



BUSINESS SCHOOL
Te Kura Pakihi

DEPARTMENT OF INFORMATION SCIENCE

Advanced Data Science
INFO304

COURSE OUTLINE

Semester Two 2019

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Paper Description and Aims

Data Science and Data Analytics are a fundamental aspect of all business decision making. This paper will give the student a solid foundation in the concepts and methods for these fields. Technical aspects will include the concept of model building and visualisation, and the methods that may be used for different forms of data. Emphasis will be made on how this relates to business processes and the use of modelling and visualisation in supporting and delivering decision making.

Learning Outcomes

Upon successful completion of this paper, students will develop the ability to:

- Identify the activities of prediction, optimisation, and adaptation that exist within a business process;
- Assess the suitability of data sources with respect to the requirements of business processes and decision making;
- Critically assess methods used to design tools for prediction, optimisation and adaptation in business processes;
- Apply a range of suitable methods to perform prediction, optimisation and adaptation in business processes, based on case study data.

Teaching Staff

Paper Coordinator/Lecturer

Name: Peter A. Whigham
Office: Commerce Building Level 9, Room 9:04
Email: peter.whigham@otago.ac.nz
Office Hours: Please contact me via email to organise a meeting

Lecturer/Support

Name: Brendon Woodford
Office: Commerce Building Level 8, Room 8:09
Email: brendon.woodford@otago.ac.nz
Office Hours: Please contact via email to organise a meeting

Course Delivery

Lectures Day/Time: Monday 10 - 10:50 pm, OBS119, Tuesday 10:00 - 10:50 am, SDAVE

Rooms: OBS119, SDAVE

Tutorials Wednesday 1:00 – 1:50pm, Room OBSLG04

Labs Day/Time: Monday 1pm – 3pm; Tuesday 2pm-4pm; Room OBS327 (Commerce Building)

Lectures present the key conceptual material through discussion and interaction between teaching staff and students. Lectures are supported by readings.

Tutorials are interactive, collaborative sessions in which students attempt to cement concepts presented at lectures with their peers in a supportive environment. Tutorial assessments will be discussed, issues and concepts of lecturers revisited, and assignment work/concepts introduced.

Labs are interactive, collaborative sessions in which students attempt to cement concepts presented at lectures with their peers in a supportive environment. They will also offer support for completion of assignments using RStudio.

Course Calendar The course calendar (in this outline) details scheduling information. Note that this calendar may change as the course proceeds. Any changes will be announced at lectures and be detailed on Blackboard.

Students are expected to prepare for and attend all classes to gain full benefit from the course

These activities should be prepared for by reviewing information detailed on Blackboard and completing any assigned readings. Students unable to attend a lecture are expected to catch up on missed material. Unless stated otherwise, all aspects of the course are examinable.

Expectations and Workload

Students are expected to spend approximately 200 hours during the semester on INFO304. This means that outside of contact hours (approx. 5 hours per week) the student should expect to have to spend up to 10 hours per week with additional lab work, assignment work and final exam preparation.

Course Learning Resources

There is no set textbook; however a number of texts will be made referenced online via Blackboard. Readings and other required work will be indicated during the lectures. In particular, the book "*An Introduction to Statistical Learning*", by G. James, D. Witten, T. Hastie & R. Tibshirani provides an excellent and detailed background to many of the concepts in this paper. This is available online through the library website.

Blackboard

Blackboard <https://blackboard.otago.ac.nz/> provides you with access to course materials, class notices, and resources. Blackboard is used to email the whole class so it is important that you check your student email and *Blackboard* regularly.

Student Webmail

IMPORTANT - DO THIS NOW:

Forward your University email address to an email address that you use regularly as follows:

1. [Log into your StudentMail account](#) using your student username and password
2. Click **Cog button (top right corner) > Options**
3. Under **Account**, select the **Forward your email** shortcut under the **Short Cuts** menu on the right side of the screen.
4. Under the Forwarding heading, type in the email address you want your email to be forwarded to. You can also choose to have a copy of these emails kept on your StudentMail account, so please check the box if you would like this.
5. Click the **Start forwarding** button.

Assessment

All material presented is examinable (except where stated otherwise) by assignments and the final examination. All-important assessment information such as due dates and times, content, guidelines and so on will be discussed at lectures and, where appropriate, detailed on Blackboard. *Students are responsible for ensuring that they are aware of this information, keeping track of their own progress, and catching up on any missed classes.*

Short Written Exercises – 10%

There will be 7 short written exercises. These aim to ensure that the student has read and understood the lecture material from the week in which they are handed out. Each written exercise is due at the **Tuesday 10am (lecture)** the week after they are handed out, and will be returned at the tutorial on the Wednesday. **No late submissions will be accepted. The best five exercises will be used to calculate the final 10%.**

A 4-tier marking scheme will be used for tutorial assessment as follows:

- 4 – Achieved with Excellence
- 3 – Achieved with Merit
- 2 – Achieved
- 0 – Not Achieved

Assignments – 40%

Description	% Final Course
Assn 1. Data analysis, clustering, visualisation	10%
Assn2. Modelling, prediction, assessing model concepts	15%
Assn3. Multi-objective modelling	15%

Examination – 50%

The end of semester examination comprises 50% of the course assessment. All course material is examinable.

