MONASH University
Information Technology

FIT5167
Natural computation for intelligent systems

Unit Guide

Semester 1, 2015

Last updated: 21 Jan 2015

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FIT5167 Natural computation for intelligent systems - Semester 1, 2015

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 (Day)

Workload Requirements

Minimum total expected workload equals 12 hours per week comprising:

(a.) Contact hours for on-campus students:

- Two hours of lectures
- One 2-hour laboratory

(b.) Additional requirements (all students):

- A minimum of 8 hours independent study per week for completing lab and project work, private study and revision.

See also Unit timetable information

Unit Relationships

Prohibitions

CSE5301

Chief Examiner

Dr Grace Rumantir

Campus Lecturer

Caulfield

Grace Rumantir

Consultation hours: TBA

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 the Student Evaluation of Teaching and Units (SETU) survey. 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, see:

www.monash.edu.au/about/monash-directions/ and on student evaluations, see:
www.policy.monash.edu/policy-bank/academic/education/quality/student-evaluation-policy.html

Previous Student Evaluations of this Unit

This unit was offered for the first time in Semester 1, 2010. It has consistently been getting well above 4 out of 5 on every question in the unit evaluation with close to 100% response rate every year. We will try to continue maintaining the high quality of the unit this year. Most notable characteristics of the unit as pointed out by previous student feedback are:

- It covers topics that technical but highly relevant in practical use in the industry
- Unit materials are structured in a well organised manner
- Delivery of unit materials is done in a friendly interactive manner
- Weekly quizzes help students in their self study during the week
- Timely feedback on formal assessments
- Feedback from students for improving the quality and delivery of the unit are sought out throughout the semester

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

Academic Overview

Learning Outcomes

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.

Unit Schedule

Week	Activities	Assessment
0		No formal assessment or activities are undertaken in week 0
1	Introduction	There is a self-assessed test (not marked) on basic maths and statistics on Moodle that will be discussed in the Week 1 tutorial. Please complete this to see if you need to do further study prior to completing this unit.
2	Artificial Neural Networks: an Overview	
3	Perceptron for Linear Pattern Classification	
4	Neural Networks for Non-linear Pattern Recognition 1	
5	Neural Networks for Non-linear Pattern Recognition 2	
6	Generalisation and Improving Neural Networks Performance	
7	Unsupervised Classification with Self Organising Maps	
8	Unit Test (in lecture time slot, tutorials still on)	Unit Test during Week 8 lecture (Monday 27 April 2015)
9	Associative Memory Networks	Assignment Stage 1 during Week 9 tutorial
10	Neural Networks for Time series Forecasting	
11	Recurrent Networks for Time series Forecasting	Assignment Stage 2 due start of Week 11 lecture (Monday 18 May 2015)
12	Revision	
	SWOT VAC	No formal assessment is undertaken in SWOT VAC
	Examination period	LINK to Assessment Policy: http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html

*Unit Schedule details will be maintained and communicated to you via your learning system.

Teaching Approach

Lecture and tutorials or problem classes

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

Assessment Summary

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

Assessment Task	Value	Due Date

Unit Schedule

Unit Test	20%	Unit Test during Week 8 lecture (Monday 27 April 2015)
Applications of Neural Network Algorithms	20%	Assignment Stage 1 during Week 9 tutorial, Assignment Stage 2 due start of Week 11 lecture (Monday 18 May 2015)
Examination 1	60 %	To be advised

Assessment Requirements

Assessment Policy

Faculty Policy - Unit Assessment Hurdles
(http://intranet.monash.edu.au/infotech/resources/staff/edgov/policies/assessment-examinations/assessment-hurd

Academic Integrity - Please see resources and tutorials at
http://www.monash.edu/library/skills/resources/tutorials/academic-integrity/

Assessment Tasks

Participation

- **Assessment task 1**

  Title:
  Unit Test
  Description:
  Closed-book unit test to be conducted in the lecture time slot in Week 8.
  Weighting:
  20%
  Criteria for assessment:
  Correct answers to questions, and quality of solutions to problems, which demonstrates understanding of the learning materials.

  Further detail of the format and coverage of the unit test will be made available on Moodle.
  Due date:
  Unit Test during Week 8 lecture (Monday 27 April 2015)
  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:
  The assignment will be in paired groups.

  Stage 1: Write up of problem definition, data analysis and pre-processing, and design of experiments (non assessable).

  Stage 2: Submission (20%).

  Students will be assessed on:

- The degree to which the submission meet the assignment specification.
- The quality of the data preprocessing and the design of experiments.
- How well the experiments are conducted and summarised.
- How well the results of the experiments are analysed and documented.

The tutor will monitor individual contributions when allocating marks to members of the group.

Further assessment criteria and marking sheet will be made available on the unit Moodle site.

Due date:

Assignment Stage 1 during Week 9 tutorial, Assignment Stage 2 due start of Week 11 lecture (Monday 18 May 2015)

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

Learning resources

Reading list

- 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

Monash Library Unit Reading List (if applicable to the unit)
http://readinglists.lib.monash.edu/index.html

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

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.monash.edu.au/exams/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.

Assignment submission

It is a University requirement (http://www.policy.monash.edu/policy-bank/academic/education/conduct/student-academic-integrity-managing-pla for students to submit an assignment coversheet for each assessment item. Faculty Assignment coversheets can be found at http://www.infotech.monash.edu.au/resources/student/forms/. Please check with your Lecturer on the submission method for your assignment coversheet (e.g. attach a file to the online assignment submission, hand-in a hard copy, or use an electronic submission). Please note that it is your responsibility to retain copies of your assessments.

Online submission

If Electronic Submission has been approved for your unit, please submit your work via the learning system for this unit, which you can access via links in the my.monash portal.

Required Resources

Please check with your lecturer before purchasing any Required Resources. Limited copies of prescribed texts are available for you to borrow in the library, and prescribed software is available in student labs.

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

- Matlab 2014b with Neural Network Toolbox
- Weka (available free from http://www.cs.waikato.ac.nz/ml/weka/)
- 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

Other Information

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: www.policy.monash.edu.au/policy-bank/academic/education/index.html

Faculty resources and policies

Important student resources including Faculty policies are located at http://intranet.monash.edu.au/infotech/resources/students/

Graduate Attributes Policy

http://www.policy.monash.edu/policy-bank/academic/education/management/monash-graduate-attributes-policy.h

Student Charter

www.opq.monash.edu.au/ep/student-charter/monash-university-student-charter.html

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 http://www.monash.edu.au/students. For Malaysia see http://www.monash.edu.my/Student-services, and for South Africa see http://www.monash.ac.za/current/.

Monash University Library

The Monash University Library provides a range of services, resources and programs that enable you to save time and be more effective in your learning and research. Go to www.lib.monash.edu.au or the library tab in my.monash portal for more information. At Malaysia, visit the Library and Learning Commons at http://www.lib.monash.edu.my/. At South Africa visit http://www.lib.monash.ac.za/.

Disability Liaison Unit

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://www.monash.edu/equity-diversity/disability/index.html
- Telephone: 03 9905 5704 to book an appointment with a DLO; or contact the Student Advisor, Student Commuity Services at 03 55146018 at Malaysia
- Email: dlu@monash.edu
- Drop In: Equity and Diversity Centre, Level 1, Building 55, Clayton Campus, or Student Community Services Department, Level 2, Building 2, Monash University, Malaysia Campus