CSCI 4210 U – Information Visualization
Winter 2015 Course Outline

UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

Professor

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Please contact me through Blackboard; urgent emails only to christopher.collins@uoit.ca

Teaching Assistant

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Contact through Blackboard; office hours TBD

Schedule

Lectures	**Labs / Tutorials**
Monday 12:30-2:00pm, UA 3120	Monday 8:10-9:30, J 123-A
Thursday 9:40-11:00, UA 3140	**No labs on January 5, March 30**

Important Dates

Classes start: January 5, 2015
Last day to register: January 16, 2015
Last day to withdraw from course without note on transcript: January 30, 2015
Midterm test: February 12, 2015
Midterm break: February 16-20, 2015
Last day to withdraw from course: March 18, 2015
Classes end: April 10, 2015
Final exam period: April 13-24, 2015

Other important dates: www.uoit.ca > current students > Important Dates

No class on April 6, 2015. Please watch Blackboard for announcements.

Instructor Contact Hours – Office UA 4024 & Online

Tuesday 12:30pm-1:30pm or by appointment. I can also be available by Blackboard Chat by appointment.

Course Description

This course introduces the emerging fields of information visualization and visual analytics through the principles of data representation, presentation, and interaction. The course will survey best practices for visualization design, data selection and cleaning, common visualization techniques, layout algorithms, animation, uncertainty, visual emphasis, aesthetics, visualization toolkits, and the role of interaction in the analytics process. The importance of visualization in managing, analyzing, and communicating about big data in science, medicine, business, and the humanities will be reviewed. Students will gain practical experience through the development of one or more information visualization applications for real-world data.

Prerequisite: CSCI 3030U: Database Systems and Concepts

Learning Outcomes

On the successful completion of CSCI 4210, students will be able to:

1. Synthesize best design practices for information visualization and thoughtfully critique existing visualizations;
2. Define each step of the information visualization pipeline including data selection, representation, presentation, and interaction;
3. Design and implement functional information visualization applications for real-world datasets;
4. Discuss emerging challenges in the field of information visualization, such as managing big data and data uncertainty.

Course Design

Instruction for CSCI 4210 will be conducted in person and through Blackboard. Lecture materials, supplemental readings and software required for the course will be provided as needed through Blackboard links. Students are expected to check Blackboard regularly.

Classes will consist of lectures based on the course readings, relevant videos, and discussions of late-breaking research. Lab sessions will review the design, implementation, and testing of information visualizations.

The laboratory portion of this course will focus on implementing data selection and cleaning, visualization, and interaction algorithms, and will introduce modern visualization programming toolkits and commercial software through practical, hands on activities. All students will be expected to participate in laboratory activities which will involve some level of computer programming – implementation of visualizations using Javascript and other tools. Basic knowledge of HTML and fundamentals of computer science is assumed.

Class meetings will be participatory, including in class activities, peer critiques, and discussions. Regular attendance is important for a successful course, and participation marks will be allocated based on attendance and active participation in class discussions in person and online.

Students are encouraged to take their own notes and to conduct online discussions to supplement the instructor's material.

We will use Blackboard for class discussions, in particular, for sharing examples of well-designed visualizations, critiques of poorly-designed examples, and news/blog articles pertaining to the course material. Please post your links and participate regularly in the discussion. Students are also invited to take advantage of *Twitter* to ask questions and share links related to course material. Please use the Twitter tag #csci4210. You can follow the professor @ChrisNF.

An Interdisciplinary, Participatory Course

While this course is a fourth year computing science course, the course is designed to accommodate students from other disciplines. Where appropriate, options will be provided for assignments and labs to accommodate a variety of student skills and backgrounds. Where alternatives to programming assignments are provided, high quality writing, research, and critique will be expected.

Course Policies

Class attendance and participation in lectures is strongly recommended. We will discuss lecture norms in class and decide on a suitable set for the course, which will be posted to Blackboard. All important new information, such as course news, notes, additional reading, etc. will be available on the Blackboard course page. It is your *responsibility* as a student to check the Blackboard page for new information. Although I will regularly monitor Blackboard's discussion board messages, these messages are not considered official communication between students and instructor.

