Unit Outline

INMT8526 / INMT7526
Artificial Intelligence in Business

Semester 2
2009
Crawley

A/Prof Peter Goldschmidt

Business School
www.business.uwa.edu.au
UNIT DESCRIPTION

Introduction

The use of computational intelligence in management, business and administration.
Considerable attention is given to general theoretical principles but the main focus is on
applying available computer packages to solve problems.

Unit content

This unit enables students to understand and apply flexible computer-based systems that learn
to solve problems—genetic algorithm, fuzzy logic and neural networks. This is in a business
management and planning environment. Hybrid methods and the relatively new swarm
intelligence models are also introduced.

Learning outcomes

On completion of this unit, you should be able to:

- Understand and apply expert systems, genetic algorithm, fuzzy logic and neural
  networks in a business management and planning environment. Hybrid methods and the
  relatively new swarm intelligence models will also be considered.
- Achieve some understanding of applied computer based systems which learn to solve
  problems - artificial intelligence and evolutionary computing.
- Develop a 'hands-on' capacity to apply these methods.
- Assess the potential to apply artificial intelligence, evolutionary computing and expert
  systems in business and administrative contexts.
- Judge where to use these methods and the strengths of each.
- Compare artificial intelligence and evolutionary computing with analytical and simulation
  approaches to solving business problems.
- Interpret and judge the work of specialised analysts.

Educational Principles

In this unit, you will be encouraged and facilitated to develop the ability and desire to:

1. master the subject matter, concepts and techniques of their chosen discipline(s) at
   internationally-recognised levels and standards;
2. acquire the skills required to learn, and to continue through life to learn, from a
   variety of sources and experiences;
3. adapt acquired knowledge to new situations;
4. communicate in English clearly, concisely and logically;
5. acquire the skills needed to embrace rapidly-changing technologies in a global
   environment;
6. think and reason logically and creatively;
7. undertake problem identification, analysis and solution;
8. question accepted wisdom and be open to new ideas and possibilities;
9. acquire mature judgment and responsibility in ethical, moral, social, and practical, as well as academic matters;
10. work independently and in a team;
11. acquire cross-cultural and other competencies to take a citizenship and leadership role in the local, national or international community.
CONTACT DETAILS

<table>
<thead>
<tr>
<th>Unit contact</th>
<th>Professor Peter Goldschmidt</th>
</tr>
</thead>
<tbody>
<tr>
<td>name:</td>
<td>Peter Goldschmidt</td>
</tr>
<tr>
<td>email:</td>
<td><a href="mailto:Peter.Goldschmidt@uwa.edu.au">Peter.Goldschmidt@uwa.edu.au</a></td>
</tr>
<tr>
<td>phone:</td>
<td>6488 2799</td>
</tr>
<tr>
<td>fax:</td>
<td>6488 1055</td>
</tr>
<tr>
<td>consultation hours:</td>
<td>Monday 3:30-5:00</td>
</tr>
<tr>
<td>lecture times:</td>
<td>Monday 5:00-8:00</td>
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<tr>
<td>lecture building &amp; room:</td>
<td>Business School- BUSN:160 ; Computer Lab G86</td>
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<tr>
<th>Tutor - Lab</th>
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<tbody>
<tr>
<td>name:</td>
<td>David Mangono</td>
</tr>
<tr>
<td>email:</td>
<td>David Mangono [<a href="mailto:margod01@student.uwa.edu.au">margod01@student.uwa.edu.au</a>]</td>
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<tr>
<td>phone:</td>
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<td>fax:</td>
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<tr>
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<tr>
<td>Tutorial/lab times:</td>
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<td>tutorial building &amp; room:</td>
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TEACHING AND LEARNING RESPONSIBILITIES

Teaching and learning strategies

Charter of student rights and responsibilities

This Charter of Student Rights and Responsibilities upholds the fundamental rights of students who undertake their education at the University of Western Australia. It recognises that excellence in teaching and learning requires students to be active participants in their educational experience. It upholds the ethos that in addition to the University’s role of awarding formal academic qualifications to students, the University must strive to instil in all students independent scholarly learning, critical judgement, academic integrity and ethical sensitivity.

