UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

APS1070   *Foundations of Data Analytics and Machine Learning*   *Winter, 2022*

SYLLABUS
-ALL SECTIONS-

Instructors:
Prof. Sinisa Colic
Email sinisa.colic@utoronto.ca (prefix subject with APS1070)

Prof. Samin Aref
Email aref@mie.utoronto.ca (prefix subject with APS1070)

Lectures:
LEC0101: Tuesdays, 12:00-15:00, starting Jan. 11
LEC0201: Wednesdays, 9:00-12:00, starting Jan. 12
Zoom link for Lectures: on Quercus

Practical Sessions (Lab Sessions):
PRA0101: Thursdays, 13:00-15:00, starting Jan. 13
PRA0201: Fridays, 9:00-11:00, starting Jan. 14
Zoom link for Labs: on Quercus

Instructors' Office Hours (see course schedule for dates and exceptions):
Online office hour of Samin Aref: Tuesdays 14:00-15:00 (Zoom link on Quercus)
Online office hour of Sinisa Colic: Tuesdays 15:00-16:00 (Zoom link on Quercus)

Teaching Assistants:

Head-TA: Ali Hadi Zadeh	a.hadizadeh@mail.utoronto.ca	Tutorials and coordination
TA: Chris Lucasius	christopher.lucasius@mail.utoronto.ca	Q&A, piazza, and marking
TA: Mustafa Ammous	mustafa.ammous@mail.utoronto.ca	Q&A, piazza, and marking
TA: Haoyan (Max) Jiang	haoyanhy.jiang@mail.utoronto.ca	Q&A, piazza, and marking
TA: Nisarg Patel	npnisarg.patel@mail.utoronto.ca	Q&A, piazza, and marking

Preferred contact method for a quick response: Piazza;
via Piazza Question using *Post to Instructor(s)* - Type the specific person's name from the list

Course Description:
This course covers topics fundamental to data analytics and machine learning, including an introduction to Python and its common packages, analysis of algorithms and data structures, probability and statistics, matrix representations, fundamental linear algebra operations, and the most fundamental elements of machine learning. The course is structured with both weekly lectures and tutorials/help sessions. APS1070 is a prerequisite to the core courses in the **Emphasis in Analytics**.

Top-4 Learning Outcomes:

By the end of the course, students will be able to:

1. Describe and contrast machine learning models, concepts, and performance metrics.
2. Analyze the complexity of algorithms and common abstract data types.
3. Perform fundamental linear algebra operations and recognize their role in machine learning algorithms and analysis pipelines.
4. Apply machine learning models and statistical methods to datasets using Python and its associated libraries.

Main Channel of Communication:

The preferred contact method for getting a quick response from the instructor and/or the teaching assistants is Piazza (using *Post to Instructor(s)* - Type the specific person's name from the list or type "instructors" to include us all). There is no guarantee that answers to questions will be provided outside of business hours.

Communication via email (prefix subject with APS1070) is fine if the student has a reason for not using Piazza for that question. You can email any of the TAs if you have difficulty with starting to use the online tools of this course (Piazza, Quercus, GitHub).

Questions in the general forms of "is this the correct answer?" or "what is wrong with my code?" or "why my code does not compile?" and the like will not receive a response.

Virtual Class Requirement:

Due to COVID-19 and the class size, the Winter 2022 offering of the APS1070 will be delivered online. You will need to log into Quercus to gain access to course material, and obtain regular course information (e.g., downloading lecture slides and codes, etc.), complete tasks for reading assignments, receive grade/feedback, and access important announcements. This can be done with your UTORid at: https://q.utoronto.ca/. All course lectures, tutorials, and support sessions will be delivered virtually through Zoom on Quercus. **Zoom sessions are only accessible to participants logged in with UofT Zoom accounts using UTORid.** Students enrolled in APS1070 should have availability based on Toronto time zone for synchronous activities or instructor's office hour (see *course structure*). Students are expected and strongly recommended to fully participate and attend all virtual lectures and practical sessions for the duration of the course.