Attendance in labs (tutorials) is required. If you miss a lab due to illness or a death in the family, you must obtain the appropriate documentation (UOIT Medical Certificate, death certificate) and submit it to the course instructor within five business days of missing the lab. As space allows, and with a legitimate reason, it may be possible to complete a lab on your own time. Contact your TA in advance for approval.

Absence from more than two labs, regardless of any documented reasons, will result in a grade of F for the course (see http://www.science.uoit.ca/undergraduate/current-students/academic-policies.php).

If a holy day will conflict with scheduled labs, assignment deadlines, or the midterm test, you must inform the professor or TA at least seven business days before the scheduled time of the lab, assignment, or test.

The instructor and TA will endeavour to provide timely responses to questions and be available during posted hours. However, students should not rely on a reply faster than one working day (i.e. questions sent two hours before assignment deadlines will likely not be answered). Please practice professional communication norms in correspondence with the professor and TA.

This course is governed by the Faculty of Science academic policies (http://www.science.uoit.ca/undergraduate/current-students/academic-policies.php).

Course Calendar (may change – official dates will be on assignment handouts)

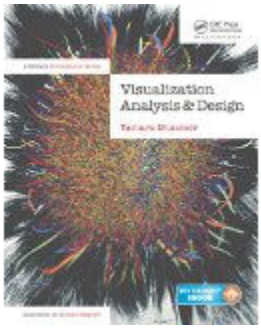
Friday, January 23	Assignment 1 due (10%)
Thursday, February 12	Midterm test (20%)
Thursday, March 5	Project Proposal due (3%)
Friday, March 20	Assignment 2 due (10%)
Thursday, March 26	In class update on project progress
Thursday, April 9	Term project presentations (5%)
Friday, April 10	Term project reports due (22%)

Outline of Topics (subject to changes)

1. Introduction: What is information visualization, and why do it?
2. Data abstraction
3. Task abstraction
4. Validation
5. Critical visualization
6. Designing visualization
    a. Visual variables, marks and channels
    b. Design guidelines
    c. Colour theory
7. Arranging tables
8. Arranging spatial data
9. Arranging networks and trees
10. Arranging text and documents
11. Interaction
12. Coordinated views
13. Handling big data
    a. Dimensionality reduction
    b. Filtering
    c. Focus+Context
14. Visual analytics
15. Special Topics (a selection of these, based on student interest)
    a. Business analytics
    b. Personal visualization
    c. Narrative visualization
    d. Time series
    e. Biological data
    f. Small / large displays
    g. Collaboration
    h. Scientific data
    i. Geographic data

Required Texts / Readings

Course Text



Tamara Munzner. Visualization Analysis and Design, 1st Edition (CRC Press, 2014).

This book is the primary text for the course material presented in the lectures and is available at the bookstore.

Reference Texts

Colin Ware. Information Visualization: Perception for Design. 3rd Ed. (Morgan Kauffman, 2013). *Online @ UOIT Library*

Software

D3: d3js.org

Tableau Desktop: http://www.tableausoftware.com/academic/students

Processing: http://processing.org

Readings

Required readings will be posted on Blackboard under "Readings" on a regular basis, as well as announced in class. Students are responsible to know the content in required readings and arrive in class prepared to discuss the assigned readings for the week.

Evaluation

Student progress in the course will be evaluated through participation, a mid-term test, assignments, labs, and a group project. The marking breakdown is:

Participation	18%
Labs	10 X 1.5% = 15%
Mid-term test	15%
Sketching / Critique Exercises	4 x 3% = 12%
Assignments	2 x 7% = 14%
Term project (proposal, presentation, report)	3 + 5 + 18 = 26%
Total	***100%***

Final course grades may be adjusted to conform to Faculty grade distribution profiles. Further information regarding grading can be found in Section 5 of the UOIT Academic Calendar.

Lower bounds on letter grade ranges will be treated as strict minimum cutoffs for that grade (grades will not be rounded up).

Participation

12% of participation is based on weekly *question assignments*, in which you are required to submit questions or comments on the readings by midnight Saturday.