Please refer to the guild website the full charter of student rights, located at http://www.secretariat.uwa.edu.au/home/policies/charter

Teaching and learning evaluation

You may be asked to complete two evaluations during this unit. The Student Perception of Teaching (SPOT) and the Students’ Unit Reflective Feedback (SURF). The SPOT is optional and is an evaluation of the lecturer and the unit. The SURF is completed online and is a university wide survey and deals only with the unit. You will receive an email from the SURF office inviting you to complete the SURF when it is activated. We encourage you to complete the forms as your feedback is extremely important and can be used to make changes to the unit or lecturing style when appropriate. The units in the UWA Business School are evaluated periodically and your constructive input is taken into account when this unit is updated.
ASSESSMENT MECHANISM

Assessment mechanism summary

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
<th>Due date</th>
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</thead>
<tbody>
<tr>
<td>Assignment 1 - Fuzzy</td>
<td>15</td>
<td>Monday 17 August</td>
</tr>
<tr>
<td>Assignment 2 - Neural Nets</td>
<td>15</td>
<td>Monday 14 September</td>
</tr>
<tr>
<td>Assignment 3 – Genetic Algorithms</td>
<td>15</td>
<td>Monday 12 October</td>
</tr>
<tr>
<td>Presentation</td>
<td>10</td>
<td>Last week of the semester</td>
</tr>
<tr>
<td>Final exam</td>
<td>45</td>
<td>During exam period</td>
</tr>
</tbody>
</table>

Note: Results may be subject to scaling and standardisation under faculty policy and are not necessarily the sum of the component parts.

Assessment details

The following outline indicates the relative importance to give to each stage of the assignments and how to structure your report. The grading will allocate marks (printed on a marks slip) out of the percentage of the assignment mark for each of the four elements.

Assignment 1

20% Formulation, Scope, Investigations
- Context of the problem and any background needed to understand the report
- Narrow the scope to some specific questions
- Identify key features of the system under investigation
- Compile information and numerical data (but reasonable guesstimation is acceptable)
- State assumptions and their justification

40% Model Building
- The report should include relevant explanation and printouts
- Including explanation of decisions about variables and adjectives.

20% Verification, Validation, Trials and Analysis
- Describe how you satisfied yourself that the model does what you intended it to do and that it gives useful insights into the problem.
- Brief outline of trials carried out and the results obtained.

20% Conclusions and Recommendations
- A statement of what has been found or demonstrated.
Assignment 2

20% Formulation, Scope, Investigations
- Context of the problem and any background needed to understand the report
- Identify key features of the system under investigation
- Collect data

40% Model Building
- The report should include relevant explanation and printouts
- Including explanation of decisions about variables.

20% Verification, Trials and Analysis
- Describe how you satisfied yourself that the model does what you intended it to do and that it gives useful insights into the problem.
- Brief outline of trials carried out and the results obtained.

20% Conclusions and Recommendations
- A statement of what has been found or demonstrated.

Assignment 3

20% Formulation, Scope, Investigations
- Context of the problem and any background needed to understand the report
- Identify key features of the system under investigation
- Compile information and numerical data (but reasonable guesstimation of missing data is acceptable)

40% Model Building
- The report should include relevant explanation and printouts
- Including explanation of decisions about variables and structure

20% Verification, Trials and Analysis
- Describe how you satisfied yourself that the model does what you intended it to do and that it gives useful insights into the problem.
- Brief outline of trials carried out and the results obtained.

20% Conclusions and Recommendations
- A statement of what has been found or demonstrated.

Assignment 4

For presentation, students will pair to present and critically review an artificial intelligence application from a journal, magazine or personal work experience. The presentation represents 10% of the final grade and it should not last more than 12 min. Powerpoint presentations will be provided to your lecturer before the presentation (last three lectures of the semester).

Final Exam
The final exam will be held during the examination period and is worth 45% of your total mark for the unit.
Standard of Assessment

The Business School must ensure that the processes of assessment are fair and are designed to maintain the standards of the School and its students. The School follows the University of Western Australia’s grading system:

- **HD** (Higher distinction) 80-100%
- **D** (Distinction) 70-79%
- **CR** (Credit pass) 60-69%
- **P** (Pass) 50-59%
- **N+** (Fail) 45-49%
- **N** (Fail) 0-44%

The School awards marks leading to these grades by using the following general criteria which are presented here as a clear indication of the School’s expectations. These general criteria may be supplemented by specific standards with regard to a particular assignment.

**HD** The student has a clear understanding of theory, concepts and issues relating to the subject and is able to adopt a critical perspective. The student is able to clearly identify the most critical aspects of the task and is able to offer a logically consistent and well articulated analysis within the analytic framework presented in the unit. The student is able to draw widely from the academic literature and elsewhere but maintains relevance.

**D** The student has a clear understanding of theory, concepts and issues relating to the subject. The student is able to develop an analysis of an issue using the analytic framework presented in the unit and is able to identify and evaluate the critical issues. The student is able to draw upon relevant academic and other material.

