understanding, data understanding and preparation, modelling, evaluation, communication, and deployment.	• Assignment • Discussion questions • Final exam
CLO2 : Explain the features and recognise the limitations of predictive analytics techniques and apply each technique in practice.	• Assignment • Discussion questions • Final exam
CLO3 : Evaluate critically the appropriateness of predictive analytics models in practice, emphasising business understanding.	• Assignment • Discussion questions • Final exam
CLO4 : Communicate effectively and appraise critically the modelling results through presentations, discussions, and written reports.	• Assignment • Discussion questions
CLO5 : Discuss and identify the ethical considerations in data science and algorithm development.	• Assignment

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

The approach adopted in this course is a blended classroom. This approach integrates student-centred, in-class (live) learning with self-study (home) learning. In this blended approach, the first conceptual encounter with the materials happens at home when students study the relevant course material (e.g. video lectures, lecture notes and reading lists). The second conceptual encounter with the material of a given module happens in class, i.e. in a workshop to deepen the understanding of related topics, spark students' interest with practical case studies, answer students' questions in the self-study process and provide a context for the subsequent modules and lab sessions. In a workshop, the lecturer provides a high-level summary of the key concepts of the module and runs other activities (such as Q&A, discussions, advanced exercises, guest lectures, real-life applications, and assignment consultancy) that aim to cement students learning. Finally, the students move on to practicing their knowledge via in-class labs in small groups. Lab sessions aim to equip students with application and implementation skills using software (R, R Studio, R Markdown) by solving real-world problems and providing personalised help on a weekly basis. This course consists of:

- Self-study course material available on the course Moodle website (e.g. video lectures, lecture notes, reading list, exercises/questions),
- Weekly workshops,
- Weekly labs, and
- Weekly consultation times.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Group Short Extension: Yes (3 days)	30%	
Discussion questions Assessment Format: Individual Short Extension: Yes (1 day)	10%	
Final exam Assessment Format: Individual	60%	

Assessment Details
Assignment

<u>Assessment Overview</u>

Incorporate real-world industry challenges to help student apply knowledge and techniques learned in class to businesses. Presentations to help students develop their presentation skills; group activities to help students learn course contents in a collaborative manner.

<u>Course Learning Outcomes</u>

- CLO1 : Explain the key iterative steps involved in building a model, including business understanding, data understanding and preparation, modelling, evaluation, communication, and deployment.
- CLO2 : Explain the features and recognise the limitations of predictive analytics techniques and apply each technique in practice.
- CLO3 : Evaluate critically the appropriateness of predictive analytics models in practice, emphasising business understanding.
- CLO4 : Communicate effectively and appraise critically the modelling results through presentations, discussions, and written reports.
- CLO5 : Discuss and identify the ethical considerations in data science and algorithm development.

<u>Generative AI Permission Level</u>

Planning/Design Assistance

You are permitted to use generative AI tools, software or services to generate initial ideas, structures, or outlines. However, you must develop or edit those ideas to such a significant extent that what is submitted is your own work, i.e., what is generated by the tool, software or service should not be a part of your final submission. You should keep copies of your iterations to show your Course Authority if there is any uncertainty about the originality of your work.

If your Convenor has concerns that your answer contains passages of AI-generated text or media that have not been sufficiently modified you may be asked to explain your work, but we recognise that you are permitted to use AI generated text and media as a starting point and some traces may remain. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.

For more information on Generative AI and permitted use please see here.

Discussion questions

Discussion activities to help students learn course contents in an interactive and active manner.

Course Learning Outcomes

- CLO1 : Explain the key iterative steps involved in building a model, including business understanding, data understanding and preparation, modelling, evaluation, communication, and deployment.
- CLO2 : Explain the features and recognise the limitations of predictive analytics techniques and apply each technique in practice.
- CLO3 : Evaluate critically the appropriateness of predictive analytics models in practice, emphasising business understanding.
- CLO4 : Communicate effectively and appraise critically the modelling results through presentations, discussions, and written reports.

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Final exam

Exam to assess students' knowledge, application, and critical thinking related to course contents.

Course Learning Outcomes

- CLO1 : Explain the key iterative steps involved in building a model, including business

understanding, data understanding and preparation, modelling, evaluation, communication, and deployment.

- CLO2 : Explain the features and recognise the limitations of predictive analytics techniques and apply each technique in practice.
- CLO3 : Evaluate critically the appropriateness of predictive analytics models in practice, emphasising business understanding.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.

For more information on Generative AI and permitted use please see here.

General Assessment Information

As a student at UNSW you are expected to display academic integrity in your work and interactions. Where a student breaches the UNSW Code of Conduct with respect to academic integrity, the University may take disciplinary action. To assure academic integrity, you may be required to demonstrate reasoning, research and the process of constructing work submitted for assessment.