Textbooks:

Slides and recommended resources will be posted throughout the course. A large portion of the lectures will be based on the following three textbooks:

1. "Mathematics for Machine Learning" by Marc P. Deisenroth et al., 2020 (free [link](#))
2. "The Elements of Statistical Learning", 2nd Ed, 12th printing, by Trevor Hastie et al., 2009 (free [link](#))
3. "Introduction to Algorithms and Data Structures", 4th Ed, by Michael J. Dinneen, Georgy Gimel'farb, and Mark C. Wilson, 2016 (free [link](#))

The following textbook is helpful as an additional resource:

- "Python for Data Analysis", 2nd Edition, by Wes McKinney, 2017

Technical Requirements & Online Tools:
You will need access to a computer equipped with microphone and webcam to attend lectures and practical sessions over Zoom. It is encouraged to use dual displays for participating in the Zoom session on one display while following along with the coding on another display.
Our preferred method for Python programming is via Google Colaboratory.

Evaluation:
A key part of the learning in this course is the hands-on programming projects. All assessments are to be completed individually. All date and times are Toronto time.

Projects/Quizzes	Weight (%)	Due dates
Reading assignment tasks/quizzes	4%	Deadline for reading assignment one: 17 Jan at 21:00 Deadlines for other reading assignments: As per course schedule
Project 1	10%	Due Feb 4 at 23:00
Midterm Assessment	14%	TBD
Project 2	14%	Due Feb 28 at 23:00
Project 3	14%	Due Mar 11 at 23:00
Project 4	14%	Due Apr 1 at 23:00
Final Assessment*	30%	TBD
Bonus for Piazza[+]	(+2 points)	Apr 11

*The Final Assessment is mandatory and will result in a grade of FZ (failing the course) assigned on the transcript if not submitted in time.
[+]Top 10 students (from both sections), ranked on the number of endorsed answerers on Piazza, will received 2 bonus points added to their final course grade. A minimum of 3 endorsed answers are required to qualify for the bonus.

Course Structure:
    Synchronous Activities
- Weekly Lectures are presented via Zoom (on Quercus). Attendance is expected and strongly encouraged.
- Weekly Practical sessions (either a Tutorial or a Q&A session according to the course schedule) are presented via Zoom (on Quercus). Again, attendance is expected and strongly encouraged. Tutorials are recorded, and available for viewing shortly after the tutorial ends.

    Asynchronous Activities
- Four projects are to be completed throughout the semester (see *Evaluation*) and submitted via Quercus by their deadline.
- Eight tasks/quizzes associated with eight reading assignments are to be completed throughout the semester (see *Evaluation*) and submitted via Quercus by their deadline.
- All questions related to the course materials (including project queries) should be posted to the course's Piazza discussion forum. It is forbidden to share your code or any parts of your project work on Piazza. You are encouraged to participate by asking (and answering) course questions. We will endeavour to respond to course inquiries as quickly as possible.

Reading Assignments:
Eight tasks/quizzes for reading assignments are required to be completed by each individual student for eight weeks of the course (one per week). The due dates are on Mondays at 21:00 (see *Evaluation;* see *Course Schedule*).

Reading assignment 1 (Summary quiz is due 17 Jan at 21:00):
Pages 15-20 from the first chapter of "Introduction to Algorithms and Data Structures", 4th Ed, by Michael J. Dinneen, Georgy Gimel'farb, and Mark C. Wilson, 2016 link

Other reading assignments will be announced on Quercus.

Penalty for Late Submissions:
Projects and tasks/quizzes for reading assignments should be submitted in time. Quercus submission time will be used. Late projects and reading assignments will incur a penalty as follows:
- -20% (of project/task maximum mark) if submitted within 72 hours past the deadline.
- A mark of zero will be given if the submission is 72 hours late or more.

Re-grading:
If a student wishes to discuss marking for a Project or the Midterm Assessment, they should first meet with a TA at the next available Q&A session. If the issue remains unresolved, then the instructor (of your enrolled section) is to be contacted directly with the TA (the marker) in cc.

Academic Integrity:
The University of Toronto expects you to be a full member of the academic community and to observe the rules and conventions of academic discourse. In particular, all the work you submit must be your own and no part of your submitted work should be prepared by someone else. Plagiarism or any other form of cheating in examinations, tests, assignments, or projects, is subject to serious academic penalty (e.g., suspension or expulsion from the faculty or university). Also, doing anything for the purpose of aiding or assisting another student to commit plagiarism is an offence which makes both parties liable for bearing the penalties and consequences. The full text of the policy that governs Academic Integrity at U of T (the Code of Behaviour on Academic Matters) can be found at:
www.governingcouncil.utoronto.ca/policies/behaveac.htm

Here are a couple of general guidelines to help you avoid plagiarism:
- Never look at another student's homework. Never show another student your solution. This applies to all drafts of a solution and to incomplete and even incorrect solutions.
- Keep discussions with other students focused on *concepts* and *examples*. Any code or solutions that you submit should be yours alone.
- Do not post any of your assignment questions in a private or public online discussion forum, social media and messaging groups, or website in order to solicit solutions from others.