Course Requirements

A student **must obtain 40% or more in the final exam** and a **final grade of at least 50% (-C)** to pass INFO304.

Late Assignments

Assignments are due at the time and in the place stated on the assignment handout. Extensions will not be allowed except in exceptional circumstances. **Late assignments will not be accepted.** Submission of tutorial and assignment work will be through blackboard – this will be discussed in lectures.

Quality Assurance

At the Otago Business School we monitor the quality of student learning and your learning experience. Your assessed work may be used for assurance of learning processes, such as evaluating the level of achievement of learning outcomes, with the aim of improving the quality of our programmes. All material used for quality assurance purposes will be treated as confidential and the outcome will not affect your grades.

Learning Outcomes

Learning outcome	Teaching and learning method	Assessment
1. Identify the activities ...	Lectures, tutorials, labs	A1, A2, WA, FE
2. Assess the suitability ...	Lectures, tutorials, labs	A1, A2, WA, FE
3. Critically assess methods ...	Lectures, tutorials, labs	A2, WA, FE
4. Apply a range of methods ...	Lectures, tutorials, labs	A2, A3, WA, FE

Note: "A1" = assignment 1; "A2" = assignment 2; "A3" = assignment 3; "WA" = weekly assignments; "FE" = final examination. If more than one assessment is listed for a learning outcome, the assessments are listed in decreasing order of significance.

Grading System

The grading scheme used at Otago is:

A+	90-100	C+	60-64
A	85-89	C	55-59
A-	80-84	C-	50-54
B+	75-79	D	40-49
B	70-74	E	<40
B-	65-69		

Academic Integrity and Academic Misconduct (Plagiarism)

Students should ensure that all submitted work is their own. Plagiarism is a form of academic misconduct (cheating). It is defined as copying or paraphrasing another's work and presenting it as one's own. Any student found responsible for academic misconduct in any piece of work submitted for assessment shall be subject to the University's dishonest practice regulations, which may result in serious penalties, including forfeiture of marks for the piece of work submitted, a zero grade for the paper, or in extreme cases, exclusion from the University. The University of Otago reserves the right to use plagiarism detection tools.

Students are advised to inform themselves about University policies concerning dishonest practice and take up opportunities to improve their academic and information literacy. If necessary, seek advice from academic staff, or the Student Learning Centre. The guideline for students is available at this link: <http://www.otago.ac.nz/study/academicintegrity/index.html>

Course Calendar

Week	Lectures	Labs	Tutorials
1	Data types, quality, sampling, scale, visualisation, transformations (log, PCA)	Introduction to “R”; Basic visualisation/transformation of a range of data types	Assessment of visualisation; Types of data
2	Information Measurements, Variable importance, Clustering: KMeans clustering, Dendrogram, tSNE	Further “R” techniques; Clustering using Dendrograms, PCA, tSNE; Case study data 1	Clustering and distance measures; scale
3	Supervised Learning: Assessing quality of models (training/test sets, cross-validation), case-based reasoning, decision trees, bootstrapping	Further “R” techniques; KMeans clustering; Information gain measures; decision trees;	Entropy and decision trees; kNN example
4	Artificial Neural Networks; Case studies on the role of supervised and unsupervised learning	Support for Assn 1	Support Assn 1
5	Time series analysis: Seasonality, Trend, Examples	Time series decomposition ANNs	ANNs, back propagation
6	Regression Models: Linear and Multiple Regression; Logistic Regression. Use of dummy variables, stepwise regression, general model fitting	Case study data 2. Measuring the quality of a model. Linear Model and ANN comparison	Interpreting linear model coefficients; Formulating logistic models
7	Graph Theory – Networks as models of structure; degree distribution; centrality; path importance	Further modelling Case study data 2. Examining decision making with data.	Journal paper assessment of modelling for business processes
MID-SEMESTER BREAK 26th-30th August			
8	Evolutionary Computation: Stochastic Search. The Genetic Algorithm case study.	Modelling and prediction using a GA. Representation issues. Support for Assn 2	Support for Assn 2 Representing problems using fixed and variable length representations.
9	Multi-objective and multi-criteria methods: Case study on portfolio management; Adaptive Business Intelligence	Multi-objective optimisation. Limitations, representation, visualisation, interpretation.	Case Study on multi-objective optimisation
10	Multi-objective Optimisation and the NSGAI Model; Further case studies of Adaptive Business Intelligence	Multi-objective optimisation. Case study in modelling and decision making	Decision making frameworks; complexity of process interactions
11	Extended modelling methods: bagging, boosting, random forest	Extended modelling methods	Sampling, model accuracy, extended methods
12	Text Analysis: Bag of words, cleaning data, semantics, word embedding	Support Assn 3	Support Assn 3
13	Case Study Review; Summary and Lessons learnt	No Lab	Exam Support

