UNSW Course Outline

ACTL5110 Statistical Machine Learning for Risk and Actuarial Applications - 2024

Published on the 12 May 2024

General Course Information

Course Code : ACTL5110
Year : 2024
Term : Term 2
Teaching Period : T2
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 syllabus for data analysis including techniques for

mortality, health, and insurance data used in actuarial analysis and decision-making. The course covers aspects of data analysis including exploratory data analysis, data checking and cleaning, and data visualization; classification and prediction with regression and generalized linear models; descriptive, inferential and predictive analysis and models; and statistical and machine learning including supervised and unsupervised learning. The course also covers ethical, regulatory and professional issues, and risks and risk management associated with using data and data analysis. A particular focus will be placed on communication of technical results for business applications.

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.

Relationship to Other Courses

The aims of this course are to provide students with an understanding of the main techniques on predictive analytics / data analytics techniques of particular relevance to actuarial work, including

- Regression techniques and classification methods
- Model selection and validation methods including cross validation and dimension reduction
- Linear and Non-linear models
- Decision Trees and extensions
- Supervised and unsupervised learning techniques

Students are assumed to have a good mathematics background and a solid understanding of the concepts of probability and statistics, and actuarial modelling.

Students need to be able to use a word processing package (such as Word) and a spreadsheet (such as Excel). They should also be able to use the statistical software package R which will be used to implement many of the models discussed in this course, and in particular in the lab classes.

Course Learning Outcomes

Course Learning Outcomes	Program learning outcomes
CLO1 : Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims.	• PLO1 : Business Knowledge • PLO2 : Problem Solving
CLO2 : Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings.	• PLO1 : Business Knowledge • PLO2 : Problem Solving
CLO3 : Estimate and apply various statistical learning models for practical applications.	• PLO1 : Business Knowledge • PLO2 : Problem Solving
CLO4 : Understand and explain ethical and regulatory issues associated with the use of data and analytic techniques.	• PLO1 : Business Knowledge • PLO5 : Responsible Business Practice
CLO5 : Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management.	• PLO3 : Business Communication

Course Learning Outcomes	Assessment Item
CLO1 : Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims.	• Formative Assessment • Assignment • Final exam
CLO2 : Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings.	• Formative Assessment • Assignment • Final exam
CLO3 : Estimate and apply various statistical learning models for practical applications.	• Formative Assessment • Assignment • Final exam
CLO4 : Understand and explain ethical and regulatory issues associated with the use of data and analytic techniques.	• Assignment
CLO5 : Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management.	• Formative Assessment • Final exam • Assignment

Learning and Teaching Technologies

Moodle - Learning Management System | Zoom | EdStem | Echo 360

Learning and Teaching in this course

This course consists of:

- Self-study course material available on the course Moodle website (e.g. textbook chapters, video lectures, lecture notes, exercises),

- Weekly lectures,

- Weekly labs, and

- Weekly consultation times.

Additional Course Information

This course covers the *Regression theory and applications* part of the subject 'CS1 – Actuarial Statistics 1' and the *Machine learning* part of 'CS2 – Risk Modelling and Survival Analysis Core Principles' of the Institute of Actuaries. Simultaneously, it covers part of the *Statistics for Risk Modeling (SRM)* Exam for the Society of Actuaries.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates	Program learning outcomes
Formative Assessment Assessment Format: Individual	10%	Start Date: Week 1 Due Date: Throughout term, see Moodle for details	• PLO1 : Business Knowledge • PLO2 : Problem Solving • PLO3 : Business Communication • PLO5 : Responsible Business Practice
Assignment Assessment Format: Individual	30%	Start Date: Week 2 Due Date: Week 5 and 9	• PLO1 : Business Knowledge • PLO2 : Problem Solving • PLO3 : Business Communication • PLO5 : Responsible Business Practice
Final exam Assessment Format: Individual	60%	Start Date: Not Applicable Due Date: Not Applicable	• PLO1 : Business Knowledge • PLO2 : Problem Solving • PLO5 : Responsible Business Practice

Assessment Details

Formative Assessment

Assessment Overview

These are aimed at encouraging students to keep up with the course materials.

Course Learning Outcomes

- CLO1 : Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims.
- CLO2 : Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings.
- CLO3 : Estimate and apply various statistical learning models for practical applications.
- CLO5 : Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management.

Detailed Assessment Description

The course offers formative activities to practice the concepts you have learned each week and aim at encouraging students to keep up with the course materials. These activities will reinforce your learning and help you identify the areas you need to focus on.

Submission notes

On Moodle

Assignment submission Turnitin type

Not Applicable

Assignment

Assessment Overview

A group assignment task involving application of course concepts.

Course Learning Outcomes

- CLO1 : Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims.
- CLO2 : Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings.
- CLO3 : Estimate and apply various statistical learning models for practical applications.
- CLO4 : Understand and explain ethical and regulatory issues associated with the use of data and analytic techniques.
- CLO5 : Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management.

Detailed Assessment Description

There will be a major assignment task involving application of course concepts to data analysis and practical risk management decision-making. It will also assess critical analysis and problem solving skills as well as written communication skills, and correspond to course learning outcomes, and program learning goals.

