THE UNIVERSITY OF WINNIPEG

APPLIED COMPUTER SCIENCE

Course Number: **ACS-4931-001**
Course Name: **Research Project in Applied Computer Science**

Instructor Information

Instructor: Qian Liu
E-mail: qi.liu@uwinnipeg.ca

Meeting Time: Wednesdays 4:00 - 5:00 pm 3C08B

Important Dates

1.	First Class:	Monday, January 8, 2024
2.	Reading Week (no classes):	February 18-24, 2024
3.	Final Withdrawal Date w/o academic penalty*:	Friday, February 16, 2024
4.	University closures: Louis Riel Day	Monday, February 19, 2024
	Good Friday	Friday, March 29, 2024

*A minimum of 20% of the work on which the final grade is based will be evaluated and available to the student before the voluntary withdrawal date.

Course Objectives / Learning Outcomes

Breast cancer is the most diagnosed cancer and is one of the leading causes of cancer death for women worldwide. Comprehensively mapping the structure of breast cancer protein communities and identify potential biomarker from them is a promising way for breast cancer research. In this project, students will use a large amount of publicly available proteomics data to create a hierarchical map for breast cancer protein communities using graph neural network (GNN) with the supervision of gene ontology terms and the assistant of a pre-trained deep contextual language model. Students will also apply group-lasso algorithm to identify protein communities that are under both mutation burden and survival burden. The created hierarchical map of protein communities could show how gene-level mutations and survival information converge on protein communities at different scales. And the identified protein communities that are under strong mutation and survival burdens can be used as clinical biomarkers. Students will provide biological annotations to the identified protein communities using a variety of computational biological validation tools.

Students involved in this project will learn how to conduct a health data science research project. They will learn and implement deep contextual language model, GNN, group-lasso, and computational biology annotation/interpretations. They will also learn scientific writing, oral

presentations, poster presentation skills. Students may have chance to attend local/national conferences to present their work.

Evaluation Criteria

- Weekly progress report (20%)
  - Students need to attend weekly meeting to report their research progress.
  - A written report is needed to submit to the instructor at least one day before the meeting. The report should include what the students have done in the last week, what they are plan for next week, what are the difficulties they met.

- Poster competition (5%)
  - Students are required to summary their research result to a poster and submit the poster to a local poster competition, for example, the Manitoba Student Health Research Forum or the Cancer care Research Day, Randy Kobes Undergraduate Poster Symposium, etc.

- Department presentation (10%)
  - Students are required to prepare a 25-minutes presentation regarding their research work to the faculties in the Department of Applied Computer Science and address the questions/comments from faculties.

- Final report (65%)
  - GOAL: The report should include: Background introduction, Project objectives, Detailed description of data sources, Detailed description of data analysis methods, Detailed description of analysis results, discuss/explain analysis results, conclusions and references.
  - PROCEDURE: The written report detailing the project description and data analysis findings should be between 10-15 pages (including figures and tables) typed in the Times New Roman font (12 point) and double spaced; references do not count toward the page limit and should be formatted in a style consistent with that described above.
  - EVALUATION CRITERIA: Students will be evaluated on the organization, content, overall presentation of the underlined items in the Goal Section.

Students should contact the instructor as soon as possible if extenuating circumstances require missing a lab, assignment, test or examination. A medical certificate from a practicing physician may be required before any adjustments are considered.

Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 204-786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential.
https://www.uwinnipeg.ca/accessibility-services.

Students may choose not to attend classes or write examinations on holy days of their religion, but they must notify their instructors at least two weeks in advance. Instructors will then provide opportunity for students to make up work examinations without penalty. A list of religious holidays can be found in the 2019-20 Undergraduate Academic Calendar online at http://uwinnipeg.ca/academics/calendar/docs/important-notes.pdf

Final Letter Grade Assignment

Historically, numerical percentages have been converted to letter grades using the following scale. However, instructors can deviate from these values based on pedagogical nuances of a particular class, and final grades are subject to approval by the Department Review Committee.

