THE UNIVERSITY OF WINNIPEG

Applied Computer Science

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

Instructor Information

Instructor: Dr. Christopher Henry
Email: ch.henry@uwinnipeg.ca
Class Room No: 3D23
Class Meeting Time: F 1:30 - 2:30 pm

Important Dates

First class:	January 11th, 2019
Winter reading week:	February 17th – 23rd, 2019 **(No classes)**
Project proposal deadline:	March 8th, 2019
Withdrawal date w/o academic penalty[1]:	March 15th, 2019
No meeting (due to conference):	March 22nd, 2019
Final project presentation	April 5th, 2019
Last Scheduled Class:	April 5th, 2018
The University is closed on the following dates (No Classes):	
	February 18th, 2019
	April 19th, 2019

[1]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.

Additional Course Related Information

When it is necessary to cancel a class due to exceptional circumstances, instructors will make every effort to inform students via uwinnipeg email, as well as the Departmental Assistant and Chair/Dean so that class cancellation forms can be posted outside classrooms.

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 their course instructors.

Please note that withdrawing before the VW date does not necessarily result in a fee refund.

There are no make-up classes scheduled. However, I will be away at a conference from March 17th – 22st, 2019. Any questions during this period can be answered via email.

Course Objectives/Learning Outcomes

F. Riesz introduced the concept of proximity or nearness of pairs of sets in 1908 [1]. In 2007,

descriptively near sets were introduced by J. Peters [2, 3], followed by the introduction of tolerance near sets. Recently, the study of descriptively near sets has led to algebraic [4, 5], topological and proximity space [6, 7] foundations of such sets. Keeping this in mind, the proposed work lies at the intersection of descriptive proximity spaces and generalpurpose computing with graphics processing units (GPUs). The introduction of general purpose computing using GPUs has democratized high-performance computing, and has provided personal computers the ability to perform trillions of floating point operations per second [8]. This confluence of descriptive set theory and GPU-based high-performance computing means that computational approaches to topology, proximity, and contiguity [6, 7, 9] are reaching a tipping point in terms of practical applications. Thus, the first objective of this work is to finalize the implementation of the theoretical framework described in [9] within a software application called DeTops. This GPU-based tool is used to find descriptive topological spaces and, within this context, to quantify the similarity of families of sets. Once completed, DeTops will be made publicly available, and its contribution disseminated via an international journal. Finally, time-permitting, practical applications of the descriptive-based variant of the Borsuk-Ulam Theorem [7] will also be investigated for inclusion in DeTops.

References

[1] F. Riesz, “Stetigkeitsbegri und abstrakte mengenlehre," Atti del IV Congresso Internazionale dei Matematici, vol. II, pp. 182-109, 1908.
[2] J. F. Peters, “Near sets. General theory about nearness of objects," App. Math. Sci., vol. 1, no. 53, pp. 2609-2629, 2007.
[3] -, Near sets. Special theory about nearness of objects, "Fund. Inform., vol. 75, no. 1-4, pp. 407-433, 2007.
[4] E. Inan and M. Ozturk, “Near groups on nearness approximation spaces," Hacettepe J. of Math. and Statistics, vol. 41, no. 4, pp. 545-558, 2012.
[5] J. Peters, E. Inan, and M. Ozturk, “Spatial and descriptive isometries in proximity spaces," General Mathematics Notes, vol. 21, no. 2, pp. 1-10, 2014.
[6] S. A. Naimpally and J. F. Peters, Topology with Applications.Topological Spaces via Near and Far. Singapore: World Scientic, 2013.
[7] J. Peters, Computational Proximity: Excursions in the Topology of Digital Images, ser. Intelligent Systems ReferenceLibrary. Berlin: Springer, 2016, vol. 102.
[8] D. B. Kirk and W. W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, 3rd ed. Waltham, Massachusetts: Morgan Kaufmann, 2017.
[9] C. J. Henry and J. F. Peters, “A descriptive contiguity relation for quantifying the nearness of families of sets," General Mathematics Notes, p. 17 pp., 2018, in press.

Course Topics

- Topological spaces
- Filters
- Proximity spaces
- Contiguity spaces
- Descriptive nearness
- Descriptive topological spaces
- Descriptive proximity spaces
- Descriptive filters
- Descriptive Contiguity relations
- Discrete descriptive contiguity measure
- Parallel implementations of these concepts

Note: Topics will be covered as time permits.

Evaluation Criteria

Project Presentation (20%)
Final Project (60%)
Final Project Presentation (20%)

Course Project will involve:

- Preparing and presenting a project proposal (max. 5 pages) approved by the instructors
- Reading a few papers related to the proposal topic
- Implementing a solution (mandatory)
- Preparing a project report (max 20 pages)

The Final Project will be evaluated on the basis of i) working software ii) innovative solution iii) technical soundness and completeness iv) readability of the technical report v) presentation **Note: It is expected that the course project will lead to a peer—reviewed paper.**

NO LATE WORK will be accepted. Class work must be typed and submitted in an 8.5x11 folder with your name and course number on the outside.

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

Exam Requirements

- Photo ID is required
- Unless a medical certificate is provided, no accommodation is made for missed deadlines or examinations
- No equipment (*e.g.* calculators, dictionaries, handheld devices) are authorized for use in tests/exams

Student Services and Information

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 786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a student's disability or medical condition remains confidential http://www.uwinnipeg.ca/accessibility.

All students, faculty and staff have the right to participate, learn, and work in an environment that is free of harassment and discrimination. The UW Respectful Working and Learning Environment Policy may be found online at www.uwinnipeg.ca/respect

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 2018-19 Undergraduate Academic Calendar.

Required Textbooks and Course Readings

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

Prerequisite Information (This information can be found in the UW General Calendar)

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

Misuse of Computer Facilities, Plagiarism, and Cheating

Academic dishonesty is a very serious offense and will be dealt with in accordance with the University's discipline bylaw. Be sure that you have read and understood **Regulations & Policies #8**, starting on page 9, in the 2018-2019 UW Course Calendar available at: http://www.uwinnipeg.ca/index/calendar-calendar.

Avoiding Academic Misconduct. 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

Avoiding Copyright Violation. Course materials are owned by the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides. 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 photographing or recording slides, presentations, lectures, and notes on the board.

Students are strongly recommended to view the University of Winnipeg library video tutorial *Avoiding Plagiarism*, which is available at: https://www.youtube.com/watch?v=UvFdxRU9a8g