COMP 4900F/5900F – Winter 2025
Surgical Data Science

Course Information
Classroom: In-person (room location is posted on Carleton Central)
Lectures: Tuesdays & Thursdays, 10:00am – 11:30am
Course Website: https://brightspace.carleton.ca/d2l/home/292821
(University of Ottawa students, please see information here to access the course website: https://gradstudents.carleton.ca/faculty-of-graduate-and-postdoctoral-affairs-access-to-brightspace/)

Instructor
Matthew Holden (he/him/his)
Contact: matthew.holden@carleton.ca
Office Hours: Tuesdays & Thursdays 11:30am – 12:30pm (or by appointment)
Office Location: Herzberg Laboratories 5435

Course Calendar Description
Core concepts for modelling and analyzing data from image-guided surgeries and interventions. Emphasis on the underlying methods in surgical navigation, sensorization of the operating environment, modelling of surgical processes, and machine learning on surgical time series data.

Prerequisites
Graduate students in COMP 5900F:
Prior coursework in machine learning or artificial intelligence.

Undergraduate students in COMP 4900F:
COMP 3105 or COMP 3106

Topics Covered
- Computer-assisted interventions
- Coordinate transformations and surgical navigation
- Introduction to medical imaging
- Representations for time series
- Alignment and comparison of time series
- Neural networks for time series
- Validation strategies for machine learning on surgical data

Learning Objectives
By the end of this course, students should be able to:

- Understand how to develop a system for surgical navigation and/or data collection
- Select appropriate methods to analyze medical imaging and surgical time series data
- Implement methods and validate their performance

Course Format
This course will be in-person. During class, we will have interactive activities such as: discussions, tutorials, demonstrations, examples, exercises, etc. Class attendance is very important as students will be responsible for all items discussed in class.

Communication
All announcements for the course will be made in class or through Brightspace. You are responsible for regularly monitoring these announcements.

Students are requested to ask questions or have discussions about the course or course material during the live classes, during instructor office hours, or on Brightspace. This way, other students may benefit from the discussion. You may not, however, post solutions to the assessments during the live classes or on Brightspace. Questions or discussion about your individual situation may be asked by email.

Learning Materials and Other Resources
Students are not required to purchase textbooks or other learning materials for this course. The course will use resources (e.g. journal articles, book chapters, conference proceedings) available through the Carleton Library. Information on accessing these resources will be provided in class or posted on Brightspace.

Assessment Scheme
Students will be evaluated in this course according to the following scheme. Details, due dates, and submission procedures for each component will be posted on Brightspace.

Component	Weight
Article summary presentations (2)	10%
Assignments (2)	20%
Participation	5%
Project (proposal + presentation + report)	50%
Student-led discussion	15%

Article Summary Presentations
Students will make two short presentation videos on an interesting problem in surgical data science, based an article in the literature. All students must complete the article summary presentations individually.

Tentative article summary presentation dates:
Article Summary Presentation #1: 2025-02-06

Article Summary Presentation #2: 2025-03-18

Assignments
There will be two assignments in this course, each weighted equally. Each assignment will contain a theoretical part and an implementation part. Implementations must be written in Python 3. Graduate students in COMP 5900F must complete the assignments individually; undergraduate students in COMP 4900F may complete the assignments in small groups of two students.

For each assignment, you may be submitting one or more files that contain source code. These files must follow the specified format. Incorrectly formatted assignments will be penalized and may receive a mark of zero. If any of the source code files you submit does not run, it may receive a mark of zero. Furthermore, you are expected to demonstrate good programming practices, and your code may be penalized if it is poorly written.

Tentative assignment due dates:
Assignment #1: 2025-02-13
Assignment #2: 2025-03-25

Participation
Students may participate through either in-class discussion or through posting on Brightspace. To receive full participation marks, students must make at least ten contributions throughout the course (maximum one contribution per week will count). All students must complete the participation individually.

