Western University
Departments of Psychology and Applied Mathematics

Introduction to Neural Networks

1. Course Information

Introduction to Neural Networks
Psychology 9221B, Applied Mathematics 9624B
Winter 2020

Times and location
Tuesday 12:00-1:30 PM (lecture), Thursday 1:00-2:30 PM (programming lab)
Western Interdisciplinary Research Building 1130

2. Instructor Information

- **Instructors:** Assistant Professors Lyle Muller and Marieke Mur
- **Office:** Western Interdisciplinary Research Building, #4168 (Muller) and #4148 (Mur)
- **E-mail (preferred):** lmuller2@uwo.ca, mmur@uwo.ca

3. Course Description

Description

This one-semester graduate course will provide you with an introduction to neural networks. You will learn the fundamentals of neural computation and explore how networks of neurons support brain information processing. You will be familiarised with mathematical models, programming, and machine learning techniques. You will gain an in-depth knowledge of neural computations through weekly programming assignments.

Learning outcomes

The course is designed to achieve three primary objectives:

1. You will learn what computations are performed by networks of neurons
2. You will learn to link neural computations to cognitive function

3. You will learn to model neural computations in a high-level programming language (MATLAB)

Topic outline and schedule

Refer to the course calendar for specific meeting dates and times. Activity and assignment details will be explained in detail within each week's corresponding learning module. If you have any questions, please contact your instructor.

Fundamental Topics

1. Mathematical models for neural and cognitive processes
2. Single-neuron models
3. Dynamics of neural networks
4. Simple models for memory
5. Simple models for sensory processing
6. Deep convolutional neural networks
7. Recurrent neural networks

Advanced topics

- Random graph theory
- Dimensionality reduction techniques
- Attractor network models

Prerequisites

This course is open to graduate students and senior undergraduates. There are no formal prerequisites for the course; however, you are expected to have elementary knowledge of linear algebra (vectors, matrices, matrix multiplication) and programming (functions, variables, loops).

We will provide an online assessment prior to the start of the course to help you determine your level of background knowledge on the elementary topics listed above. If you do not have the background knowledge on these topics but are willing to learn, we can provide authorisation to enroll in the course on a case-by-case basis. For those who would like to gain programming experience prior to the course, please consider taking Psychology 9040a: Scientific Computing (Fall 2019).

4. Course Materials

There is no textbook for the course. For most weeks, we will assign recommended readings from primary literature relevant for the coursework. We will also provide links to online resources for learning to program in MATLAB. Readings and links will be posted on the course website. Students are responsible for checking the course website on a regular basis for news and updates.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assignments (10)	70%
Final project	30%

The course will be graded according to weekly programming assignments and a final project. The lowest score among the 10 assignments will be dropped in computing the course grade. Assignments need to be completed independently. The final project will be performed in small groups. The project involves implementing a model of a neural system and presenting the results in class.

6. Accommodation and Accessibility

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. If you are a Social Science student, the Academic Counselling Office of the Faculty of Social Science is located in SSC 2105, and can be contacted at ssaco@uwo.ca. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at scibmsac@uwo.ca. For further information, please consult the university's policy on academic consideration for student absences.

7. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca. In accordance with policy, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that email received from the University at his/her official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf. We will clearly indicate the level of acceptable collaboration on assignments and projects.

All assignments and papers may be checked for textual similarity for detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service for papers is subject to the licensing agreement currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com). Programming assignments may be checked for similarity using MOSS (Measure of Software Similarity).

8. Support Services

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

The policy on Accommodation for Students with Disabilities can be found here: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help. Additional student-run support services are offered by the USC, http://westernusc.ca/services.