COMP9444: Neural Networks Home Page

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News Headlines 2006s1

- 3 March: There is now a COMP9444/9844 discussion forum.

COMP9444/COMP9844 Neural Networks Course Introduction

Course Staff

Lecturer	A/Prof. Bill Wilson (Coordinator)	Dr Alan Blair
E-mail	billw	blair
Phone	9385 6876	9385 7131
Office	K17-405	K17-412C
Consultations	(06s1)K17-405 Tue 1-2, Thu 2-4 (in weeks when Bill is lecturing or when one of his assignments is running)	(06s1)???

Course Information

Units of credit	6	
Parallel teaching	no	Only COMP9444 students attend these classes. The students include postgraduates and senior undergraduates.
Related courses and programs	*Assumed knowledge:* COMP9024 Data Structures and Algorithms *or* COMP2011 Data Organization. *Mathematical assumed knowledge:* We also assume you have completed basic university mathematics courses, such as the UNSW courses MATH1131 and MATH1231, and so know about concepts of vectors and matrices (including inner products and orthogonality). It is possible to learn (or revise) these concepts as you do COMP9444; obviously this will take more time than if you already know them.	
Course philosophy and teaching strategies	The learning foci in this course are primarily lectures and assignments, plus a sample exam which you can use to test your preparedness for the final exam. While marks are assigned to the assignments, their primary purpose is to give you concrete tasks with deadlines to help you structure your learning.	
Course aims	To introduce students to a range of topics in the field of artificial neural networks. *Topics are chosen from:* Network architectures: perceptrons, Hopfield and Kohonen nets, ART models, back-propagation trained feed-forward networks, recurrent nets, weightless nets. Computational complexity analysis of training neural network architectures. Probabilistic analysis of generalisation capabilities of feed-forward networks. Hardware based neural nets. Introduction to fuzzy logic, neurotrained nets; designing successful applications of neural networks; tensor product networks; and recent developments in neural networks.	
Learning outcomes	Students successfully completing this course will have a working knowledge of the neural networks topics covered, and will be able to demonstrate their knowledge both by describing aspects of the topics, and by solving problems related to the topics. They will have practical experience with the topics covered in the assignments undertaken. The assignments and specific topics for the current offering are shown below.	
COMP9844 Extended Neural Networks	Extended Neural Networks will cover the syllabus of COMP9444 together with additional topics, to be presented in the additional lecture hour. It is expected that topics will include cascade correlation, radial basis functions, and number of others. Information on assessment in COM9844 is below.	

Assessment

The assessment for this course will consist of:

- 3 hour final exam (70%)
- 4 programming assignments worth 30% in total.
  However, this component of your assessment will be based on your *best 3* assignment marks.
  It *is* acceptable to hand in only 3 assignments. Handing in all four assignments can be viewed either as an extension activity, or as a way of improving your marks in case you don't do a good job on one of the first 3 assignments.

Planned assignment due dates are weeks 6, 8, 11, and 14.

The best 3 assignment marks will be added together and scaled to give a class mark out of 100. The exam will also be marked out of 100. The class mark and final exam mark will be combined using the harmonic mean formula, weighting the exam as 70% (0.7) and the class mark as 30% (0.3):

```
final mark = class * exam/(class*0.7 + exam*0.3)
```

The effect of this formula is that uneven performances are penalised: getting 100% (30/30) for the assignments and 30% (21/70) for the exam would allow a pass if the marks were simply added together, but under the harmonic mean formula, it results in a final mark of 38%.

In fact, if you get 100% (30/30) for the assignments, you will need a mark of at least 41% to obtain a pass in this course. Details of the assignments are below.

Late submission of assignments: Assignments submitted late are subject to the following penalty: the maximum mark obtainable reduces by 10% per day late, up to a maximum of 50%. Thus if the assignment is marked out of 10, and students A and B hand in assignments worth 9 and 7, both two days late, then the maximum mark obtainable is 8, so A gets min(9, 8) = 8 and B gets min(7,8) = 7. Assignments handed in over a month late, or after (if) a solution has been released, will normally receive no marks.

Assignment submission: Assignment submission procedure is described in the assignment specification document, which will be linked to this page when the assignment specification becomes available. Generally assignments are submitted electronically using the `give` program running on the School's computer systems (in labs, and on servers). Details are in the assignment specifications. In COMP9444, you may also or instead sometimes be asked to submit a paper assignment. Again, details will be in the assignment specification.