Project
Students will complete a project where they address a research question in surgical data science. They may address the question by providing a practical solution, developing a theoretical solution, comparing/analyzing pre-existing solutions, or other related topics. Students must first submit a project proposal for approval by the instructor. Students will make a presentation on their project and write a report on their project. Graduate students in COMP 5900F must complete the project individually; undergraduate students in COMP 4900F may complete the project in small groups of two students.

Tentative project dates:
Project proposal: 2025-02-24
Project presentations: 2025-04-03 or 2025-04-08
Project report: 2025-04-08

Student-Led Discussion
Students will lead a class discussion on a topic in surgical data science. Students are encouraged to consult with the course instructor about their discussion beforehand. Graduate students in COMP 5900F must complete the student-led discussion individually; undergraduate students in COMP 4900F may complete the student-led discussion in small groups of two students.

Tentative student-led discussion dates:
2025-03-20, 2025-03-25, 2025-03-27, or 2025-04-01

Late and Missed Work Policies

Late Work

For each assignment, the project proposal, and the project report, students may request a 48-hour extension with no questions asked. A link to request a 48-hour extension will be provided on Brightspace. Submissions within this 48-hour extension period will be accepted without penalty. Late submissions beyond this will not be accepted.

Technical problems do not exempt you from this requirement. Consequently, you are advised to: (1) periodically upload your progress (e.g. upload your progress at least daily) and (2) attempt to submit your final submission well in advance of the due date and time. It is your responsibility to ensure you have submitted the correct materials.

Missed Work

Students requesting academic consideration for short-term (5 days or shorter) extenuating circumstances must contact the course instructor as soon as possible and complete the Academic Consideration for Coursework Form (https://carleton.ca/registrar/academic-consideration-coursework-form/).

Students requesting academic consideration for long-term (longer than 5 days) extenuating circumstances must contact the course instructor as soon as possible and complete the Long-Term Academic Consideration Form with supporting documentation (https://payments.carleton.ca/registrar/long-term-academic-considerations-for-coursework/).

Typical accommodation for missed quizzes will involve a modified grading scheme; typical accommodation for missed assignments or project components will involve modified due dates. In all cases, accommodation will be at the discretion of the course instructor.

Graduate Academic Advisors

The Graduate Advisors for the School of Computer Science are available in Room 5302 HP; or by email at grad.scs@carleton.ca. The graduate advisors can assist with understanding your academic audit and the remaining courses required to meet graduation requirements.

Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at scs.ug.advisor@cunet.carleton.ca . The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/tech-support/. Technical support staff may be contacted in-person or virtually, see this page for details: https://carleton.ca/scs/tech-support/contact-it-support/.

University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton's Academic Year website (https://calendar.carleton.ca/academicyear/).

Academic Accommodation

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Chat GPT/Generative AI Usage

Unless explicitly stated otherwise, the use of any AI system to complete coursework must be appropriately cited. This includes the use of chatbots (e.g., ChatGPT, Google Bard, Bing Chart), research assistants (e.g., Elicit), and image generators (e.g., Stable Diffusion, Dall-E), etc. Failure to reference such systems or tools is considered academic misconduct.

Academic Integrity

Students are expected to uphold the values of academic Integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT without appropriate reference.

If you are unsure of the expectations regarding academic integrity (e.g. how to use and cite references, to what degree collaboration with labmates or classmates is permitted), then you must ask your instructor. Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are not permitted to post, share, or upload course materials without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Information, process and penalties for such offences can be found on the ODS webpage: https://science.carleton.ca/students/academic-integrity/.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy (https://carleton.ca/secretariat/wp-

content/uploads/Academic-Integrity-Policy-2021.pdf). Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science and additional details about processes can be found here: https://science.carleton.ca/academic-integrity/.

Student Rights & Responsibilities
Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the Rights and Responsibilities Policy (https://carleton.ca/studentaffairs/student-rights-and-responsibilities/#sect1.1) for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.