To assist you in understanding what academic integrity means, and how to ensure that you do comply with the UNSW Code of Conduct, it is strongly recommended that you complete the Working with Academic Integrity module before submitting your first assessment task. It is a free, online self-paced Moodle module that should take about one hour to complete.

Grading Basis

Standard

Requirements to pass course

In order to pass this course, you must:

- achieve a composite mark of at least 50 out of 100;
- meet any additional requirements described in the Assessment Summary section.

You are expected to attempt all assessment requirements in the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Blended	• Introduction of Actuarial Data Analytics • Business Environment • Exploratory Data Analysis: Data Visualisation • Case Study
Week 2 : 16 September - 22 September	Blended	• Exploratory Data Analysis: Manipulation and Transformation • Exploratory Data Analysis: Import Data, Quality Check and Data Cleaning • Case Study
Week 3 : 23 September - 29 September	Blended	• Modelling and Shrinkage Techniques • Case Study
Week 4 : 30 September - 6 October	Blended	• Model Assessment and Selection • Communication • Case Study
Week 5 : 7 October - 13 October	Blended	• Generalised Linear Model • Case Study
Week 6 : 14 October - 20 October	Blended	Review and Reflection
Week 7 : 21 October - 27 October	Blended	• Random Forest • Case Study
Week 8 : 28 October - 3 November	Blended	• Gradient Boosting Machines • Case Study
Week 9 : 4 November - 10 November	Blended	• Neural Networks • Case Study
Week 10 : 11 November - 17 November	Blended	• Professional Ethics in Data Modelling • Case Study

Attendance Requirements

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

General Schedule Information

Please refer to Moodle for detailed schedule and key dates for assessment items.

Course Resources

Prescribed Resources

Course website

To access the Moodle online support site for students, follow the links from that website to UNSW Moodle Support/Support for Students. Additional technical support can be obtained from itservicecentre@unsw.edu.au (02 9385 1333).

All course contents will be available from the course website on Moodle. It is essential that you visit the site regularly to see any notices posted there by the course coordinator, as it will be assumed that they are known to you within a reasonable time.

Textbooks

There are many books of relevance to the course topics. We will use book chapters from different books. And the specific reading list for each module will be made available and posted on Moodle. The main books used in the course as listed below:

- Wickham, H., & Grolemund, G. (2016). R for data science: import, tidy, transform, visualize, and model data. O'Reilly Media, Inc.
- Peng, R. D., & Matsui, E. (2016). The Art of Data Science: A guide for anyone who works with Data. Skybrude consulting LLC.
- James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning. New York: Springer (or the Second Edition of this book in 2021).
- Hastie, T., Tibshirani, R., & Friedman, J. (2009). The elements of statistical learning: data mining, inference, and prediction. Springer Science & Business Media.

Additional readings from other books and the professional actuarial literature will also be used to provide additional context, details, and examples. This will be communicated in the course website.

Actuaries Institute

The Actuaries Institute allows students to become University Subscribers free of charge. Full time undergraduates studying at an Institute accredited university who are members of a university student actuarial society are eligible.

Course Evaluation and Development

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the myExperience survey, opens in a new window, which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

Each year feedback is sought from students and other stakeholders about the courses offered in the School and continual improvements are made based on this feedback. UNSW's Course and Teaching Evaluation and Improvement (myExperience) Process is one of the ways in which student evaluative feedback is gathered. In this course, we will seek your feedback during the course of the term (via Moodle based surveys) and end of session myExperience.

As a result of feedback from previous offerings in the course, significant changes and improvements were introduced in recent years with significant positive feedback from students as a result. In 2024, we will improve the course material by incorporating additional illustrative examples to further enhance student understanding. In addition, all lectures will be available via the lecture recording system in order to facilitate students' flexible learning strategies. These recordings become available via the Moodle course webpage.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Fei Huang					Yes	Yes

Other Useful Information
Academic Information

COURSE POLICIES AND SUPPORT

The Business School expects that you are familiar with the contents of this course outline and the UNSW and Business School learning expectations, rules, policies and support services as listed below:

- Program Learning Outcomes
- Academic Integrity and Plagiarism
- Student Responsibilities and Conduct
- Special Consideration
- Protocol for Viewing Final Exam Scripts
- Student Learning Support Services

Further information is provided on the Policies and Guidelines page.

Students may not circulate or post online any course materials such as handouts, exams, syllabi or similar resources from their courses without the written permission of their instructor.

STUDENT LEARNING OUTCOMES

The Course Learning Outcomes (CLOs) – under the Outcomes tab – are what you should be able to demonstrate by the end of this course, if you participate fully in learning activities and successfully complete the assessment items.

