Course Outline

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Course Details

Course Code	COMP9444
Course Title	Neural Networks and Deep Learning
Convenor	Alan Blair (/users/z3029739)
Admin	TBA
Classes	Monday 5-7pm (Weeks 1, 3-10) and Tuesday 5-7pm (Weeks 1-10) (no lecture on Monday of Week 2 due to the Labour Day Holiday)
Consultations	TBA
Units of Credit	6
Course Website	http://cse.unsw.edu.au/~cs9444/19T2/ (http://cse.unsw.edu.au/~cs9444/19T3/)
Handbook Entry	http://www.handbook.unsw.edu.au/postgraduate/courses/current/COMP9444.html (http://www.handbook.unsw.edu.au/postgraduate/courses/current/COMP9444.html)

Course Summary

This course aims to introduce students to the main topics and methods in the field of neural networks and deep learning, ranging from traditional neural network models to the latest research and applications of deep learning.

Topics chosen from: perceptrons, feedforward neural networks, backpropagation, deep convolutional networks for image processing; geometric analysis of trained neural networks; recurrent networks, language processing, semantic analysis, long short term memory; Hopfield networks, restricted Boltzmann machines and

autoencoders, generative adversarial networks; deep reinforcement learning; designing successful applications of neural networks; recent developments in neural networks and deep learning.

Student Learning Outcomes

After completing COMP9444, students should

- understand aspects of the social, intellectual, and neurobiological context of neural networks and deep learning
- have an understanding of a variety of NN and DL techniques, including the Planned Topics listed below
- be able to analyse a problem for neural network solution in terms of these techniques
- have an awareness of the computational theory underlying the various methods
- have a working knowledge of one or more neural network simulation packages, and be able to use them to perform a range of computational tasks
- have experience in programming neural network and deep learning applications
- exposure to research techniques in neural networks, deep learning and cognitive science: some topics will be based on research papers and monographs, to which references will be given in the course notes

Textbook

The textbook for this course is:

Deep Learning
By Ian Goodfellow, Yoshua Bengio and Aaron Courville
MIT Press

http://www.deeplearningbook.org (http://www.deeplearningbook.org)
https://mitpress.mit.edu/books/deep-learning (https://mitpress.mit.edu/books/deep-learning)

Assumed Knowledge

The course will assume knowledge of the following mathematical topics:

- Linear Algebra (2.1-2.8)
- Probability (3.1-3.14)
- Calculus and Chain Rule (6.5.2)

Students should study the relevant sections of the textbook (shown in brackets) and, if necessary, try to revise these topics on their own during the first few weeks of the course.

Planned Topics

The planned topics for this course are:

Week	**Topic**	**Textbook**
wk1 Mon	Neuroanatomy, Perceptrons	(1.2, 9.10)
wk1 Tue	Backpropagation	(4.3, 5.1-5)
wk2 Mon	(Labor Day Holiday)	-
wk2 Tue	Probability and Backprop Variations	(3.1-14, 6.1-5)
wk3 Mon	Hidden Unit Dynamics	(7.11-12, 8.2-3)
wk3 Tue	PyTorch	
wk4 Mon	Convolutional Networks	(7.9, 9.1-5)
wk4 Tue	Image Processing	(7.4, 8.4, 8.7.1)
wk5 Mon	Recurrent Networks, LSTM and GRU	(10.2, 10.7, 10.10)
wk5 Tue	Language Processing	(10.4, 12.4)
wk6	(Flexibility Week)	

wk7 Mon Reinforcement Learning (12.5.1.1)
wk7 Tue Deep Reinforcement Learning (18.1, 20.9)
wk8 Mon Hopfield Network & Boltzmann Machine (16.7, 17.4, 18.2, 20.1-4)
wk8 Tue Autoencoders (14.1-5, 20.10.3)
wk9 Mon Generative Adversarial Networks (20.10.4)
wk9 Tue Extension Topics
wk10 Mon Review

The relevant sections of the textbook are shown in brackets.
The textbook may be supplemented with additional materials for some topics.

Teaching Strategies

Due to social distancing restrictions, the course will be delivered online. Students are required to watch pre-recorded lecture videos before each session. The scheduled class time will take the form of an interactive video chat session, and will be used to briefly summarise the content, deliver additional material, and to answer any questions that you may have about each topic.

The recorded lectures and online sessions introduce you to the various concepts and methods, provide motivating examples to help you understand them, and demonstrate skills and processes. You should not expect to understand the material completely simply by watching the lecture videos. You should also:

- review the lecture material before and after the scheduled class
- discuss the material with fellow students if possible
- read up on the topics covered in each lecture
- complete relevant assignments, exercises and quizzes
- consider exploring the topic on-line by writing and running your own programs
- ask questions in an online consultation session, if you still don't understand the material

Assessment

At this stage we are planning two assignments as well as a final exam. Further details will be posted on the course Web site as they come to hand.

The assignments will involve writing code in PyTorch. Please try to install PyTorch on your own laptop, and try to match the environment on the CSE Lab machines as closely as possible:

python3	3.7.3
torch	1.2.0
numpy	1.16.2
sklearn	0.20.2

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:

- Academic Integrity and Plagiarism (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)

Course Evaluation and Development

This course is evaluated each session using the myExperience system. Feedback from previous sessions was generally positive and we have tried to keep the same basic course structure.

The field of Neural Networks and Deep Learning is changing rapidly. This course was substantially redesigned in 2017, and we make an on-going effort to keep the course materials up-to-date and include the latest developments in the field.

All comments and suggestions are welcomed, and will be listened to respectfully and appreciatively.

Enjoy!

Resource created about a year ago (Tuesday 19 May 2020, 11:40:05 AM), last modified about a year ago (Tuesday 09 June 2020, 03:59:39 PM).