Course Outline Public

Edit Resource (/COMP9418/19T3/resources/32792/edit)

Admin Requests

Please use these online forms (https://www.engineering.unsw.edu.au/study-with-us/current-students/student-resources/online-forms) for admin requests.

Technical Questions

For technical questions regarding the course contents always use the Forums on this site. I will not reply emails sent to me directly.

First Point of Contact

When necessary, emails should be sent to the course admin (Armin Chitizadeh (https://webcms3.cse.unsw.edu.au/users/z3323393)).

Contents

- Course Details
- Course Summary
- Assumed Knowledge
- Student Learning Outcomes
- Teaching Strategies and Rationale
- Student Conduct
- Assessment
- Special Consideration
- Course Schedule
- Resources for Students
- Course Evaluation and Development

Course Details

Course Code	COMP9418
Course Title	Advanced Topics In Statistical Machine Learning
Convenor	Gustavo Batista (/users/z3527242)
Admin	Armin Chitizadeh (/users/z3323393)
Classes	Mon 14:00 - 16:00 (Weeks:1-3,5-11), Wed 14:00 - 16:00 (Weeks:1-10) Timetable for all classes (/COMP9418/19T3/timetable)

Consultations	Thursday 11:00-12:00, K17 Lv2 Consultation room 204 (by appointment with the course admin)
Units of Credit	6
Course Website	http://cse.unsw.edu.au/~cs9418/19T3/index.html (http://cse.unsw.edu.au/~cs9418/19T3/index.html)
Handbook Entry	http://www.handbook.unsw.edu.au/postgraduate/courses/current/COMP9418.html (http://www.handbook.unsw.edu.au/postgraduate/courses/current/COMP9418.html)

Course Summary

This course presents an in-depth study of statistical machine learning approaches. It aims to provide the student with a solid understanding of methods for learning and inference in structured probabilistic models, with a healthy balance of theory and practice.

It will cover topics on the semantics of direct and undirect representations in probabilistic graphical models, exact and approximate inference, and learning of model parameters and structure.

Assumed Knowledge

Official Pre-requisites

Knowledge of machine learning at the level of COMP9417. No pre-reqs waiver will be granted this year. So, if you haven't done COMP9417, you will not be able to enrol in COMP9418.

Programming

We will use Python in the practical part of our bring-your-own-device tutorials. However, it is expected that students unfamiliar with Python can get up to speed if they are able to construct (i.e., design, implement and test) working software in a general-purpose language such as C/C++, Java or Perl, at least to the level of a first-year computing course (e.g., COMP1927 Computing 2 or equivalent). Having a good working knowledge of and be able to construct working software in standard data analysis languages such as Matlab/Octave, or R can also be helpful.

Software Tools

Since an important part of practical machine learning is "data wrangling" (i.e. pre-processing, filtering, cleaning, etc.) of data files, students are expected to master Unix tools such as those taught in COMP2041 Software Construction, or equivalents such as those in R, Matlab/Octave or R.

Student Learning Outcomes

After completing this course, students will:

1. Derive statistical independence assumptions from a given graphical representation of a probabilistic model
2. Understand and implement exact inference methods in graphical models including variable elimination and the junction tree algorithm
3. Derive and implement maximum likelihood learning approaches to latent variable probabilistic models
4. Understand and implement approximate inference algorithms in graphical models, including sampling and loopy belief propagation.
5. Understand and apply basic methods for structured prediction

This course contributes to the development of the following graduate capabilities:

Graduate Capability	Acquired in
Scholars capable of independent and collaborative enquiry, rigorous in their analysis, critique and reflection, and able to innovate by applying their knowledge and skills to the solution of novel as well as routine problems	Lectures, tutorials, assignments and exam
Entrepreneurial leaders capable of initiating and embracing innovation and change, as well as engaging and enabling others to contribute to change	Assignments
Professionals capable of ethical, self-directed practice and independent lifelong learning	Lectures, tutorials and assignments
Global citizens who are culturally adept and capable of respecting diversity and acting in a socially just and responsible way	Lectures, tutorials, assignments and student interactions

Teaching Strategies and Rationale

Machine learning is at the intersection of Artificial Intelligence, Computer Science and Statistics. While the main goal of this course is to go beyond the basics of machine learning as provided by COMP9417 (focused on probabilistic modelling and inference), we will adopt a similar teaching rationale, where theory, algorithms and empirical analysis are all important components of the course. Therefore, the lectures, tutorials and assessments are design to address these components jointly.

