COGS3020

Computational Neuroscience

Session 1, Weekday attendance, North Ryde 2021

Archive (Pre-2022) - Department of Cognitive Science

Contents

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
Matthew Crossley
matthew.crossley@mq.edu.au

Credit points
10

Prerequisites
130cp including ((COGS1000 or COGS100) or (BIOL2230 or BIOL257) or (MEDI2300 or MEDI204)) and (COGS2020 or (STAT2170 or STAT270))

Corequisites

Co-badged status

Unit description
Computational modelling is increasingly important for understanding brain function at the single neuron, circuit, and network levels. This unit provides students with a rigorous introduction to the exciting field of computational neuroscience including topics such as the mathematical description of neurons, simple neural networks, statistical inference, reinforcement learning, and decision making. Students will learn the Python programming language and use it to explore some of the most influential models in computational neuroscience to deepen their understanding of the relationship between the brain, behaviour, and neural computation.

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:

ULO1: Demonstrate advanced knowledge of key computational models in neuroscience.
ULO2: Simulate and analyse models of individual neurons and brain circuits.
ULO3: Fit computational models to experimental data to find best fitting parameters.
ULO4: Compare different computational models using statistical model comparison techniques.

General Assessment Information

Late Penalty

Late submissions will attract a penalty of 50%. This is because assignment solutions will be posted online immediately after their due dates, and this givens students that submit late an advantage over those that submit on time. Special arrangements will be considered for hardship due to COVID-19 and other similar circumstances.Please note that it is the student's responsibility to notify the University of a disruption to their studies and that requests for extensions for assignments must be made via the University's Ask MQ System (as outlined in the Disruption to Studies Policy).

Assessment Tasks

Name	Weighting	Hurdle	Due
Mid-term exam	30%	No	Mid semester
Weekly problem sets	30%	No	Approximately weekly
Weekly online quizzes	10%	No	Approximately weekly
Final exam	30%	No	Final exam period

Mid-term exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 15 hours
Due: **Mid semester**
Weighting: **30%**

1-hour mid-term exam

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

Weekly problem sets

Assessment Type [1]: Problem set

Indicative Time on Task [2]: 40 hours
Due: **Approximately weekly**
Weighting: **30%**

10 problem sets

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

Weekly online quizzes

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 10 hours
Due: **Approximately weekly**
Weighting: **10%**

10 short online multiple choice quizzes designed to provide routine assessment and feedback. Graded on credit/no-credit basis. The 2 lowest quizzes (missed or marked non-credit) may be dropped without penalty.

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

Final exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 20 hours
Due: **Final exam period**
Weighting: **30%**

2-hour exam conducted during the examination period.

On successful completion you will be able to:

- Demonstrate advanced knowledge of key computational models in neuroscience.
- Simulate and analyse models of individual neurons and brain circuits.
- Fit computational models to experimental data to find best fitting parameters.
- Compare different computational models using statistical model comparison techniques.

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[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

Delivery

Lectures are 1-hour sessions held once per week, starting in Week 1. Lectures run from 9:00 AM - 10:00 AM Fridays and will be delivered live over Zoom.

Readings

Reading sources for this course are the weekly lecture notes and published papers from the computational neuroscience literature. The lecture notes will be made available via the course iLearn page, and additional readings will be linked in the lecture notes.

iLearn

Through iLearn you will be able to access the lecture recordings (Echo360), readings, and feedback and marks for the assessment tasks. You are also required to submit all assignments via iLearn, using the Turnitin submission tool. You will need access to the internet to access iLearn.

Mid-term exam

There will be a mid-term exam which will take the form of a 1 page proposal in which you choose a computational model from the literature and choose key results from this paper that you will replicate for the final exam. If you are unable to turn in the mid-semester exam at the specified time, you must advise the Student Centre via ask.mq.edu.au and must also apply for Special Consideration through ask.mq.edu.au and submit appropriate supporting documents. Original documents need to be presented at the Student Centre. This should be done within five (5) working days from the day of the examination. It should be noted that Macquarie University Policy states: "Pre-booked holidays will not routinely be considered unavoidable absences or

commitments by the University". Students deemed eligible for a late mid-semester exam will be notified via email about the time and location of the exam.

Final exam

There will be a final exam which will take the form of a final written report and / or presentation to the class (class size and time allowing) about a computational model from the literature that you selected as part of your midterm exam. You will be responsible for replicating key findings from this paper with code that you have written from scratch. Final exams may be due as early as the final week of normal lectures. The only exception to turning in the final exam at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for special consideration due to disruption to studies. Information about unavoidable disruption and the special consideration process is available at: http://students.mq.edu.au/study/my-study-program/special-consideration. All students are expected to ensure that they are available until the end of the teaching semester, which is the final day of the official examination period

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). 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) 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.