Note that, under the University of Toronto code of conduct, a person who supplies an assignment or project to be copied will be penalized in the same way as the one who makes the copy.

Use of Automated Plagiarism Detection Methods:
Several plagiarism detection tools will be used to assist in the evaluation of the originality of the submitted work for both text and code. They are quite sophisticated and difficult to defeat. Submissions go through automated plagiarism detection tools as a part of the evaluation.

Suspected Plagiarism:
The following constitute plagiarism on project and reading assignment submissions:
-Copying any segment of code or essay from online sources without citation
-Submitting anything that you did not write yourself or adapt from cited online sources
-Doing anything for the purpose of aiding or assisting another student to commit plagiarism

Students suspected of plagiarism will be referred to the department for formal discipline for breaches of the Code of Behaviour on Academic Matters. There is zero tolerance for plagiarism in this course. For more information on the penalties and offences under the U of T Code of Behaviour on Academic Matters, please refer to
https://academicintegrity.utoronto.ca/key-consequences/

Video Privacy and Restrictions on the Course Materials:
This course, including your participation, will be recorded on video for review. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Do not download, copy, record, reproduce, or share any course or student materials or videos without obtaining the explicit written permission of the course instructors beforehand.

Students Responsibilities
- Participate in one lecture every week. Be prepared to participate in class discussions via Zoom chat. This is an intensive and high-demand course which requires active engagement and participation.
- Plan to not miss any week's lecture. If you miss both lectures of a week, you are responsible for obtaining class notes and reading the textbook to not fall behind.
- Do not unmute your microphone without permission or otherwise cause distractions during online sessions. Use the Zoom chat to type the question or request permission to unmute for asking a question.
- Attend tutorials and Q&A sessions; they are needed for projects. If you miss a synchronous tutorial; dedicate focused time to watch the recorded video as soon as possible to not fall behind.
- Ask all your questions in class (zoom chat), lab, office hours, or on Piazza and ask many. We love answering your questions as many as they are or as frequent as they are.

Acknowledgment of Traditional Land
We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

Mental Health:

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times.

As a U of T Engineering student, you have a Departmental Graduate Administrator who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the U of T Engineering Mental Health & Wellness webpage, and a small selection are also included here:

- Accessibility Services & the On-Location Advisor
- Graduate Engineering Council of Students' Mental Wellness Commission
- Health & Wellness and the On-Location Health & Wellness Engineering Counsellor
- Inclusion & Transition Advisor
- U of T Engineering's Learning Strategist and Academic Success
- U of T Engineering's Mental Health Programs Officer
- My Student Support Program (MySSP)
- Registrar's Office
- SKULE Mental Wellness
- Scholarships & Financial Aid Office & Advisor

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at My Student Support Program (MySSP) or visiting U of T Engineering's Urgent Support – Talk to Someone Right Now webpage.

Inclusivity Statement:

Students and the instruction team of APS1070 represent a diverse community in which mutual respect is a foremost principle. This means that no matter a person's gender, race, religion, sexual identity, language or background they will be included as equals, their ideas will be listened to and considered and they will be given all opportunity to participate and contribute to the creation of knowledge that is the goal of this course.

All students and faculty at the University of Toronto have a right to learn, work and create in a welcoming, respectful, inclusive and safe environment. In this class we are all responsible for our language, action and interactions. Discriminatory comments or actions of any kind will not be permitted. This includes but is not limited to acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, and ableism. As a class we will work together to create an inclusive learning environment and support each other's learning.

If you experience or witness any form of discrimination, please reach out to the Engineering Equity Diversity & Inclusion Action Group online, an academic advisor, a U of T Equity Office, or any U of T Engineering faculty or staff member that you feel comfortable approaching.

Accessibility:

The University of Toronto and your instructors are committed to accessibility. The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register as soon as possible with Accessibility Services at https://studentlife.utoronto.ca/service/accessibility-services-registration-and-documentation-requirements/

Phone: 416-978-8060 Email: accessibility.services@utoronto.ca