CLOs also contribute to your achievement of the Program Learning Outcomes (PLOs), which are developed across the duration of a program. PLOs are, in turn, directly linked to UNSW graduate capabilities. More information on Coursework PLOs is available on the Policies and Guidelines page. For PG Research PLOs, including MPDBS, please refer to UNSW HDR learning outcomes.

Academic Honesty and Plagarism

As a student at UNSW you are expected to display academic integrity in your work and interactions. Where a student breaches the UNSW Code of Conduct with respect to academic integrity, the University may take disciplinary action. To assure academic integrity, you may be required to demonstrate reasoning, research and the process of constructing work submitted for assessment.

To assist you in understanding what academic integrity means, and how to ensure that you do comply with the UNSW Code of Conduct, it is strongly recommended that you complete the Working with Academic Integrity module before submitting your first assessment task. It is a free, online self-paced Moodle module that should take about one hour to complete.

Submission of Assessment Tasks

SHORT EXTENSIONS

Short Extension is a new process that allows you to apply for an extended deadline on your assessment without the need to provide supporting documentation, offering immediate approval during brief, life-disrupting events. Requests are automatically approved once submitted.

Short extensions are ONLY available for some assessments. Check your course outline or Moodle to see if this is offered for your assessments. Where a short extension exists, all students enrolled in that course in that term are eligible to apply. Further details are available the UNSW Current Students page.

SPECIAL CONSIDERATION

You can apply for special consideration when illness or other circumstances beyond your control interfere with your performance in a specific assessment task or tasks, including online exams. Special consideration is primarily intended to provide you with an extra opportunity to demonstrate the level of performance of which you are capable.

Applications can only be made online and will NOT be accepted by teaching staff. Applications will be assessed centrally by the Case Review Team, who will update the online application with the outcome and add any relevant comments. The change to the status of the application immediately sends an email to the student and to the assessor with the outcome of the application. The majority of applications will be processed within 3-5 working days.

For further information, and to apply, see Special Consideration on the UNSW Current Students page.

LATE SUBMISSION PENALTIES

LATE SUBMISSION PENALTIES

For assessments other than examinations, late submission will incur a penalty of 5% per day or part thereof (including weekends) from the due date and time. An assessment will not be accepted after 5 days (120 hours) of the original deadline unless special consideration has been approved. In the case of an approved Equitable Learning Plan (ELP) provision, special consideration or short extension, the late penalty applies from the date of approved time extension. After five days from the extended deadline, the assessment cannot be submited.

An assessment is considered late if the requested format, such as hard copy or electronic copy, has not been submitted on time or where the 'wrong' assessment has been submitted.

For assessments which account for 10% or less of the overall course grade, and where answers are immediately discussed or debriefed, the LIC may stipulate a different penalty. Details of such late penalties will be available on the course Moodle page.

FEEDBACK ON YOUR ASSESSMENT TASK PERFORMANCE

Feedback on student performance from formative and summative assessment tasks will be provided to students in a timely manner. Assessment tasks completed within the teaching period of a course, other than a final assessment, will be assessed and students provided with feedback, with or without a provisional result, 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.

Faculty-specific Information

PROTOCOL FOR VIEWING FINAL EXAM SCRIPTS

UNSW students have the right to view their final exam scripts, subject to a small number of very specific exemptions. The UNSW Business School has set a [protocol](#) under which students may view their final exam script. Individual schools within the Faculty may also set up additional local processes for viewing final exam scripts, so it is important that you check with your School.

If you are completing courses from the following schools, please note the additional school-specific information:

- Students in the **School of Accounting, Auditing & Taxation** who wish to view their final examination script should also refer to [this page](#).
- Students in the **School of Banking & Finance** should also refer to [this page](#).
- Students in the **School of Information Systems & Technology Management** should also refer to [this page](#).

COURSE EVALUATION AND DEVELOPMENT

Feedback is regularly sought from students and continual improvements are made based on this feedback. At the end of this course, you will be asked to complete the [myExperience survey](#), which provides a key source of student evaluative feedback. Your input into this quality enhancement process is extremely valuable in assisting us to meet the needs of our students and provide an effective and enriching learning experience. The results of all surveys are carefully considered and do lead to action towards enhancing educational quality.

QUALITY ASSURANCE

The Business School is actively monitoring student learning and quality of the student experience in all its programs. A random selection of completed assessment tasks may be used for quality assurance, such as to determine the extent to which program learning goals are being achieved. The information is required for accreditation purposes, and aggregated findings will be used to inform changes aimed at improving the quality of Business School programs. All material used for such processes will be treated as confidential.

TEACHING TIMES AND LOCATIONS

Please note that teaching times and locations are subject to change. Students are strongly

advised to refer to the Class Timetable website for the most up-to-date teaching times and locations.