**CR** The student demonstrates an understanding of the analytic framework developed in the unit and a partial understanding of concepts and issues. The student is able to identify some key issues and is able to present a logical discussion, but with some conceptual errors or gaps between analysis and conclusions. The student is able to draw upon an adequate range of references and other materials.

**P** The student generally takes a descriptive rather than analytic approach to the subject. The student is able to demonstrate some understanding of the issues involved but does not demonstrate the ability to apply the analytic framework which had been developed in the unit. Draws primarily upon unit materials for referencing.

**N+** The student is unable to demonstrate that he or she understands the core elements of the subject matter. The student is able to provide some insight into issues but misapplies analytic framework developed in the unit, omitting key factors and, for example, drawing conclusions which are not related to the preceding discussion.

**N** The student is unable to demonstrate any understanding of the subject matter. Material presented for assessment is unrelated to unit framework and shows not effort to identify or address critical aspects of the topic.

The scaling of marks to ensure comparability between classes is an acceptable academic practice. The School and Board of Examiners have the right to scale marks where it is considered necessary to maintain consistency and fairness.
Special Consideration and Deferred Exams

If something exceptional and beyond your control has interfered with your ability to study in the normal way you should consider completing an application for special consideration. The forms can be obtained at the Undergraduate Student Centre or Postgraduate Student Centre, or from the Student Administration website http://www.studentadmin.uwa.edu.au/welcome/forms

In exceptional circumstances you can also apply for a deferred mid-semester/trimester exam or a deferred end of semester/trimester exam within three (3) university working days from the date of the exam. Application forms can be obtained at the Undergraduate Student Centre or Postgraduate Student Centre.

A student may be granted a deferred examination in one or more of their units if the Sub-Dean of the Business School is satisfied that on the basis of medical or other exceptional reasons the candidate was either:

• substantially and unusually hindered in their preparation for an examination; or
• unavoidably absent from or unable to complete an examination.

Further information concerning Special Consideration and Deferred Examinations is available on the Business School website http://www.business.uwa.edu.au/students/assessments

Supplementary Assessment

Supplementary Assessment is not offered by the Business School.

Ethical Scholarship, Academic Literacy and Academic Misconduct

Ethical scholarship is the pursuit of scholarly enquiry marked by honesty and integrity.

Academic Literacy is the capacity to undertake study and research, and to communicate findings and knowledge, in a manner appropriate to the particular disciplinary conventions and scholarly standards expected at university level.

Academic misconduct is any activity or practice engaged in by a student that breaches explicit guidelines relating to the production of work for assessment, in a manner that compromises or defeats the purpose of that assessment. Students must not engage in academic misconduct. Any such activity undermines an ethos of ethical scholarship. Academic misconduct includes, but is not limited to cheating, or attempting to cheat, through:

• Collusion
• Inappropriate collaboration
• Plagiarism
• Misrepresenting or fabricating data or results or other assessable work
• Inappropriate electronic data sourcing/collection
• Breaching rules specified for the conduct of examinations in a way that may compromise or defeat the purposes of assessment.
Penalties for academic misconduct vary according to seriousness of the case, and may include the requirement to do further work or repeat work; deduction of marks; the award of zero marks for the assessment; failure of one or more units; suspension from a course of study; exclusion from the University, non-conferral of a degree, diploma or other award to which the student would otherwise have been entitled. Refer to the Ethical Scholarship, Academic Literacy and Academic Misconduct located on the University's website at http://www.teachingandlearning.uwa.edu.au/t4/for_uwa_staff/policies/student_related_policies/academic_conduct

**Academic Conduct Essentials (ACE)**

All newly enrolled students are required to complete a short compulsory online unit called *Academic Conduct Essentials* (ACE) within the first 10 weeks of semester. ACE introduces students to essential knowledge regarding ethical scholarship, it helps prepare them for the expectations they will need to meet during their university career and it informs them of correct academic conduct.

ACE can be accessed via WebCT (http://webct6.uwa.edu.au). In order to pass the unit, the unit quiz must be completed with a mark of 80% or greater. To gain the required pass mark students may attempt the quiz as many times as they wish. Completion of the unit will be recorded as an Ungraded Pass (UP) on the student’s academic record. Non-completion (NC) within the required timeframe will also be documented on formal academic records (ie, in either case the grade will appear on transcripts). More information on ACE is available at http://ace.uwa.edu.au

**Acknowledging sources of information**

In the course of your individual and team work assignments, you will encounter ideas from many sources. These will include journal and newspaper articles, commentaries, books, web sites and other electronic sources, original case sources, lecture materials. All assignments that you submit must acknowledge all the different sources you have used. Not to acknowledge your sources is plagiarism, a form of dishonesty. Plagiarism is the misappropriation of the work or ideas of others and presenting them as your own. This is reprehensible from both an ethical and legal viewpoint. Neither the School nor the University accepts ignorance or the fact that a student’s previous acts of plagiarism had been undetected as a defence.

