ACE Network Subject Information Guide

Statistical Learning STAT430

Semester 1, 2024

Administration and contact details

Host department	School of Science and Technology
Host institution	University of New England
Name of lecturer	Farshid Hajati
Phone number	
Email address	fhajati@une.edu.au
Homepage	
Name of honours coordinator	Adam Harris
Phone number	02 6773 2210
Email address	aharris5@une.edu.au
Name of masters coordinator	Edmund Sadgrove (Master of Data Science)
Phone number	02 6773 5549
Email address	esadgro2@une.edu.au

Subject details

Handbook entry URL	https://www.une.edu.au/study/units/statistical-learning-stat430
Subject homepage URL	Moodle - TBA
Honours student hand-out URL	Moodle - TBA
Start date:	February 26, 2024
End date:	June 9, 2024
Contact hours per week:	**4**
Last ACE enrolment date:	March 2, 2024
Lecture day(s) and time(s):	**Lectures:** Tuesday 2-4pm, Wednesday 2-3pm **Tutorial** Thursday 1-2pm (starting Week 2)
Description of electronic access arrangements for students (for example, WebCT)	Moodle

Subject content

1. Subject content description

Data analysis has been transformed in recent years through the huge increase in data collection and advances in computational methods. This has led to rapidly evolving methods in statistical learning and is one of the core research areas in statistics and computer science. With a focus on applications, this unit introduces you to modern approaches to computational data analysis, whether you are interested in further study or research in an area of science, or you want to learn about applications for marketing, finance and other business disciplines. Exploring cutting-edge topics, you will discuss regression models, linear discriminant analysis, model selection and regularisation (choosing the optimal model, dimension reduction methods, ridge and lasso), tree-based methods such as random forest and boosting, resampling methods and support-vector machines. You will also cover some unsupervised learning methods, including principal components and clustering.

2. Week-by-week topic overview

Week 1: Linear regression (Chapter 3)
Week 2: Classification (Chapter 4)
Week 3: Resampling Methods (Chapter 5)
Week 4: Linear Model Selection and Shrinkage Methods (Ridge regression, the Lasso) (Chapter 6)
Week 5: Dimension reduction (Chapter 6)
Week 6: Tree-based methods (Chapter 8)
Week 7-8: Trimester break
Week 9 - 10: Support Vector Machines (Chapter 9)
Week 11: Unsupervised Learning (Principal Components Analysis) (Chapter 12)
Week 12: Clustering Methods (Chapter 12)
Advanced reading topic: Artificial Neural Networks

3. Assumed prerequisite knowledge and capabilities

Basic statistical inferential knowledge, multivariable data analysis, basic matrix and linear algebra and basic computational skills in R.

4. Learning outcomes and objectives

Upon completion of this unit, students will be able to:

1. implement various statistical learning techniques in R to analyse complex datasets, interpret and communicate results and conclusions in a broad range of contexts;
2. apply critical thinking and understanding of the rationale behind the formulation and components of common statistical models;
3. enhance and broaden their knowledge of the theoretical and computational underpinnings of various statistical procedures; and
4. demonstrate a high level of understanding and highly developed communication skills by independently and critically analysing a special topic in advanced computational model.

AQF specific Program Learning Outcomes and Learning Outcome Descriptors (if available):

AQF Program Learning Outcomes addressed in this subject	Associated AQF Learning Outcome Descriptors for this subject
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below
Insert Program Learning Outcome here	Choose from list below

Learning Outcome Descriptors at AQF Level 8

Knowledge

K1: coherent and advanced knowledge of the underlying principles and concepts in one or more disciplines

K2: knowledge of research principles and methods

Skills

S1: cognitive skills to review, analyse, consolidate and synthesise knowledge to identify and provide solutions to complex problem with intellectual independence

S2: cognitive and technical skills to demonstrate a broad understanding of a body of knowledge and theoretical concepts with advanced understanding in some areas

S3: cognitive skills to exercise critical thinking and judgement in developing new understanding

S4: technical skills to design and use in a research project

S5: communication skills to present clear and coherent exposition of knowledge and ideas to a variety of audiences

Application of Knowledge and Skills

A1: with initiative and judgement in professional practice and/or scholarship

A2: to adapt knowledge and skills in diverse contexts

A3: with responsibility and accountability for own learning and practice and in collaboration with others within broad parameters

A4: to plan and execute project work and/or a piece of research and scholarship with some independence

5. Learning resources

A set of subject notes and exercises will be provided together with the textbook:

An Introduction to Statistical Learning (2nd Edition)

James, G., Witten, D., Hastie, T. and Tibshirani, R. (2021)

6. Assessment

Exam/assignment/classwork breakdown					
Exam	Oral exam 20 %	**Assignment**	80 %	**Class work**	0 %
Assignment due dates		17 March (A1)	7 April (A2)	5 May (A3)	19 May (A4)
9 June (Advanced reading topic assignment)					
Approximate exam date				27 May – 9 June	

Institution honours program details

Weight of subject in total honours assessment at host department	1/8
Thesis/subject split at host department	Thesis worth 50 – 75%
Honours grade ranges at host department	
H1	85 - 100
H2a	75 - 84
H2b	65 - 74
H3	50 - 64

Institution masters program details

Weight of subject in total masters assessment at host department	1/16
Thesis/subject split at host department	Thesis worth 1/4
Masters grade ranges at host department	
H1	85 - 100
H2a	75 - 84
H2b	65 - 74
H3	50 - 64