COMP9844 Extended Neural Networks: Assessment in COMP9844 will differ from that in COM9444 as follows:

- There will be extra exam questions, or parts of exam questions, to cover the additional syllabus material;
- There will be extra components to assignments, or possibly two small extra assignments, to cover the additional syllabus material;
- In recognition of the fact that students in COMP9844 have done extra work, they will have the opportunity to earn extra marks compared with COMP9444;
- Students enrolled in COMP9844 must make a reasonable attempt at the extra assignment material, and must attend 80% of the extension lectures, or present (a) medical certificate(s), or they will be denied assessment in COMP9844. This rule will be administered in a humane way, and is intended to stop people from enrolling in COMP9844, doing none of the extension work, thus ending with a grade in "Extended Neural Networks" rather than "Neural Networks" without any effort.

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Reading e-mail

You should check your school e-mail frequently in case of announcements relating to this course. We assume that you read e-mail sent to your CSE account by the next working day during teaching sessions.

How to forward your CSE E-mail to another e-mail address
CSE E-mail guidelines

Academic honesty and plagiarism

Copying assignments is unacceptable. Assignments will be checked. The penalties for copying range from receiving no marks for the assignment, through receiving a mark of 00 FL for the course, to expulsion from UNSW (for repeat offenders). Allowing someone to copy your work counts as plagiarism, even if you can *prove* that it is your work.

Further details of the School plagiarism policy can be found here. (You acknowledged receipt of these rules when you obtained your CSE computer account, and the link above is for your convenience so that you can review the rules now.)

We are aware that a lot of learning takes place in student conversations, and don't wish to discourage those. However, it is important, for both those helping others and those being helped, not to provide/accept any programming language code in writing, as this is apt to be used exactly as is, and lead to plagiarism penalties for both the supplier and the copier of the codes. Write something on a piece of paper, by all means, but tear it up/take it away when the discussion is over.

If you are new to studying in Australia, be aware that attitudes to plagiarism at UNSW may be different from those in your home country. Make sure you are clear about the rules here at UNSW. In brief, and for the purposes of COMP9444, plagiarism includes copying or obtaining all, or a substantial part, of the material for your assignment, whether programming language code, or written or graphical report material, without written acknowledgement in your assignment from:

1. a location on the internet;
2. a book, article or other written document (whether published or unpublished) whether electronic or on paper or

other medium;
3. another student, whether in your class or another class;
4. a non-student (e.g. from someone who writes assignments for money)

Note that if you copy code or other material from another student or non-student with acknowledgement, you will not be penalised for plagiarism, but you are unlikely to get any marks for the copied material. If you use code found in a publication (on the internet or otherwise) then the marks you get for this will be at the marker's discretion, and will reflect the marker's perception of the amount of work you put into finding and/or adapting the code, and the degree to which you understand the code.

Note also that there is a big difference between being able to understand someone else's code, and writing that code yourself from scratch. A computer programmer has to be able to write code from scratch. The assignments provide opportunities for you to develop the skills necessary to write your own neural-network-related code. Use these opportunities!

Course schedule

Lectures: Wednesday 6-9pm; Room: Biomed A

Schedule: (the order and content shown below may vary - this is an indication only). Lecture notes for each week will be available when a link appears in the column, below, labelled **Notes**.

Week	Date	Lecturer	Topic	Notes	Assignment Out (Plan)
1	1 Mar	Alan	Introduction and brain physiology	Intro & Physiology	
2	8 Mar	Alan	Perceptrons	-	
3	15 Mar	Alan	Multi-layer perceptrons	-	Backprop
4	22 Mar	Alan	Geometry	-	
5	29 Mar	Alan	Applications	-	
6	5 Apr	Alan	Support Vector Machines	-	SVM(?)
7	12 Apr	Alan	Committee machines	-	
	19 Apr		Mid-session Break		
8	26 Apr	Bill	Recurrent networks 1	-	
9	3 May	Bill	Recurrent networks 2/Boltzmann machine	-	Recurrent networks
10	10 May	Bill	Tensor product networks	-	
11	17 May	Bill	Self-organising systems	-	Kohonen nets
12	24 May	Bill	Simulated annealing	-	
13	31 May	Bill	Neurodynamics - Hopfield nets Boltzmann machine	-	
14	7 Jun	Both	Revision	-	

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Resources for students

Resources for students include the course lecture notes, which will appear linked to the table above as the course runs. In some cases, these notes provide pointers to further resources, such as internet sites and publications.

