MONASH University
Information Technology

FIT5167
Natural computation for intelligent systems

Unit Guide

Semester 1, 2011

Last updated: 02 Mar 2011

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FIT5167 Natural computation for intelligent systems - Semester 1, 2011

This unit looks at the development and application of biologically inspired models of computation. We study: basic components of a natural neural systems: synapses, dendrites and neurons and their computational models; fundamental concepts of data and signal encoding and processing; neural network architectures: pattern association networks, auto associative networks, feedforward networks, competitive networks, self organizing networks and recurrent networks; plasticity and learning. Hebb rule, supervised learning, reinforced learning, error-correcting learning, unsupervised learning, competitive learning, self-organization.

Mode of Delivery

Caulfield (Evening)

Contact Hours

2 hrs lectures/wk, 2 hrs laboratories/wk

Workload

Two-hour lecture and two-hour tutorial (or laboratory) (requiring advance preparation) a minimum of 2-3 hours of personal study per one hour of contact time in order to satisfy the reading and assignment expectations. You will need to allocate up to 5 hours per week in some weeks, for use of a computer, including time for newsgroups/discussion groups.

Unit Relationships

Prohibitions

CSE5301

Chief Examiner

Grace Rumantir

Campus Lecturer

Caulfield

Grace Rumantir

Contact hours: Friday 12-2pm

Tutors

Caulfield

Minh Viet Le

Contact hours: Monday 5-6pm

Learning Objectives

At the completion of this unit students will:

- understand basic computational principles underlying the operations of biological neural systems;
- have knowledge of computational methods of simulating biological and artificial neural systems;
- have knowledge of supervised, unsupervised and self-organising neuronal learning systems;
- be able to use computer software to simulate behaviour of neurons and neural networks.

Graduate Attributes

Monash prepares its graduates to be:

1. responsible and effective global citizens who:

a. engage in an internationalised world
b. exhibit cross-cultural competence
c. demonstrate ethical values

critical and creative scholars who:

a. produce innovative solutions to problems
b. apply research skills to a range of challenges
c. communicate perceptively and effectively

Assessment Summary

Examination (3 hours): 60%; In-semester assessment: 40%

Assessment Task	Value	Due Date
Unit Test	20%	Week 8 lecture
Applications of Neural Network Algorithms	20%	Stage 1 due Week 9 (hurdle), Stage 2 due start Week 11 lecture
Examination 1	60 %	To be advised

Teaching Approach

Lecture and tutorials or problem classes

This teaching and learning approach provides facilitated learning, practical exploration and peer learning.

Feedback

Our feedback to You

Types of feedback you can expect to receive in this unit are:

- Informal feedback on progress in labs/tutes
- Graded assignments with comments
- Interviews
- Test results and feedback
- Quiz results
- Solutions to tutes, labs and assignments

Your feedback to Us

Monash is committed to excellence in education and regularly seeks feedback from students, employers and staff. One of the key formal ways students have to provide feedback is through SETU, Student Evaluation of Teacher and Unit. The University's student evaluation policy requires that every unit is evaluated each year. Students are strongly encouraged to complete the surveys. The feedback is anonymous and provides the Faculty with evidence of aspects that students are satisfied and areas for improvement.

For more information on Monash's educational strategy, and on student evaluations, see:
http://www.monash.edu.au/about/monash-directions/directions.html
http://www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

Previous Student Evaluations of this unit

If you wish to view how previous students rated this unit, please go to
https://emuapps.monash.edu.au/unitevaluations/index.jsp

Required Resources

You will need access to a Neural Network tool such as:

- Matlab 2009a with Neural Network Toolbox
- Emergent (available free from http://grey.colorado.edu/emergent/index.php/Main_Page)
- SNNS (available free from www.ra.cs.uni-tuebingen.de/SNNS)

All the above softwares are available in the 24 hour labs B3.45, B3.46, B3.46b at the Caulfield Campus. Submit an online IT request to gain access to these labs at
http://www1.infotech.monash.edu.au/webservices/servicedesk/requestform/

Examination material or equipment

Scientific Calculator

Unit Schedule

Week	Date*	Activities	Assessment
0	21/02/11	FIT5167 Moodle site is open for "guests". There is a self-assessed test on basic maths and statistics on Moodle. Please check this out before enrolling in this unit.	
1	28/02/11	Introduction	Self-assessed test on basic maths and statistics
2	07/03/11	Artificial Neural Networks: an Overview	
3	14/03/11	Perceptron for Linear Pattern Classification	
4	21/03/11	Neural Networks for Non-linear Pattern Recognition 1	
5	28/03/11	Neural Networks for Non-linear Pattern Recognition 2	
6	04/04/11	Generalisation and Improving Neural Networks Performance	
7	11/04/11	Unsupervised Classification with Self Organising Maps	
8	18/04/11	Unit Test (in the lecture time slot - tute still on)	Unit Test during Week 8 lecture
Mid semester break			
9	02/05/11	Associative Memory Networks	Assignment Stage 1 due Week 9 (hurdle)
10	09/05/11	Neural Networks for Time series Forecasting	
11	16/05/11	Recurrent Networks for Time series Forecasting	Assignment Stage 2 due start Week 11 lecture
12	23/05/11	Revision	
	30/05/11	SWOT VAC	No formal assessment is undertaken SWOT VAC

*Please note that these dates may only apply to Australian campuses of Monash University. Off-shore students need to check the dates with their unit leader.