The course involves lectures and practical work.

- *Lectures:* Aim to summarise the concepts and present case studies.
- *Tutorials:* Aim to reinforce the topics covered in lectures and will cover theoretical and practical exercises. The practical part of the tutorials will be based on a bring-your-own-device approach, where students will be introduced to the technology required for the assignments and follow a series of programming and data analysis questions. There will be no formal assessment of the tutorials.
- *Assignments:* Aim the same as the tutorials at a higher degree of difficulty and will be assessed.
- *Final exam:* There will be a final exam. We will use the CSE laboratories.

Engagement Tools and Blended Learning

- All lectures (slides/recordings) will be on the Web.
- All tutorial and lab materials (questions before, solutions after) will be on the Web.
- All assignments will have specifications on the Web and online submission.
- Only the final exam will require attendance in person.
- Forum (https://webcms3.cse.unsw.edu.au/COMP9418/18s2/forums/course) for answering questions using WebCMS3

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives.

Plagiarism is defined as (https://student.unsw.edu.au/plagiarism) using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Assessment

Please note due dates are subject to change.

Item	Topics	Due	Marks	Contributes to (learning outcomes)
Assignment 1	Weeks 1-2	Week 4	15%	1-2

Assignment 2	Weeks 3-7	Week 9	15%	3-4
Quizzes	Weeks 1-10	Weeks 1-10	10%	1-5
Final Exam	All topics	Exam period	60%	1-5

The overall course mark will be the weighted average of the individual components in the table above.

Special Consideration

If your work in this course is affected by unforeseen adverse circumstances, you can apply for Special Consideration (https://student.unsw.edu.au/special-consideration) through MyUNSW (https://iaro.online.unsw.edu.au/special_consideration/home.login#_blank) , including documentation on how your work has been affected. If your request is reasonable and your work has clearly been impacted, then

- for an assignment, you may be granted an extension
- for the Final Exam, you may be offered a Supplementary Exam

Note the use of the word "may". None of the above is guaranteed. It depends on you making a convincing case that the circumstances have clearly impacted your ability to work.

Supplementary Exam

In particular, a student will be awarded the right to take a supplementary exam if:

- they miss the final exam with a good medical excuse; they get a mark calculated in the same way as other students who sat the original exam.
- they end up with a mark in the range 45-49, after sitting the final exam; they can expect a maximum mark of 50 if they successfully complete the supplementary exam.

Course Schedule

Please note this is a tentative schedule. All dates are only indicative and subject to change.

Week	Lecture	Tute/Lab	Assignments
0	Graph representation and traversal	Week 1	-
1	Course overview and statistical inference	Week 2	-
2	Bayesian networks representation and semantics	Week 3	A1 released
3	Naive Bayes and Markov chains	Week 4	-
4	Hidden Markov models and applications	Week 5	A1 due
5	Markov networks and exact inference	Week 6	-
6	Belief propagation	Week 7	-
7	Sampling	Week 8	A2 released
8	Learning parameters	Week 9	-

9	Learning model structure	Week 10	A2 due
10	Bayesian learning		

Resources for Students

Texts and recommended readings:

Prescribed Resources

- [Book] Probabilistic Graphical Models: Principles and Techniques (http://pgm.stanford.edu/) . Daphne Koller and Nir Friedman. MIT Press. 2009.

