



STAT7178

Modern Computational Statistical Methods

Session 1, Special circumstances 2021

Archive (Pre-2022) - Department of Mathematics and Statistics

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Notice

As part of [Phase 3 of our return to campus plan](#), most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to [timetable viewer](#). To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

General Information

Unit convenor and teaching staff

Convener / Lecturer

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Lecturer and Convenor

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Credit points

10

Prerequisites

Admission to MRes

Corequisites

STAT710 or STAT7310

Co-badged status

STAT8178

Unit description

This unit offers students the opportunity to study some modern computational methods in statistics. The first half of the unit covers maximum likelihood computations, penalised likelihood, missing data and the EM algorithm. The second half considers Kernel density estimation, Kernel regression, quantile regression and inferences using Monte-Carlo and bootstrapping methods. State-of-the-art computing softwares are used.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO2: Apply EM algorithm to deal with missing data.

ULO1: Derive and explore Maximum Likelihood and Bayesian estimators.

ULO3: Produce estimates of bias and variance along with confidence interval by applying Monte-Carlo and bootstrapping methods.

ULO4: Apply nonparametric function estimation approaches to estimate density function, regression function and quantile regression function.

ULO5: Evaluate the performance of nonparametric curve estimators by applying Monte-Carlo and bootstrapping methods.

ULO6: Use Matlab and R for parametric and nonparametric estimation problems.

Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Assignment 1</u>	20%	No	Week 4
<u>Mid-Semester Test</u>	10%	No	Week 8
<u>Assignment 2</u>	20%	No	Week 10
<u>Final Exam</u>	50%	No	TBA

Assignment 1

Assessment Type ¹: Quantitative analysis task

Indicative Time on Task ²: 10 hours

Due: **Week 4**

Weighting: **20%**

Students will write code and interpret output in order to answer statistical questions. Students may work on the assignment on their own computers or using University resources.

On successful completion you will be able to:

- Apply EM algorithm to deal with missing data.
- Derive and explore Maximum Likelihood and Bayesian estimators.
- Produce estimates of bias and variance along with confidence interval by applying Monte-Carlo and bootstrapping methods.
- Use Matlab and R for parametric and nonparametric estimation problems.

Mid-Semester Test

Assessment Type ¹: Quiz/Test

Indicative Time on Task ²: 1 hours

Due: **Week 8**

Weighting: **10%**

Mid-Semester Test

On successful completion you will be able to:

- Apply EM algorithm to deal with missing data.
- Derive and explore Maximum Likelihood and Bayesian estimators.
- Use Matlab and R for parametric and nonparametric estimation problems.

Assignment 2

Assessment Type ¹: Quantitative analysis task

Indicative Time on Task ²: 10 hours

Due: **Week 10**

Weighting: **20%**

Students will write code and interpret output in order to answer statistical questions. Students may work on the assignment on their own computers or using University resources.

On successful completion you will be able to:

- Apply nonparametric function estimation approaches to estimate density function, regression function and quantile regression function.
- Evaluate the performance of nonparametric curve estimators by applying Monte-Carlo and bootstrapping methods.
- Use Matlab and R for parametric and nonparametric estimation problems.

Final Exam

Assessment Type ¹: Examination

Indicative Time on Task ²: 2 hours

Due: **TBA**

Weighting: **50%**

Formal invigilated examination testing the learning outcomes of the unit.

On successful completion you will be able to:

- Apply EM algorithm to deal with missing data.
- Derive and explore Maximum Likelihood and Bayesian estimators.
- Produce estimates of bias and variance along with confidence interval by applying Monte-Carlo and bootstrapping methods.
- Apply nonparametric function estimation approaches to estimate density function, regression function and quantile regression function.
- Evaluate the performance of nonparametric curve estimators by applying Monte-Carlo and bootstrapping methods.
- Use Matlab and R for parametric and nonparametric estimation problems.

¹ If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

² Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

You should attend the following classes each week:

- one 2 hour synchronous online lecture
- one 1 hour SGTA online class

Check timetables.mq.edu.au or the unit iLearn page for class details.

Lectures begin in Week 1. Lecture notes are available on iLearn prior to the lecture.

SGTA classes begin in week 2 and are based on work from the current week's lecture.

Prescribed texts

Students should obtain the lecture overheads from iLearn prior to the lecture. The lecture overheads are available module by module.

The following are recommended reading books for this unit:

- *Pattern Recognition and Machine Learning*, Bishop, Christopher M. 2006.
- **[Machine Learning: A Probabilistic Perspective](#)**. Kevin Murphy, MIT Press, 2012.
- Computational Statistics Handbook with MATLAB®, W. L. Martinez and A. R. Martinez, Chapman & Hall. (QA276.4.M272)
- Local regression and likelihood, C. Loader, Springer-Verlag, 1999. QA276.8 .L6/1999.
- Quantile Regression, Roger Koenker, Cambridge University Press 2005,

Unit webpage

Unit webpage is located on iLearn at <https://ilearn.mq.edu.au>.

You can only access the material on iLearn if you are formally enrolled in the unit. All lecturing materials are available at this webpage.

Teaching and Learning Strategy

The unit is taught in both traditional mode and external mode. In traditional mode, students are on campus in standard semesters with weekly lectures. In external mode, students access all teaching material from iLearn and do not attend lectures on campus.

Students are expected to

- attend all the lectures if enrolled internally;
- have read through the material to be covered using the lecture notes provided on iLearn;
- submit assignments on time via iLearn;
- participate the mid-semester test at the designated time;
- contact the unit convenor in advance if for any reason, you cannot hand in your assessment tasks on time;

Refer to the next section for a week-by-week list of topics to be covered in this unit.

Software used in teaching

We are using R through Rstudio and MATLAB in teaching this unit. R and Rstudio are free software and are widely used nowadays by statisticians. Matlab is commercial software, but is available for Macquarie students and staff: <https://web.science.mq.edu.au/it/matlab/>.

Policies and Procedures

Macquarie University policies and procedures are accessible from **Policy Central** (<https://policies.mq.edu.au>). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)

- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Grade Appeal Policy](#)
- [Complaint Management Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies \(https://students.mq.edu.au/support/study/policies\)](https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central \(https://policies.mq.edu.au\)](https://policies.mq.edu.au) and use the [search tool](#).

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- [Getting help with your assignment](#)
- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.