6% of participation will be graded based on participation in class discussions in lectures, lab activities, and online. An estimate grade will be reported after the first 5 weeks of class but will not count, giving students feedback to improve participation.

Assignments and Tests

Assignments will be evaluated based on the correctness of solutions and clarity of argument or reasoning. Marks may be deducted for assignments which are poorly written or disorganized.

Assignments will be distributed and handed in using Blackboard. Assignments are due at 11:59pm on the due date.

Mid-term Test: Thursday, February 12 (tentative).

If a scheduled midterm exam in a Science course will conflict with another test or a course you must contact the Science Academic Advising Office at least 7 days before the date of the exam. Special early exam arrangements may be made under these circumstances if the student applies by the deadline.

Collaboration: All assignments and tests are to be completed individually. Lecture and laboratory activities may be collaborative as described by the instructor or TA for each activity.

Lateness: Students are expected to complete the required assignments on time. This is especially important due to the cumulative nature of the term project. Extensions will be granted on request and with an acceptable reason. 10% per day will be deducted from unexcused late assignments for a maximum of 4 days (including weekends), after which the assignment will not be accepted. Late submission of group assignments will not necessarily result in an extension on the next part!

Missed assignments and tests: When a student has sufficient grounds for special consideration (such as documented illness or death in the family) the normal policy is to re-weight the remaining work in the course to account for the missing grade, in accordance with the regulations at http://www.science.uoit.ca/undergraduate/academic-policies.php (Science) and http://www.engineering.uoit.ca/undergraduate/academic-support/student-policies (Engineering). Students who do not provide sufficient grounds, as determined by the course instructor in consultation with the appropriate Faculty Academic Advising Office, will receive a grade of zero for the missed work. **There are no make-up exams, tests, labs, or assignments.**

Students who have legitimate grounds for missing a test/exam should not write the exam expecting to later decide whether or not the exam will count. If you choose to write an exam under any circumstances the decision is irreversible. If you are concerned about your ability to perform on the exam, you should speak to your Faculty Academic Advising Office about your options in advance of the exam.

Remarking: It is very important that all assessments are properly graded. If you believe there is an error in your assignment or exam grading, please submit an *explanation in writing* within 2 days of receiving the grade. No remarking requests will be accepted orally, and no re-grade requests will be accepted more than 7 days after return of the assignment.

Computer Science Study Room

J 123A is available as a drop in study room for students registered in this course. Check the schedule on the door for details.

Academic Integrity

Students and faculty at UOIT share an important responsibility to maintain the integrity of the teaching and learning relationship. This relationship is characterized by honesty, fairness and mutual respect for the aim and principles of the pursuit of education. Academic misconduct impedes the activities of the university community and is punishable by appropriate disciplinary action.

Students are expected to be familiar with and abide by UOIT's regulations on Academic Conduct (Section 5.15 of the Academic Calendar) which sets out the kinds of actions that constitute academic misconduct, including plagiarism, copying or allowing one's own work to copied, use of unauthorized aids in examinations and tests, submitting work prepared in collaboration with another student when such collaboration has not been authorized, among other academic offences. The regulations also describe the procedures for dealing with allegations, and the sanctions for any finding of academic misconduct, which can range from a resubmission of work to a failing grade to permanent expulsion from the university. A lack of familiarity with UOIT's regulations on academic conduct does not constitute a defense against its application.

Further information about academic misconduct can be found in the Academic Integrity link on your laptop. Extra support services are available to all UOIT students in academic development, study skills, counseling, and peer mentorship. More information on student support services can be found in the Academic Calendar (Section 8).

Further information on academic integrity is available at:

http://uoit.ca/main/current-students/academics-and-programs/programs-and-resources/academic-integrity/index.php

Final Examination

This course does not have a final examination.

Freedom of Information and Protection of Privacy Act

The following is an important notice regarding the process for submitting course assignments, quizzes and other evaluative material in your courses in the Faculty of Science / Engineering and Applied Science.

As you may know, UOIT is governed by the *Freedom of Information and Protection of Privacy Act* ("FIPPA"). In addition to providing a mechanism for requesting records held by the university, this legislation also requires that UOIT not disclose the personal information of its students without their consent.