In order to avoid engaging in plagiarism it is your responsibility to acknowledge all of your sources in any work submitted for assessment and it is essential that you reference the work of others correctly. Where you quote directly from a source, you must ensure that any direct quotations are placed in quotation marks and are fully referenced. Even when you do not quote directly and are just referring to or expanding on the work of others, you must still acknowledge the sources of your information and ideas. Close paraphrasing in which you change a few phrases around, leave a clause out of a long sentence or put the original sentences in a different order is still plagiarism. To mark words as a quotation the entire text that has been copied should be enclosed within the quotation marks. If the copied text is four or more lines in length, it may be more appropriate to set it as a separate and indented paragraph. Each time that text is copied, the source must be acknowledged with a reference citation, including the page number.

If you have any doubts concerning appropriate referencing formats or how to acknowledge the work of others correctly, you should seek the advice of your lecturer.

The Faculty of Economics and Commerce has the following regulation on Plagiarism: “The Faculty will promote the highest levels of probity and honesty amongst students and will provide instruction on ethical conduct. By submitting assignments and other work for
assessment, students acknowledge Faculty's duty to guard against plagiarism, including by electronic means such as Turnitin or Mydropbox. A lecturer may require students submitting written or electronic work to sign a Plagiarism Declaration Form indicating that the work is original.”

Referencing

It is important that the referencing of any sources used in your written work is done properly, if only to substantiate the points you are making in your assignment or project. The Harvard style is the preferred and there are some notes for guidance which have been prepared by the library staff: ‘Citing your Sources Harvard Style’

www.library.uwa.edu.au/education_training___and___support/guides/how_to_cite_your_sources/citing_your_sources_-_harvard_style

EndNote is a really good system for building up a database of references. Not everyone will want to invest the time in using this system but you should consider it if you intend to build up resource materials or plan to undertake extensive research in a particular area. The library staff have also developed a tutoring package: ‘A Quick Guide to Using EndNote’ which provides the basics for using EndNote with an essay

http://libguides.library.uwa.edu.au/endnote

Appeals against academic assessment

In the first instance, students are strongly advised to talk informally to the lecturer about the grade awarded. The University provides the opportunity for students to lodge an appeal against any mark which he or she feels is unfair. Any student making an appeal is under an obligation to establish a prima facie case by providing particular and substantial reasons for the appeal. It is recommended that students contact the Guild Education Officers to aid them in the appeals process.

There is a 12 day time limit for making any such appeal. An appeal against academic assessment may result, as appropriate, in an increase or decrease in the mark originally awarded. The University regulations relating to appeals and the form on which the appeal should be lodged can be found at


Student Guild contact details

The University of Western Australia Student Guild
35 Stirling Highway
Crawley WA 6009
Phone: (+61 8) 6488 2295
Facsimile: (+61 8) 6488 1041
E-mail: enquiries@guild.uwa.edu.au
Website: http://www.guild.uwa.edu.au
TEXTBOOK(S) & RESOURCES

Unit Website

http://www.ecom.uwa.edu.au/enrolled_students/unit_pages  Note: Some unit web pages are still under construction and will be available in 2008.

Recommended/required text(s)

No Textbook is required for this unit.

Additional/Suggested/Alternate text(s)

N/A

Technical requirements

NA

Software requirements

Expert Systems and Fuzzy
   CubiCalc RTC, HyperLogic Corporation

Neural Network
   NeuroShell 2, Ward Systems

Genetic Algorithm
   Evolver 4.0 Professional Edition

Additional resources & reading material

READING

There is no prescribed text. Readings will be distributed. It is often useful to scan other books and papers for the more comprehensible sections.