Recommended Resources

- [Book] Modeling and Reasoning with Bayesian Networks (https://www.cambridge.org/core/books/modeling-and-reasoning-with-bayesian-networks/8A3769B81540EA93B525C4C2700C9DE6) Adnan Darwiche. Cambridge. 2009.
- [Book] Machine Learning: A Probabilistic Perspective. (https://www.cs.ubc.ca/~murphyk/MLbook/) Kevin P. Murphy. MIT Press. 2012.
- [Book] Bayesian Reasoning and Machine Learning (http://web4.cs.ucl.ac.uk/staff/D.Barber/pmwiki/pmwiki.php?n=Brml.HomePage) . David Barber. Cambridge University Press. 2012.
    - References to online version (2 Feb 2017).
- [Book] Gaussian Processes for Machine Learning (http://www.gaussianprocess.org/gpml/) . Carl Edward Rasmussen and Christopher K. I. Williams. The MIT Press. 2006.
- [Book] Pattern recognition and machine learning (https://www.microsoft.com/en-us/research/people/cmbishop/#prml-book) . Christopher M. Bishop. Springer, 2006.
- [Book] Information Theory, Inference, and Learning Algorithms (http://www.inference.org.uk/mackay/itila/) . David J. C. Mackay. Cambridge University Press. 2003.

Other resources

- Stanford CS228 course notes (https://ermongroup.github.io/cs228-notes/)
- The matrix cookbook (https://www.math.uwaterloo.ca/~hwolkowi/matrixcookbook.pdf)
- Tom Minka's Old and New Matrix Algebra Useful for Statistics (https://tminka.github.io/papers/matrix/)

Other resources will be posted on a weekly basis under Course Work on the course website (http://cse.unsw.edu.au/~cs9418/index.html) .

Course Evaluation and Development

This course is evaluated using the myExperience system.

Resource created 8 months ago (Monday 09 September 2019, 11:48:21 AM), last modified 7 months ago (Wednesday 02 October 2019, 11:46:17 AM).

Comments

(/COMP9418/19T3/forums/search?forum_choice=resource/32792)

(/COMP9418/19T3/forums/resource/32792)



David Nguyen (/users/z5154591) 5 months ago (Wed Dec 11 2019 08:41:08 GMT+1100 (Australian Eastern Daylight Time))

Are each of the 4 quizes weighted evenly? or by their raw mark values?

Edit Delete



Gustavo Batista (/users/z3527242) 5 months ago (Wed Dec 11 2019 10:32:33 GMT+1100 (Australian Eastern Daylight Time))

David,

evenly.

Gustavo.

Edit Delete



David Nguyen (/users/z5154591) 5 months ago (Mon Dec 02 2019 20:37:45 GMT+1100 (Australian Eastern Daylight Time))

The final exam will be 2 hours correct?

Edit Delete



Gustavo Batista (/users/z3527242) 5 months ago (Mon Dec 02 2019 21:27:48 GMT+1100 (Australian Eastern Daylight Time))

David,

3 hours.

Gustavo.

Edit Delete



David Nguyen (/users/z5154591) 5 months ago (Fri Nov 22 2019 15:15:31 GMT+1100 (Australian Eastern Daylight Time))

Will there be a lecture on Bayesian learning monday? If so will this be on the exam? Other classes seem to be over.

Edit Delete



Gustavo Batista (/users/z3527242) 5 months ago (Mon Nov 25 2019 11:04:52 GMT+1100 (Australian Eastern Daylight Time))

Hi David,

The Bayesian learning lecture is finished. The slides are in Lectures/Week 10.

This Monday, Payal will present some sample exam questions and answers.

Gustavo.

Edit Delete



Ari Tchetchenian (/users/z5062555) 6 months ago (Wed Oct 16 2019 17:46:56 GMT+1100 (Australian Eastern Daylight Time))

Hi, I am wondering if the final exam will involve theory, coding, or both?

