ANSC*6350 - Machine Learning Modelling for Animal Biosciences

Winter 2026 Course Outline
Section: 01
Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

The course covers major topics in machine learning with applications to animal biosciences and related areas. Topics include: data types, problem types (classification, regression, clustering, dimensionality reduction), models (decision trees, artificial neural networks, k-nearest neighbour, k-means), quality measures (accuracy, precision, recall, errors, correlations), data (re)sampling procedures (k-fold cross validation, fixed percentage splits), and Python implementations using various libraries (pandas, scipy, numpy, scikit-learn). This is a project-based course and it will have a computational component and a lab component focused on Python programming.
Restriction(s): Restricted to MSc and PhD Animal Biosciences students.
Department(s): Department of Animal Biosciences

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Lecture Schedule

Fri 11:30am-2:20pm in ANNU*101 (1/5 to 4/21)

Lab / Seminar Schedule

Day	Time	Location
Wednesday	8:30 AM - 10:20 AM	ANNU*101

Instructor Information

Dan Tulpan
Email: dtulpan@uoguelph.ca

Additional Support

The instructor will facilitate discussions, present lecture notes in an interactive and hands-on fashion, provide feedback to students, help with project direction and oversee/prepare the lab activities.

Learning Resources

Course Resources

Course notes and code will be used during the course (both available on Course link (Website) (https://courselink.uoguelph.ca/)).

Extra pertinent information, such as papers, chapters of books, etc. will be accordingly recommended.

Students are advised to take their own notes during lectures.

Potentially useful/interesting Python programming resources:

• Online book: How to Code in Python (https://assets.digitalocean.com/books/python/how-to-code-in-python.pdf)

• Online python and machine learning courses (https://python-course.eu/)

• Website: https://machinelearningmastery.com/

Campus Resources

If you are concerned about any aspect of your academic program: make an appointment with a Program Counsellor (https://www.uoguelph.ca/uaic/programcounsellors) in your degree program. If you are struggling to succeed academically: there are numerous academic resources offered by the Learning Commons (https://www.lib.uoguelph.ca/using-library/spaces/learning-commons) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Cost of Textbooks and Learning Resources

Textbook / Learning Resource	Required / Recommended	Cost
Only free reading resources are used in this course.		$0

Students are advised that prices are often determined by the publisher or bookstore and may be subject to change.

Course Learning Outcomes

1. Understand machine learning data processing and data types and be able to manipulate them using computer programming.
2. Perform and understand data modelling concepts and analytic approaches.
3. Appreciate differences among machine learning methods and algorithms for both data curation and data analyses.
4. Being able to manipulate data sets and apply machine learning models using Python programming in a Linux environment.
5. Discuss the relative merits of machine learning methods and analytic results applied on various types of problems.
6. Be able to contribute to a team project and perform various types of data analyses.
7. Accurately and effectively communicate scientific analyses in written form.
8. Have a proficient command terminology commonly used in machine learning modelling.

Schedule of Topics and Assignments

Week of	Topic	Activities	Due
1/9	General introduction + Introduction to technology, data and computing Introduction to Linux - part 1		
1/16	Introduction to Linux - part 2 Introduction to programming + Intro to Python - part 1		

1/23	Introduction to Python - part 2 Introduction to Python - part 3	Release: Assignment 1	
1/30	Introduction to Python - part 4 More Python programming		
2/6	Introduction to ML - part 1: general notions, problem formulation, data preparation and cleaning Introduction to ML - part 2: Data organization, feature engineering and data splitting	Release Assignment 2	Due: Assignment 1
2/13	Introduction to ML - part 3: Outlier detection/removal + clustering Introduction to ML - part 4: classification part 1		Due: Assignment 2
2/20		Winter Break	
2/27	Introduction to ML - part 5: classification part 2 Introduction to ML - part 6: regression	Release: Assignment 3	
3/6	Introduction to ML - part 7: Classification, regression and model fitting analysis Introduction to ML - part 8: Ensemble learning and hyper-parameter optimization	Release: Assignment 4	Due: Assignment 3
3/13	Introduction to ML - part 9: Hyper-parameter optimization, saving and loading models, project info Invited lecture		Due: Assignment 4
3/20	Invited lecture Invited lecture		
3/27	Final lecture Project meetings		
4/3		Holiday	
4/10		Project presentations Project reports	

Teaching and Learning Activities

LECTURES
Topics covered in this course:

- Python programming and Linux OS - overview
- Introduction to machine learning
- Data types (numeric, categorical, etc.)
- Data preparation and (pre)processing (test, validation, training, feature selection, feature engineering)
- Data (re)sampling (holdout sets, leave-one-out, fixed-percentage splits, k-fold cross validation, stratified sampling, etc.)
- Methods/model evaluation (confusion matrices, error measures, correlations, etc.)
- Model hyper-parameter optimization (learning and validation curves, parameter grid search)
- Classification methods (e.g. Decision Trees)
- Regression methods (e.g. Artificial Neural Networks)
- Clustering methods (e.g. K-Nearest Neighbour, K-Means)
- Ensemble methods (e.g. Random Forest, Bagging, Stacking)
- Other topics of interest (time permitting)

ADDITIONAL INFORMATION

Lab component

Lectures and labs are combined such that each theoretical concept is followed by a practical example or exercise, which will offer attendants the opportunity to practice the theoretical notions covered in the lecture using Python programs executed on a Linux platform (server) or on your laptops.

