University of Alberta

PSYCO 452 "Minds and Machines"
Section: X51
Winter Term 2019

Instructor: Professor Michael R.W. Dawson
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Office Hours: See web page (URL given above) for hours, contact information, etc. for the instructor and for the teaching assistant.

Lecture Time & Room: Tuesdays, 6:30-9:30pm, BSB P-116

Course Description: Computational models are playing an increasingly important role in cognitive psychology. The purpose of this course is to provide students with the theoretical background for using such models, as well as some hands-on experience. Students will learn about the history of these models in cognitive psychology, how one might characterize good and bad models, and how cognitive psychologists attempt to experimentally validate their models. [Faculty of Science]

Course Prerequisites: PSYCO 354

Course Objectives and Expected Learning Outcomes: Computer simulation has played an important role in many different research areas in psychology. The purpose of this course is to provide students with a general understanding of the methods and goals of "synthetic psychology". This will be accomplished by striving towards two different goals. First, students will learn some of the fundamental concepts of how computer simulation methods can be incorporated into psychology. They will receive "hands on" experience with a variety of connectionist architectures, and by the end of the course they should feel comfortable in their knowledge of the advantages and disadvantages of this approach to modeling.   Second, students will be able to relate their knowledge of connectionism to specific research issues in experimental psychology.

Required Text (Available From Bookstore):
Dawson, M.R.W. (2018). *Connectionist representations of tonal music: Discovering musical patterns by interpreting artificial neural networks.* Athabasca University Press: Edmonton, AB

Readings (Supplied In Class):
Dawson, M.R.W. (2004). *Minds and Machines: Connectionism and psychological modeling.* Blackwell: Oxford, UK.
Dawson, M.R.W. (2005). *Connectionism: A Hands-On Approach.* Blackwell: Oxford, UK

Lecture Schedule & Assigned Readings:

Day	Lecture	Homework	Activity	Required Reading
Jan. 8	Week 1: Building Block 1 -- Connectionism and Association	Chapters 4, 5	Demonstrate distributed associative memory	Dawson (2005) Chapters 1-3 Dawson (2004) Chap 9
Jan. 15	Week 2: Building Block 2 – Decisions (Nonlinearity)	Chapters 6, 7, 8	Demonstrate perceptron **Network Project Consult #1**	Dawson (2004) Chap 10
Jan. 22	Week 3: Building Block 3 – Chains of Decisions	Chapters 11, 12 **Network Project Stage 1: Title, Topic, Initial References Is Due In Class**	Demonstrate multilayer perceptron	Dawson (2005) Chapters 9-10 Dawson (2004) Chap 11
Jan. 29	Week 4: Exploring Distributed Memory	Chapters 13, 14	Discussion of CRTM **Network Project Consult #2**	Dawson (2018) Chapter 1
Feb. 5	Week 5: Perceptrons and Animal Learning	Chapters 15, 16	Discussion of CRTM	Dawson (2018) Chapter 2
Feb. 12	Week 6: Case Studies in Multilayer Perceptrons	Chapters 19, 20 **Network Project Stage 2: Annotated Bibliography Is Due In Class**	Discussion of CRTM **Network Project Consult #3**	Dawson (2005) Chapters 17-18 Dawson (2018) Chapter 3
		No Class February 16; Reading Week		
Feb. 26	Week 7: The Analog Perceptron	Chapters 21, 22	Discussion of CRTM	Dawson (2018) Chapter 4
Mar. 5	Week 8: Interpreting Local Representations	Chapters 23, 24 **Network Project Stage 3: Topic, Training Set, Pilot Studies Is Due In Class**	Discussion of CRTM	Dawson (2018) Chapter 5
Mar. 12	Week 9: Interpreting Distributed Representations	Chap 25	Discussion of CRTM **Network Project Consult #4**	Dawson (2018) Chapter 6
Mar.19	Week 10: Exploring Distributed representations	Chap 26	Discussion of CRTM	Dawson (2018) Chapter 7
Mar. 26	Week 11: Autoassociative networks	Chap 27	Discussion of CRTM	Dawson (2005) Chapter 27 Dawson (2018) Chapter 8
Apr.2	Week 12: Deep Learning	**All homework assignments from textbook should have been completed and submitted by today.**	Discussion of CRTM **Network Project Consult #5**	Dawson (2018) Chapter 9
Apr. 9	Week 13: Spatial Representations	**Network Project Stage 4: Final Report Is Due In Class**	Class discussion of network projects	No Reading

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Representative Evaluative Material:
Past or representative material for evaluating performance in the course will be available from the course website.