FIPPA's definition of "personal information" includes, among other things, documents that contain both your name and your Banner ID. For example, this could include graded test papers or assignments. To ensure that your rights to privacy are protected, the Faculty of Science / Engineering and Applied Science encourages you to use only your Banner ID on assignments or test papers being submitted for grading. This policy is intended to prevent the inadvertent disclosure of your information where graded papers are returned to groups of students at the same time. If you still wish to write both your name and your Banner ID on your tests and assignments, please be advised that UOIT will interpret this as an implied consent to the disclosure of your personal information in the normal course of returning graded materials to students.

If you have any questions or concerns relating to this policy or the issue of implied consent addressed above, please contact the UOIT Chief Privacy Officer at accessandprivacy@uoit.ca.

Accessibility

Accommodating students with disabilities at UOIT is a responsibility shared among various partners: the students themselves, SAS staff and faculty members. To ensure that disability-related concerns are properly addressed during this course, students with documented disabilities and who may require assistance to participate in this class are encouraged to speak with me as soon as possible. **Students who suspect they have a disability that may affect their participation in this course are advised to go to Student Accessibility Services (SAS) as soon as possible.** Maintaining communication and working collaboratively with SAS and faculty members will ensure you have the greatest chance of academic success.

Students taking courses on the North Campus Location can visit Student Accessibility Services in the U5 Building located in the Student Life Suite

Students taking courses on the Downtown Oshawa Campus Location can visit Student Accessibility Services in the 61 Charles St. Building, 2nd Floor, Room DTA 225 in the Student Life Suite.

Disability-related support and accommodation support is available for students with mental health, physical, mobility, sensory, medical, cognitive, or learning challenges. Office hours are 8:30am-4:30pm, Mon-Fri. For more information on services provided, you can visit the SAS website at http://uoit.ca/studentaccessibility

Students may contact Student Accessibility Services by calling 905-721-3266, or email studentaccessibility@uoit.ca

Students who require the use of the Test Centre to write tests, midterms, or quizzes MUST register online using the SAS test/exam sign-up module, found here www.uoit.ca/SASexams. Students must sign up for tests, midterms or quizzes AT LEAST seven (7) days before the date of the test.

Students must register for final exams by the registration deadline, which is typically 2 weeks prior to the start of the final examination period. SAS will notify students of the registration deadline date.

Professional Conduct

Please participate respectfully in lectures – contribute to discussions and listen politely to your peers. I will not tolerate excessive talking, loud eating, use of mobile phones, gaming, wearing of headphones, or any other disruption which may disturb my teaching or the learning experience of other students.

Research has shown that laptop use during classes can reduce learning outcomes [1]. You should only use your laptop for course-related work during lectures. This includes: following along on slides, participating in back-channel chat on course-related topics, taking notes, and completing in-class activities. Disruptive laptop use (gaming, coding, other class work, etc.) will not be tolerated. While the UOIT laptop program provides us with a useful learning tool, there may be times when I request that your laptops are closed, for example during student presentations.

Activities in this course may require students to interact with members of the university and wider community in the role of ethnographic researchers. When carrying out these assignments students are expected to adhere to all ethical research guidelines discussed in class, as well as to represent UOIT in a professional manner (punctual, professional attire, polite, etc.).

[1] Fried, C. In-class laptop use and its effects on student learning. *Computers & Education* 50(2008), 906—914. http://dx.doi.org/10.1016/j.compedu.2006.09.006

Course Evaluations

Student evaluation of teaching is a highly valued and helpful mechanism for monitoring the quality of UOIT's programs and instructional effectiveness. To that end, course evaluations are administered by an external company in an online, anonymous process during the last few weeks of classes. Students are encouraged to participate actively in this process and will be notified of the dates. Notifications about course evaluations will be sent via e-mail, and posted on Blackboard, Weekly News and signage around the campus.

In addition to the formal evaluation process at the end of term, student feedback is encouraged and welcome through the semester. Students may contact the instructor to discuss any issues related to lectures or tutorials and to make suggestions throughout the term. Online feedback activities will take place throughout the term, and students are encouraged to use them fully.


Christopher Collins, Ph.D. | UOIT Faculty of Science