A+	90 – 100%	B+	75 – 79%	C	60 – 64%
A	85 – 89 %	B	70 – 74%	D	50 – 59%
A-	80 – 84%	C+	65 – 69%	F	below 50%

Required Text Book

There is no textbook for the course. The instructor will provide reading material in the form of journal papers, theses, and/or tutorials.

Prerequisite and Restriction Information

30 credit hours of course work in Applied Computer Science and written permission from the Department Chair.

Regulations, Policies, and Academic Integrity

Students are encouraged to familiarize themselves with the Academic Regulations and Policies found in the University Academic Calendar at:
https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf
Particular attention should be given to subsections 8 (Student Discipline), 9 (Senate Appeals) and 10 (Grade Appeals).

Avoiding Academic Misconduct: Academic dishonesty is a very serious offense and will be dealt in accordance with the University's policies.

Detailed information can be found at the following:

- Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf
- About Academic Integrity and Misconduct, Resources and FAQs: https://library.uwinnipeg.ca/use-the-library/help-with-research/academic-integrity.html

Uploading essays and other assignments to essay vendor or trader sites (filesharing sites that are known providers of essays for use by others who submit them to instructors as their own work) involves "aiding and abetting" plagiarism. Students who do this can be charged with Academic Misconduct.

Academic Integrity and AI Text-generating Tools: Students must follow principles of academic integrity (e.g., honesty, respect, fairness, and responsibility) in their use of material obtained through AI text-generating tools (e.g., ChatGPT, Bing, Notion AI). If an instructor prohibits the use of AI tools in a course, students may face an allegation of academic misconduct if using them to do assignments. If AI tools are permitted, students must cite them. According to the MLA (https://style.mla.org/citing-generative-ai/), writers should

- cite a generative AI tool whenever you paraphrase, quote, or incorporate into your own work any content (whether text, image, data, or other) that was created by it
- acknowledge all functional uses of the tool (like editing your prose or translating words) in a note, your text, or another suitable location
- take care to vet the secondary sources it cites

If students are not sure whether or not they can use AI tools, they should ask their professors.

Non-academic misconduct: Students are expected to conduct themselves in a respectful manner on campus and in the learning environment irrespective of platform being used. Behaviour, communication, or acts that are inconsistent with a number of UW policies could be considered "non-academic" misconduct. More detailed information can be found here:

- Respectful Working and Learning Environment Policy https://www.uwinnipeg.ca/respect/respect-policy.html,
- Acceptable Use of Information Technology Policy https://www.uwinnipeg.ca/institutional-analysis/docs/policies/acceptable-use-of-information-technology-policy.pdf
- Non-Academic Misconduct Policy and Procedures: https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf and https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf.

Copyright and Intellectual Property: Course materials are the property of the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides—irrespective of format. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also seek prior permission of the instructor/presenter before, for example, photographing, recording, or taking screenshots of slides, presentations, lectures, and notes on the board. Students found to be in violation of an instructor's intellectual property rights could face serious consequences pursuant to the Academic Misconduct or Non-Academic Misconduct Policy; such consequences could possibly involve legal sanction under the Copyright Policy: https://copyright.uwinnipeg.ca/basics/copyright-policy.html

Privacy

Students have rights in relation of the collecting of personal data the University of Winnipeg

- Student Privacy: https://www.uwinnipeg.ca/privacy/admissions-privacy-notice.html
- Zoom Privacy: https://www.uwinnipeg.ca/privacy/zoom-privacy-notice.html

Class Cancellation, Correspondence with Students and Withdrawing from Course

When it is necessary to cancel a class due to exceptional circumstances, the course instructor will make every effort to inform students via uwinnipeg email and Nexus.

Students are reminded that they have a responsibility to regularly check their uwinnipeg e-mail addresses to ensure timely receipt of correspondence from the University and/or the course instructor**.**

Please let course instructor know if you plan on withdrawing from the course. Note that withdrawing before the VW date does not necessarily result in a fee refund.

Topics to be covered (tentative)

- Deep learning
- Deep contextual language model
- Graph neural network
- Proteomics
- Computational biology
- Gene set enrichment analysis
- Group-lasso
- Cytoscape mapping tool
- Gene pair codependency analysis
- Synthetic lethality analysis

Note that all topics listed may not be covered and can be offered in a different time order.