Grade Evaluation:

Scaffolded Network Project:	**50%**
Homework Assignments from textbook:	**40%**
Class participation:	**10%**

Scaffolded Network Project:
Students are required to write a short report (10-15 pages) that describes an original simulation project conducted by the student (using class software). The purpose of the project is for the student to train an artificial neural network on some task of interest to the student. The topic of the project will be selected by the student in consultation with the instructor. In general, the report should describe the topic of interest, the definition of a training set, the training of a network on the project, and some properties of a trained network. **This network project is scaffolded, so that it is developed in four stages, and each stage is handed in for grading at different points during the term**. The course homepage provides a detailed description of each stage, how it will be graded, and its contribution to the total value of 60%. ***The due dates for each stage are provided in the table on page 2 of this document!***

Homework Assignments:
Much of our understanding of the connectionist architectures discussed in this course will come from hands-on experience with software exercises that will be delivered from the textbook and supported by the course web page. Students will be working on these assignments throughout the term, as indicated in the Homework column of the lecture schedule provided above. Assignments are activated on the day of the lecture for which they are listed, and are due to be handed in for marking by the start of the next class. ***Assignments that are more than a week late will not be marked!***

Class Participation

The general format of many of the course meetings will be a lecture followed by a discussion of course material, readings of the required text, and so on. After the discussion the class will participate in various hands-on activities as detailed in the lecture schedule above. Part of a student's grade will be based upon their contribution to these class discussions and activities. An important goal of the course is to get students to think about course themes, and part of the thinking process is stimulated by discussing issues with other students who are taking the course.

How I Assign Your Letter Grade:

Letter Grade For Course	Final Mark (In Percent) To Obtain That Letter Grade
A+	89 – 100
A	85 – 88.9
A-	80 – 84.9
B+	77 – 79.9
B	71 – 76.9
B-	66 – 70.9
C+	61 – 65.9
C	57 – 60.9
C-	52 – 56.9
D+	50 – 51.9
D	48 – 49.9
F	0 – 47.9

This grade translation is approximate; the instructor reserves the right to use expert judgment to adjust the grades as necessary. **Grades are unofficial until approved by the Department and/or Faculty offering the course.**

Missed Term Exams and Assignments:

For an excused absence where the cause is religious belief, a student must contact the instructor(s) within two weeks of the start of Fall or Winter classes to request accommodation for the term (including the final exam, where relevant). Instructors may request adequate documentation to substantiate the student request.

A student who cannot complete a term assignment due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for an extension of time to complete an assignment. This is to be done by consulting with the instructor. Deferral of term work is a privilege and not a right; there is no guarantee that a deferral will be granted. Misrepresentation of Facts to gain a deferral is a serious breach of the *Code of Student Behaviour.*

Student Responsibilities:

ACADEMIC INTEGRITY:
"The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour   (online at http://www.governance.ualberta.ca/en/CodesofConductandResidenceCommunityStandards/CodeofStudentBehaviour.aspx) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University."

All forms of dishonesty are unacceptable at the University. Any offence will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offences. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for **cheating** on any examination will include **a disciplinary failing grade** (no exceptions) and senior students should expect a period of suspension or expulsion from the University of Alberta.

CELL PHONES AND RECORDING: Cell phones are to be turned off during lectures, labs and seminars. Cell phones are not to be brought to exams. Any recording, including written, audio or video, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

STUDENTS WITH DISABILITIES: Students who require accommodation in this course due to a disability are advised to discuss their needs with Specialized Support & Disability Services (2-800 Students' Union Building).

ACADEMIC SUPPORT CENTRE: Students who require additional help in developing strategies for better time management, study skills or examination skills should contact the Student Success Centre (2-300 Students' Union Building).

Policy about course outlines can be found in section 23.4(2) of the University Calendar.

Disclaimer: Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this syllabus.

Note: Recording is permitted only with the prior written consent of the professor or if recording is part of an approved accommodation plan.