Edit Delete



Gustavo Batista (/users/z3527242) 6 months ago (Thu Oct 17 2019 10:39:24 GMT+1100 (Australian Eastern Daylight Time))

Hi Ari,

we will have multiple choice questions, open-ended questions and a bit of programming.

Gustavo.

Edit Delete



Huanrui Zhang (/users/z5185099) 7 months ago (Sun Oct 06 2019 21:24:05 GMT+1100 (Australian Eastern Daylight Time))

Hi,

Do we have lecture and tutorial next week?

Edit Delete



Rong Zhang (/users/z3456421) 7 months ago (Sun Oct 06 2019 23:55:50 GMT+1100 (Australian Eastern Daylight Time))

We don't have the lecture and tutorials on Monday.

COMP9418 Timetable

UNSW Map | CSE Lab Map

Lectures

Name	Staff	Day	Start Time	End Time	Weeks	Room
1PGA	Gustavo Batista	Mon	14:00	16:00	1-3,5-11	ColomboThB
		Wed	14:00	16:00	1-10	ColomboThC
1UGA	Gustavo Batista	Mon	14:00	16:00	1-3,5-11	ColomboThB
		Wed	14:00	16:00	1-10	ColomboThC

Tutorials

Name	Staff	Day	Start Time	End Time	Weeks	Room
M16A		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01
		Mon	16:00	18:00	1-3,5-11	AinswthG01

Instead, we will have the lecture on week 11.
Edit Delete



Ari Tchetchenian (/users/z5062555) 7 months ago (Tue Sep 24 2019 15:37:24 GMT+1000 (Australian Eastern Standard Time))

Hi, I'm a bit confused about the numbering of the weeks. Last week's 'Graph representation and traversal' lectures are called week 0, but last week's tutorial was called week 1? But also, last week we covered 'Course overview and statistical inference', but it is in the second row (week '1')?

Edit Delete



Armin Chitizadeh (/users/z3323393) 7 months ago (Sat Sep 28 2019 09:26:45 GMT+1000 (Australian Eastern Standard Time))

You are right, in the course outline we used week 0 to indicate that there will be no lectures about graph representation and traversal.
Edit Delete



Aniket Sharma (/users/z5126009) 7 months ago (Sun Sep 22 2019 19:43:07 GMT+1000 (Australian Eastern Standard Time))

Hi Professor,

Am I correct in assuming that there is no "double pass" requirement for this course?
I.e. there is no hurdle requirement in the exam to get above a certain grade to pass the course overall?

Edit Delete



Armin Chitizadeh (/users/z3323393) 7 months ago (Tue Sep 24 2019 12:32:42 GMT+1000 (Australian Eastern Standard Time))

I have asked the lecturer in charge. There is no double pass in this course.

Edit Delete



Xinyue Wang (/users/z5002735) 7 months ago (Fri Sep 20 2019 09:22:36 GMT+1000 (Australian Eastern Standard Time))

Hi Armin,

Are assignments group based or individual based?

Thanks,

Xinyue

Edit Delete



Armin Chitizadeh (/users/z3323393) 7 months ago (Tue Sep 24 2019 10:31:38 GMT+1000 (Australian Eastern Standard Time))

Hi Xinyue,

The assignment is not completely finalised yet. But the first assignment will probably be a group assignment. Each group can have up to three students.

Cheers,
Armin

Edit Delete



Hao Wu (/users/z3444724) 8 months ago (Fri Sep 13 2019 23:45:20 GMT+1000 (Australian Eastern Standard Time))

Hi Armin,

I have always been wondering what the 'Quizzes' are? It takes 10 points out of the total mark. Is it kind of homework?

Thanks,

Hao

Edit Delete



Armin Chitizadeh (/users/z3323393) 7 months ago (Fri Sep 20 2019 00:33:34 GMT+1000 (Australian Eastern Standard Time))

Hi Hao,

"The quizzes are multiple-choice questions to check the student understanding during the course. We will use webcms. There will be around 5 quizzes".

The course outline will be updated soon.

Edit Delete