Second Semester ends Friday 11th October 2019
University Exam Period 2nd Semester begins Wednesday 16th October
Ends Saturday 9th November

Student Learning Support and Information

Student Charter

<http://www.otago.ac.nz/about/otago005275.html>

Guidelines for Learning at Otago

<http://hedc.otago.ac.nz/hedc/wp-content/uploads/2012/12/Guidelines-for-Learning.pdf>

<http://hedc.otago.ac.nz/hedc/learning/>

Student Learning Centre

The Student Learning Centre, which is part of the Higher Education Development Centre, provides learning support, free of charge, to ALL enrolled students. Their services include:

- a workshop programme designed to help students to improve their learning strategies and their generic skills;
- individual assistance with learning issues;
- on-line study skills advice;
- a student leadership programme
- a student-led peer support programme for students of all ages and backgrounds.
- conversational English groups for students from a non-English speaking background

The Centre also provides two very helpful study guides, "Guidelines for Writing and Editing" and "Writing University Assignments" and these are available on the SLC website.

<http://slc.otago.ac.nz/>

Library Support

The Library website <http://www.otago.ac.nz/library> provides access to resources and services, including group room bookings, library hours and locations, past exam papers, subject guides, article databases and more.

If you need assistance either check out the self-help guides <http://otago.libguides.com/selfhelp>, or ask Library staff at the ground floor service desks, or email ask.library@otago.ac.nz

Māori Student Support

Tēnā koutou katoa,

Ko Hikaroroa te māunga, ko Waikouaiti te awa, ko Takitimu te waka, ko Ngāi Tahu tōku iwi, nō Ōtepoti ahau.

Ko Rachel Sizemore tōku ignoa.

Kia ora, my name is Rachel Sizemore and I am the Kaiāwhina Māori in the Otago School of Business. My role is to help link Māori students with the various support networks throughout the university and the community. Kāua e whakamā, don't be shy - come in for a chat. Mauri ora mai.

Tel: +64 3 479 5342 **Email:** rachel.sizemore@otago.ac.nz or kaiarahi.obs@otago.ac.nz

Pacific Islands' Student Academic Advisor (Part-time)

Warm Pacific Greetings,

Talofa lava, my name is Esmay Eteuati, my role is to help connect and liaise with all the Academic Departments in the Business School and other student support services. I provide pastoral care, information regarding scholarships and can refer you on get some course advice with our Academic Manager or by the Departments.

As a point of contact Pacific students can see one of our Pacific Network Support People (academic staff member) in each department who will be available to assist and support students with their course of study. I also have a wide network of Pacific and non-Pacific contacts across the University should students wish to know more about other services.

Tel +64 3 479 4756 **Email:** esmay.eteuati@otago.ac.nz

Disability Information and Support

Students are encouraged to seek support if they are having difficulty with their studies due to disability, temporary or permanent impairment, injury or chronic illness. It is important to seek help early, through one of the contacts below:

Website: <http://www.otago.ac.nz/disabilities>

65 Albany St, West Lane, ISB, Student Services

Tel: +64 3 479 8235 **Email:** disabilities@otago.ac.nz

Student Feedback

We encourage your feedback. This can be in the form of contacting staff, participating in course evaluation surveys and communicating with class representatives. Continual improvements will be made to this course based in part on student feedback.

Class Representatives

The class (or student) representative system is an avenue for encouraging communication and consultation between staff and students. It provides you with a vehicle for communicating your views on the teaching and delivery of the paper and provides staff with an opportunity to communicate information and gain constructive feedback from students. It contributes to the development of a sense of community within a department and it adds a further dimension to the range of support services offered to students.

Volunteers for the role of class representatives will be called early in the semester. The OUSA invites all class representatives to a training session, conducted by OUSA, about what it means to be a class representative and some of the possible procedures for dealing with issues that arise. They also provide information on the services that OUSA offers and the role OUSA can play in solving problems that may occur. The OUSA provides support to class representatives during the semester. Departmental staff will also meet with class representatives during the semester to discuss general issues or matters they wish to have considered.

Your class representative's name and contact details will be posted on Blackboard early in the semester.

Concerns about the Course

We hope you will feel comfortable coming to talk to us if you have a concern about the course. Alternatively, you can report your concerns to the Class Representative who will follow up with me or the Head of Department. Hopefully you will feel comfortable to see me in the first instance. If, after making approaches via these channels, you do not feel that your concerns have been addressed, there are University channels that may aid resolution. For further advice or more information on these, contact the departmental administrator or head of department.

Disclaimer

While every effort is made to ensure that the information contained in this document is accurate, it is subject to change. Changes will be notified in class and via Blackboard. Students are encouraged to check Blackboard regularly. It is the student's responsibility to be informed.