Text Book

Haykin, S. Neural Networks: a comprehensive foundation, 2nd edition. Prentice-Hall, 1999

Recommended Reference Books

On the role of neural networks and connectionism as framework for developing AI systems:

Hoffmann, A.G. Paradigms of Artificial Intelligence - A methodological and computational analysis, Springer-Verlag, 1998. This book was written by a former lecturer in COMP9444.

Journals and Conferences

Here are the names of some of the more prominent Neural Network journals and conferences:

- J: Neural Networks
- J: IEEE Transactions on Neural Networks
- J: Neural Computation
- J: Connection Science

- C: NIPS (Neural Information Processing Systems)
- C: ICONIP (International Conference On Neural Information Processing
- C: for conferences organized by the International Neural Network Society, see here, under Announcements.

Some material on neural networks appears in more general journals and conferences. Places to look for the cognitive science end of NNs include:

- J: Behavioral and Brain Sciences
- J: Artificial Intelligence
- J: Cognitive Science

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Software Availability

tlearn

- tlearn user manual (about 40 pages) and Unix manual for tlearn (7 pages);
- tlearn home page from which you can download Mac and Windows versions, as well as source code for a Unix version (but see next dot-point);
- xtlearn is available for CSE's pc.i86.linux machines, at `~cs9444/bin/xtlearn`). Note that the interface to `xtlearn` is a bit different from the Mac interface, on which the documentation is based. The Mac version has a built-in text editor, whereas in the Unix (X-windows) version, you need to use your own favorite text editor to create the `.cf`, `.data`, `.teach`, etc. files. Note also that there seems to be a bug in it: it freezes under certain circumstances if the "Num Lock" key is on (pressed). The workaround is: press the "Num Lock" key again to turn it off.
- A command-line version of tlearn is also available for pc.i86.linux machines, at `~cs9444/bin/tlearn`. It might be useful for batch-style simulations - e.g. where you wanted to run, say, 1000 simulations of a particular model and then, presumably, automatically analyse the output. Again, you would use your own favorite text editor to create the `.cf`, `.data`, `.teach`, etc. files.
- Info on Cross-Entropy as a error measure in `tlearn`. See also the Training Options menu item in `tlearn`.

Matlab

- Haykin's Matlab code
- Other Matlab code

Tensor Product Networks

- C code for Tensor Product Net operations (simplified version of STAR-1 system)

Sample Exam Questions

Not yet available

Continual course improvement

Student feedback on this course, and on the lecturing in this course, will be gathered via questionnaires held at or after the end of the course. Student feedback is taken seriously, and continual improvements are made to the course based in part on this feedback. The course questionnaire results go to the Head of the School of Computer Science and Engineering, who reads the results and follows up in cases where action is clearly needed.

Assignments

Links to the assignment specification documents will appear below when each assignment is ready (or almost ready).

1. Error backpropagation learning (set by Alan Blair)
2. Support vector machines (set by Alan Blair)
3. Simple recurrent networks (set by Bill Wilson)
4. Kohonen networks (set by Bill Wilson)

Testing your Program: Testing is an important part creating a correct program. Here are some tips on testing.

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Dictionaries

- The Machine Learning Dictionary for COMP9414

Further information

- Students enrolled in COMP9444 are expected to attend all classes
- The use of School of Computer Science and Engineering computing laboratories is subject to rules described in the Yellow Form, which you acknowledge (electronic) receipt of when you receive your computing account. The Yellow Form also outlines what to do in case illness or misadventure that affects your assessment, and supplementary examinations procedures within the School of Computer Science and Engineering.
- Information on UNSW Occupational Health and Safety policies and expectations
- Equity and Diversity issues

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Page maintained by:
Bill Wilson and Alan Blair
Phone: 9385 6876 and 9385 7131
E-mail: {billw,blair}@cse.unsw.edu.au

CRICOS Provider Number: 00098G
Last updated: 11/19/2021 14:59:20