Note, this will be an individual assignment, not a group assignment (despite it being shown as a group assignment in "Assessment Overview").

Submission notes

See Moodle for details

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Final exam

Assessment Overview

The examination will aim to assess the achievement of the learning course outcomes.

Course Learning Outcomes

- CLO1 : Understand aspects of the theory and practice of predictive analytics / data analytics for insurance and financial applications as covered in the course aims.
- CLO2 : Assess models used for predictive analytics / data analytics in practice and their advantages and shortcomings.
- CLO3 : Estimate and apply various statistical learning models for practical applications.
- CLO5 : Use effective presentation, discussion and report writing skills for explaining risk-modelling concepts used in quantitative risk management.

Detailed Assessment Description

The examination will aim to assess the achievement of the learning outcomes of the course including the course aims.

Submission notes

Inspera invigilated exam

Assignment submission Turnitin type

Not Applicable

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 Student Code](#) with respect to academic integrity, the University may take disciplinary action under the Student Misconduct Procedure. 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 Student Code, 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.

UEC arrangements with SOA regarding Exam SRM:

The aforementioned calculation of the final grade (10% formative assessment, 30% project, 60% final exam) is applicable to the course grade appearing in students' UNSW transcripts. For consideration of SOA's UEC program, a different formula will be used to judge whether a student can earn UEC (and this "UEC grade" will generally be different from the one that appears in the transcript). As it stands, SOA requires 80% of the UEC grade to come from invigilated exams. More details with regard to the formula will be announced at the beginning of the term.

<u>Grading Basis</u>

Standard

<u>Requirements to pass course</u>

In order to pass this course students must:

- Achieve a composite mark of at least 50 out of 100
- Engage actively in course learning activities and attempt all assessment requirements
- Meet any additional requirements specified in the assessment details
- Meet the specified attendance requirements of the course

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Lecture	Course Overview, Basics of Statistical Learning
Week 2 : 3 June - 9 June	Lecture	Linear Regression Techniques: Part 1
Week 3 : 10 June - 16 June	Lecture	Linear Regression Techniques: Part 2
Week 4 : 17 June - 23 June	Lecture	Logistic Regression and Introduction to Generalised Linear Models
Week 5 : 24 June - 30 June	Lecture	Generalised Linear Models
Week 6 : 1 July - 7 July	Homework	Flexibility Week - No Classes
Week 7 : 8 July - 14 July	Lecture	Machine Learning Ideas (Cross-Validation and Regularisation)
Week 8 : 15 July - 21 July	Lecture	Moving Beyond Linearity
Week 9 : 22 July - 28 July	Lecture	Tree-Based Methods
Week 10 : 29 July - 4 August	Lecture	Unsupervised Learning

Attendance Requirements

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

Course Resources

Prescribed Resources

Course website

The website for this course is on Moodle.

The course will use various digital resources, but they all will be linked from Moodle.

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. 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. The following book will be the main text references for a substantial part of the course:

- James, G., Witten, D., Hastie, T., Tibshirani, R., An Introduction to Statistical Learning with

Applications in R, Second Edition, Springer, 2021

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

The 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. To sign up.

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.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Patrick Laub				TBC	Yes	Yes
Lecturer	Patrick Wong				TBC	No	No
Head tutor	Jaime Cheung					No	No

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 key policies and support 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 key policies and support page. For PG Research PLOs, including MPDBS, please refer to the 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 Student Code with respect to academic integrity, the University may take disciplinary action under the Student Misconduct Procedure. 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 Student Code, 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

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. Students studying remotely who have exams scheduled between 10pm and 7am local time, are also able to apply for special consideration to sit a supplementary exam at a time outside of these hours.

Special consideration is primarily intended to provide you with an extra opportunity to demonstrate the level of performance of which you are capable. To apply, and for further information, see Special Consideration on the UNSW Current Students page.

Special consideration 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.

Please note the following:

1. Applications can only be made through Online Services in myUNSW (see the UNSW Current Students page). Applications will not be accepted by teaching staff. The lecturer-in-charge/ course coordinator will be automatically notified when your application is processed.
2. Applying for special consideration does not automatically mean that you will be granted a supplementary exam or other concession.
3. If you experience illness or misadventure in the lead up to an exam or assessment, you must submit an application for special consideration, either prior to the examination taking place, or prior to the assessment submission deadline, except where illness or misadventure prevent you from doing so.
4. If your circumstances stop you from applying before your exam or assessment due date, you must apply within 3 working days of the assessment or the period covered by your supporting documentation.
5. Under the UNSW Fit To Sit/Submit rule, if you sit the exam/submit an assignment, you are declaring yourself well enough to do so and are cannot subsequently apply for special consideration.
6. If you become unwell on the day of – or during – an exam, you must stop working on your exam, advise your course coordinator or tutor and provide a medical certificate dated within 24 hours of the exam, with your special consideration application. For online exams, you must contact your course coordinator or tutor immediately via email, Moodle or chat and advise them you are unwell and submit screenshots of your conversation along with your medical certificate and application.
7. Special consideration requests do not allow the awarding of additional marks to students.

Further information on Business School policy and procedure can be found under "Special

Consideration" on the [key policies and support](#) page.

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