Lecturer: Dr Weichang Yu

Tutors: Haoze Hou (haoze.hou.1@unimelb.edu.au), Bill Rudd (b.rudd@unimelb.edu.au)

Office location: Old Geology Building (South Wing), Level 1, Room 108

Course Material: All course material will be uploaded on a weekly basis on `Canvas LMS`.

Workshops/Labs: Workshops/Labs will be held from Week 1 to 12. Check your personalised timetable for venue and time. Lab sheets may be downloaded from Canvas. You should glance through the sheet before each session and ensure that all required software and libraries are installed before class. You are strongly encouraged to work through the problems before attending tutorial.

Assessment:

- Four individual assignments worth 5% each.
- A written mid-semester exam on week 7 worth 35%.
    - Date/Time: Wed, 4 Sep 2024. 6pm - 9.15pm.
    - Venue: Kwong Lee Dow Exam Space, 122A – 122 to 125 (Combined)
    - Permitted items: TWO double-sided A4 page of notes (handwritten or printed) AND Casio FX-82 calculator AND black/blue pens
- Computer lab test worth 10%.
    - Date/Time: Fri, 18 Oct 2024. 6.45pm - 7.35pm (5 mins reading; 45 mins writing)
    - Venue: PAR-160-L2-212-Nanson Computer Lab; PAR-160-G-G69-Thompson Lab; PAR-160-G-G70-Wilson Computer Lab
    - Permitted items: Either hardcopy or electronic of course material on a laptop or tablet. All electronic devices must be switched to airplane mode during the exam. More details coming up.
- A written final exam worth 35%.

Due dates for assignments:

- Assignment 1: 16 Aug 2024, 6.00pm
- Assignment 2: 30 Aug 2024, 6.00pm
- Assignment 3: 4 Oct 2024, 6.00pm
- Assignment 4: 18 Oct 2024, 6.00pm

All late submissions will be penalised. Late submissions will have their score deducted (10% for every 12 hrs late). For example, a submission that is scored 15 marks but is handed in 24 hours late will receive a 20% deduction, receiving a recorded mark of 12. Waiver of this penalty will only apply under exceptional circumstances with documented proof (e.g., medical certificate). More details on the process of applying for a penalty waiver can be found on `https://ask.unimelb.edu.au/app/answers/detail/a_id/5667/~/applying-for-an-extension`. Under extenuating circumstances, please email Bill Rudd (b.rudd@unimelb.edu.au) to apply for extensions that are lesser than 10 days. For extensions $\geq$ 10 days, please apply through `https://students.unimelb.edu.au/your-course/manage-your-course/exams-assessments-and-results/special-consideration`.

Content delivery: Lectures will be delivered in-person in the lecture hall and the recording will be uploaded. Practical and workshop classes are all in-person.

Course content:

- Week 1: Course overview, linear models (big picture), Matrix operations, Matrix attributes
- Week 2: Orthogonality, Quadratic forms, Matrix Calculus, Eigendecomposition

- Week 3: Linear models estimation, Random vectors and their distributions, independence
- Week 4: Linear models inference theory
- Week 5: Model selection
- Week 6: Experimental design, ANOVA, ANCOVA
- Week 7: Binomial regression, likelihood inference
- Week 8: Exponential families, generalised linear models, Weighted least squares
- Week 9: Multinomial logit mode, ordinal regression, contingency tables
- Week 10: Monte Carlo
- Week 11: Bayesian inference
- Week 12: Unsupervised learning

Peer-supported learning: Please post all course-related questions on the Canvas discussion page for the benefit of your peers who may have similar questions. I will endeavour to respond to questions as soon as I can. You are also encouraged to answers your fellow students' questions (no shaming of wrong answers, please!) I will not respond to content-related questions via email, unless there is reason for it to be kept confidential.

Consultation hours (in-person only): Starting from Week 2. Mondays, 3pm – 4pm. Tuesdays, 2pm – 3pm.

Texbooks:

- Weeks 1 to 6:
  (1) Myers & Milton, A First Course in the Theory of Linear Statistical Models, Duxbury, 1991. This textbook may not be easy to access, so an alternative that covers similar topics is:
      - Rencher & Schaalje, Linear Models in Statistics 2nd edition, 2008 (be careful of some differences in notations)
  (2) Linear Models with R, Julian J. Faraway, Chapman & Hall/CRC, 1st or 2nd edition. (Very good on the practical side with a summary of theory)
  (3) Rao & Toutenberg, Linear Models: Least Squares and Alternatives, 1999 (More advanced)
  (4) Draper & Smith, Applied Regression Analysis, 2014 (Less advanced but good for first reading, online edition)
- Weeks 7 to 9:
  (1) Faraway, Extending the Linear Model with R. Chapman & Hall, 1st or 2nd edition. (close to a textbook for GLMs)
  (2) McCullagh & Nelder, Generalised Linear Models, 2nd edition. Chapman & Hall, 1989 (more technical)
- Weeks 10 to 11
  - Gelman, Carlin, Stern, Dunson, Vehtari & Rubin, Bayesian Data Analysis, 3rd edition. CRC Press, 2014. `http://www.stat.columbia.edu/~gelman/book/`
- Week 12
  - James, Witten, Hastie & Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013.