Assessment Policy

To pass a unit which includes an examination as part of the assessment a student must obtain:

- 40% or more in the unit's examination, and
- 40% or more in the unit's total non-examination assessment, and
- an overall unit mark of 50% or more.

If a student does not achieve 40% or more in the unit examination or the unit non-examination total assessment, and the total mark for the unit is greater than 50% then a mark of no greater than 49-N will

be recorded for the unit

Assessment Tasks

Participation

- **Assessment task 1**

Title:
Unit Test
Description:
Closed book
Weighting:
20%
Criteria for assessment:
Details will be provided.
Due date:
Week 8 lecture
Remarks:
The unit test will be conducted during the Week 8 lecture time slot. Week 8 tutorials will still run as per normal.

- **Assessment task 2**

Title:
Applications of Neural Network Algorithms
Description:
Students are to build neural network models for a given data set and provide analysis thereof.
Weighting:
20%
Criteria for assessment:
Details will be provided.
Due date:
Stage 1 due Week 9 (hurdle), Stage 2 due start Week 11 lecture
Remarks:
The assignment is to be submitted at the start of the Week 11 lecture. Penalty for late submission applies.

Examinations

- **Examination 1**

Weighting:
60 %
Length:
3 hours
Type (open/closed book):
Closed book
Electronic devices allowed in the exam:
Scientific Calculator

Assignment submission

Assignment coversheets are available via "Student Forms" on the Faculty website:
http://www.infotech.monash.edu.au/resources/student/forms/
You MUST submit a completed coversheet with all assignments, ensuring that the plagiarism declaration section is signed.

Extensions and penalties

Submission must be made by the due date otherwise penalties will be enforced.

You must negotiate any extensions formally with your campus unit leader via the in-semester special consideration process:
http://www.infotech.monash.edu.au/resources/student/equity/special-consideration.html.

Returning assignments

Students can expect assignments to be returned within two weeks of the submission date or after receipt, whichever is later

Policies

Monash has educational policies, procedures and guidelines, which are designed to ensure that staff and students are aware of the University's academic standards, and to provide advice on how they might uphold them. You can find Monash's Education Policies at:
http://policy.monash.edu.au/policy-bank/academic/education/index.html

Key educational policies include:

- Plagiarism (http://www.policy.monash.edu/policy-bank/academic/education/conduct/plagiarism-policy.html)
- Assessment (http://www.policy.monash.edu/policy-bank/academic/education/assessment/assessment-in-coursework-po
- Special Consideration (http://www.policy.monash.edu/policy-bank/academic/education/assessment/special-consideration-policy.h
- Grading Scale (http://www.policy.monash.edu/policy-bank/academic/education/assessment/grading-scale-policy.html)
- Discipline: Student Policy (http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-discipline-policy.html)
- Academic Calendar and Semesters (http://www.monash.edu.au/students/key-dates/);
- Orientation and Transition (http://www.infotech.monash.edu.au/resources/student/orientation/); and
- Academic and Administrative Complaints and Grievances Policy (http://www.policy.monash.edu/policy-bank/academic/education/management/complaints-grievance-policy.

Student services

The University provides many different kinds of support services for you. Contact your tutor if you need advice and see the range of services available at www.monash.edu.au/students The Monash University Library provides a range of services and resources that enable you to save time and be more effective in your learning and research. Go to http://www.lib.monash.edu.au or the library tab in my.monash portal

for more information. Students who have a disability or medical condition are welcome to contact the Disability Liaison Unit to discuss academic support services. Disability Liaison Officers (DLOs) visit all Victorian campuses on a regular basis

- Website: http://adm.monash.edu/sss/equity-diversity/disability-liaison/index.html;
- Telephone: 03 9905 5704 to book an appointment with a DLO;
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1 Gallery Building (Building 55), Monash University, Clayton Campus.

Recommended Reading

- S. Samarasinghe, *Neural Networks for Applied Sciences and Engineering: From Fundamentals to Complex Pattern Recognition*, Auerbach Publications, 2007 (e-book from Monash Library)
- G. Dreyfus, *Neural Networks: Methodology and Applications*, Springer-Verlag Berlin Heidelberg, 2005 (e-book)
- R. Beale, *Neural Computing: an Introduction*, Institute of Physics Pub., Bristol, 1991 (e-book)

- S. Haykin, *Neural Networks and Learning Machines*, 3rd edition, Prentice Education , Inc., New Jersey, 2009
- C. Bishop, *Neural Networks for Pattern Recognition*, Oxford University Press, 2005
- J. Freeman and D. Skapura, *Neural Networks: Algorithms, Applications, and Programming Techniques*, Addison-Wesley, Massachussets, 1991