DSS/OR/Expert Systems


Fuzzy Logic


**Artificial Neural Networks**


Roberts, S.J. and W. Penny (1997) 'Neural networks: friends or foes', *Sensor Review*, 17 (1), 64-70


**Genetic Algorithms**


**Swarm Intelligence**


Vogel, A., Fischer, M. and T. Teich (2001) 'Urban disposal of waste with ant colony optimization', *Proceedings of the 9th World Conference on Transportation Research (WCTR)*, Seoul

Zhang, H., Li, X., Li, H. and F. Huang (2005) 'Particle swarm optimization-based schemes for resource-constrained project scheduling', *Automation in Construction*, 14, 393-404

**Hybrid Systems**


UNIT STRUCTURE

Overview

• Lectures/Intensive sessions
  
  o Lectures will include discussions on the weekly topic; preparation for the lab exercises and reviews of the previous week lab exercises.

• Tutorials/Labs

  o Labs will include software exercises:

Instruction in each technique will be given in the computing lab. This will normally occupy about two of the three class hours. No previous experience is needed. Software packages to be used in the course are listed in the following table and are installed in the computing lab.

Approved calculators for examinations

The University only permits the use of calculators in examinations when the calculator has an approved sticker. If the student does not have an approved sticker on their calculator, they will not be permitted to use the calculator. Since this is a University wide policy it is not possible for unit coordinators to grant on the spot exemptions. Calculators can be approved at the Business School Student Centre between 9.00am – 4.30pm Monday to Friday. Further information is available on the Business School web site, see http://www.business.uwa.edu.au/students/assessments.
## UNIT SCHEDULE

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<tr>
<th>Week #</th>
<th>Prior Reading</th>
<th>Discussion Topic</th>
<th>Computing</th>
<th>Software</th>
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<tbody>
<tr>
<td>1 20 Jul – 26 Jul</td>
<td>Introduction to computational intelligence, fuzzy sets and fuzzy logic</td>
<td>No lab</td>
<td>CubiCalc (1)</td>
<td></td>
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<tr>
<td>2 27 Jul 2 Aug</td>
<td>Introduction to Expert Systems</td>
<td>Initial exploration of fuzzy expert systems software</td>
<td>CubiCalc (2)</td>
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<tr>
<td>3 3 Aug – 9 Aug</td>
<td>Fuzzy for decision and multiple attributes</td>
<td>Applying fuzzy to business decisions</td>
<td>NeuroShell (1)</td>
<td></td>
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<tr>
<td>4 10 Aug – 16 Aug</td>
<td>Introduction to artificial neural networks (ANN)</td>
<td>Initial exploration of ANN software</td>
<td>NeuroShell (2)</td>
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<tr>
<td>5 17 Aug – 23 Aug</td>
<td>Advanced applications of artificial neural networks (ANN)</td>
<td>Apply ANN to forecasting, and assessment</td>
<td>No lab</td>
<td></td>
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<tr>
<td>6 24 Aug – 30 Aug</td>
<td>Introduction to genetic algorithm(GA); crossover, mutation, fitness, convergence</td>
<td>Excel Solver and Evolver (1)</td>
<td></td>
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<tr>
<td>7 31 Aug – 6 Sept</td>
<td>GA to cope with intractable problems, multiple optima; GA-ANN hybrids</td>
<td>Introductory GA applications; use GA to fit a function GA options to find best ANN solutions; shop location</td>
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<tr>
<td>7 Sept – 13 Sept</td>
<td>Study Break</td>
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<tr>
<td>Week</td>
<td>Dates</td>
<td>Lecturer(s)</td>
<td>Topic</td>
<td>Presentations</td>
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| 8    | 14 Sept – 20 Sept | Jaramillo, Bhadury and Batta       | • When to use GA  
• GA to track user preferences  
• GA to optimise locations  
Kingdon (in Sanchez, Shibata et al.); | GA for recipe, TSP | Evolver (2) |
| 9    | 21 Sept – 27 Sept | Gonzalez & Fernandez               | Combine GA recipe and order; optimizing fuzzy models | GA for delivery scheduling | Evolver (3) |
| 10   | 28 Sept – 4 Oct  | Shuliang Li; Intelligent Systems for Market Strategy (handout); Hybrid EA and the Shape of the Search Space (handout); | Formulate a hybrid intelligent system for market strategy  
• Exact & near exact solutions | No lab |         |
| 11   | 5 Oct – 11 Oct | Fish, Johnson, Dorsey & Blodgett; Rizzoli et al | • GA for marketing (ref Hurley et al)  
• Swarm intelligence  
• The ‘ant pheromone’ model | PRESENTATIONS | PowerPt |
| 12   | 12 Oct – 18 Oct | Gatarski, Breed better banners: ... Giarratano&Riley 316-319 Applying the max-min fuzzy function in matrix form (handout) | • Evolutionary algorithms in marketing  
• Applying the max-min fuzzy operator | PRESENTATIONS | PowerPt |