Please bring you own laptop to each class and make sure that it connect to the Internet and that you have applications that support SSH (Secure Shell) and SFTP/SCP (Secure File Transfer Protocol/Secure Copy) installed on it. SSH allows connections to remote Linux/Unix servers, while SFTP/SCP allows file transfers to and from the Linux/Unix servers to your own computer.

Recommended Software for Windows users

- Python (https://www.python.org/downloads/)
- Atom text editor (https://atom-editor.cc/)
- SSH: Putty (https://www.chiark.greenend.org.uk/%7Esgtatham/putty/latest.html)
- SFTP/SCP. WinScp (https://winscp.net/eng/download.php)

Recommended Software for Mac OS X (Apple) users

- Python (https://www.python.org/downloads/)
- Atom text editor (https://atom-editor.cc/)
- SSH and SCP are typically pre-installed on Mac OS X and can be accessed via the Terminal application (Applications --> Utilities --> Terminal.app).
- Note: For Mac users it is important to have XCode (from App Store) and the Homebrew package manager (https://brew.sh/) installed as well.

Recommended Software for Linux users

- Python (https://www.python.org/downloads/)
- SSH and SCP are typically pre-installed on a Linux OS and can be accessed using a terminal.

Assessment Breakdown

Description	Weighting (%)	Due Date
Assignment 1	12.5%	February 4
Assignment 2	12.5%	February 13
Assignment 3	12.5%	March 4
Assignment 4	12.5%	March 13
Project presentations	25%	April 7
Project report	25%	April 10

Assessment Details

Assignment

Assignment 1 — 12.5

Release date: January 21

Due date: February 4 @ 11:59 PM EST

Note: Due date is subject to change at the discretion of the instructor.

Course Learning Outcomes Assessed: 1, 4

Assignment 2 — 12.5

Release date: February 4

Due date: February 13 @ 11:59 PM EST

Note: Due date is subject to change at the discretion of the instructor.

Course Learning Outcomes Assessed: 2, 3, 5, 8

Assignment 3 — 12.5
Release date: February 25

Due date: March 4 @ 11:59 PM EST

Note: Due date is subject to change at the discretion of the instructor.

Course Learning Outcomes Assessed: 1, 2, 4, 5, 7, 8

Assignment 4 — 12.5
Release date: March 4

Due date: March 13 @ 11:59 PM EST

Note: Due date is subject to change at the discretion of the instructor.

Course Learning Outcomes Assessed: 3, 5, 6, 7, 8

Presentation
Project presentation — 25
Due: April 7

The project presentation will be up to 15 minutes (to be adjusted depending on the number of projects) and will have a 5-10 minutes question period.

Presentation slides will be made available to the instructor via CourseLink submission 24 hours in advance. The tentative presentation date is April 7.

Note: Please ensure that you have slide numbers included in your presentation.

Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7, 8

Research Paper
Project report — 25
Due: April 10

The project report will be structured as a journal article using the template of the Journal of Animal Science (https://academic.oup.com/jas/pages/General_Instructions) and will be submitted after the presentation. This will allow students to integrate feedback from presentations into reports.

Group work is highly encouraged. Groups of up to 4 students can work on the same project and it is expected that each one contributes equally to the project.

The topic of each project will be decided by each team and it will be shared with the instructor as part of Assignment 4. Alternatively, the instructor can also provide project topics to students who cannot decide on a suitable one. The reports are due on April 10.

Note: The instructor reserves the right to change the due dates for all evaluations including the project report.

Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7, 8

Last Day to Drop Course

The final day to drop Winter 2026 courses without academic penalty is the last day of classes: April 06

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Submission of Assignments
All assignments, presentations and reports must be submitted by 11:59 pm EST of the due date using the CourseLink system.

Late Assignment
Late assignments will receive zero (0) marks.

Course Standard Statements

Course Policies

Class attendance is expected but not reinforced. All courses are offered in-person. There will be no recordings available.

Course Technology Requirements

This course has a significant programming component. Therefore, each student that enrolls in this course will need access to a laptop and is asked to bring the laptop in class.

Standard Statements for Graduate Courses

Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/academic-misconduct/) is outlined in the Graduate Calendar.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Use of the SAS Exam Centre requires students to make a booking at least 10 business days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (https://www.uoguelph.ca/sas)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/academic-accommodation-religious-obligations/)

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/registration/) dropping courses are available in the Graduate Calendar (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/registration/).

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (https://wellness.uoguelph.ca/). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (https://wellness.uoguelph.ca/navigators) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources. (https://wellness.uoguelph.ca/shine-this-year) The Student Wellness team are here to help and welcome the opportunity to connect with you.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Recording of Materials

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars (http://www.uoguelph.ca/registrar/calendars/?index) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Graduate Calendar for information on regulations and procedures for Academic Consideration (https://calendar.uoguelph.ca/graduate-calendar/general-regulations/grounds-academic-consideration/).