

COURSE SYLLABUS

CMPT 384: INFORMATION VISUALIZATION

Lecture - Tuesdays and Thursdays, 08:30 AM - 09:50 AM, Geology Building Room: 255

Tutorial - M/F - S320

Catalogue Description

This course will introduce visualization process for different datasets, design principles, techniques for developing effective visualizations, visualization algorithms and interaction techniques. The course is targeted to students interested in using visualization in their own work, as well as to those who are interested in developing visualization systems. Topics include: data abstractions, visualization process, design principles, visualizations of tabular data, geo-visualizations, cartographic representation, visualization for sets, temporal and hierarchical data (treemaps, radial layouts), network visualizations, visualization algorithms and software, interactions with large dataset, and a brief overview of visual analytics.

Prerequisite(s): CMPT 280 (required); MATH 164 (formerly MATH 264) recommended

Class Time and Location: TR 08:30 AM - 09:50 AM, Geology Building Room: 255 Start Date: 06-Jan-2025 End Date: 04-Apr-2025

Website: canvas.usask.ca

The lectures are planned to be delivered in person and in the class.

Instructor Information

Instructor Debajyoti Mondal

Contact: Email: d.mondal@usask.ca,
Office Phone: (306)-966-6277

Office Hours: Tuesdays 10:30 AM - 12:30 PM or scheduled by email

Course Objectives

Upon completion of this course, students will be expected to:

- Learn the principles and design process to create effective visualizations
- Gain an understanding of the underlying theoretical models and concepts
- Validate the feasibility of a proposed visualization process
- Develop skills to evaluate visualizations and suggest improvements
- Design visualizations for data coming from different practical domains
- Apply the idea of human perception and cognition in visualization design
- Convey technical information visually to the general audience
- Work constructively in a team and carry out a complex project

Student Evaluation

Intangibles may be considered in the determination of your grade.

Table 1: Grading Scheme

<i>Item</i>	<i>Description</i>	<i>Weighting</i>
Class Participation	Throughout the term	10%
Tutorial Participation	Throughout the term	5%
Assignments	5 Assignments (6% each)	30%
Midterm Examination [February 13, 2025]	40 minutes	20%
Final Examination	180 minutes	35%
<i>Total</i>		100%

Grading Scheme

The course evaluation will be based on participation in class and tutorials, assignments, midterm and final examination.

For every work submitted for grading, you must write the answers in your own word. Do not communicate with any person. Do not share any of your answers with any other individual at any time even after the assignment deadline or after the examination.

Participation Marks & Criteria

The course contains in-class group activities. The participation will be assessed as follows.

Excellent (9-10): Good understanding of the assigned topics. Frequent contribution. Thoughtful comments that encouraged fellow classmates.

Good (7-8): Moderate understanding of the assigned topics. Participation in group discussions but comments are often drawn from the readings

Adequate (5-6): Contributed occasionally. Limited understanding of the readings. Infrequent group participation.

Inadequate (0-4): Remained silent, failed to demonstrate an understanding of the readings, made off-topic remarks, restated points already made, or was absent without an excuse.

Midterm and Final Exam

The students will be asked the following types of questions:

1. True/False and Multiple Choice Questions (midterm and final).
2. Coding and Computational questions: The students will be given a problem and asked to apply a technique from the course to derive a solution (midterm and final).
3. Short answer items: The student will be given a claim, and they will be asked to present their thoughts to justify or refute the claim (midterm and final).
4. Design questions: Given a description of a dataset, the student will be asked to propose a visual design based on the design guidelines introduced in the course (final).

Criteria That Must Be Met To Pass

Students must receive a passing grade in the final examination.

Attendance Expectation

Students are expected to attend tutorials, lectures and participate in group discussions. Attendance will be taken in classes and tutorials. Please note that students who are absent without a legitimate excuse will receive a grade of 0 for participation in that class.

Midterm and Final Exam Scheduling

Midterm and final examinations must be written on the date scheduled.

The midterm examination will be held on February 13, 2025, in the class (Geology Building Room: 255 at 1:00 PM).

Final examinations may be scheduled at any time during the examination period (<https://students.usask.ca/academics/exams.php>); students should therefore avoid making prior travel, employment, or other commitments for this period. If a student is unable to write an exam through no fault of his or her own for medical or other valid reasons, documentation must be provided and an opportunity to write the missed exam may be given. Students are encouraged to review all examination policies and procedures: <http://students.usask.ca/academics/exams.php>

Note: All students must be properly registered in order to attend lectures and receive credit for this course.

Textbook Information

All required readings will be made available through the course website (No textbook is required). The following books are related and can be found in the University of Saskatchewan library.

Recommended Texts

Course Slides and Documents posted on Canvas.

- Visualization Analysis and Design, Tamara Munzner, A K Peters Visualization Series, CRC Press, 2014.
- Technical book:
 - Data Driven Documents D3.js: Tips and Tricks. Malcolm Maclean (<https://leanpub.com/d3-t-and-t-v5>)
 - Interactive Data Visualization for the Web. Scott Murray, O'Reilly Media, 2013

Additional Readings

- The visual display of quantitative information, Edward R. Tufte, Graphics Press, 2001.
- Data Visualization, Principles and Practice, Alexandru C. Telea, 2nd edition, CRC Press, 2014

Lecture Schedule

Week	Topics	Assignment/Project related Deadlines
Week 1	Introduction, Visualization Process, Basics of D3	
Week 2	Datasets and Data Abstraction and Organization	Assignment 1 (out)
Week 3	Chart and Statistical Visualization	Assignment 1 (due), Assignment 2 (out)
Week 4	Dimensionality Reduction	Assignment 2 (due), Assignment 3 (out)
Week 5-6	Overview of Visual Analytics	Assignment 3 (due), Assignment 4 (out)
Week 7-9	Visualizing Trees and Networks	Assignment 4 (due), Assignment 5 (out)
Week 10-11	Putting Data on the Map, Cartography	Assignment 5 (due)
Week 11	Visual Representations: Colors, Marks, and Perception	
Week 12-13	Visualization Case Studies	

Course Overview

The proposed course aims at preparing students to design useful data visualization, analyze information through visualizations, comprehend human perception and cognition, as well as present their own works in an appealing way to both scientific and general audiences. The first half of the course will give a brief overview of the visualization process, discuss the challenges in big data visualization, introduce the students to a variety of practical-life datasets, and discuss techniques to visualize such data and underlying theoretical concepts. The next half of the course will cover design choices and principles, interaction techniques, visualization algorithms, and visual representations for temporal, scientific, and structured data. The course will give enough overview of different types of visualizations and corresponding case studies such that the students can learn how to develop a visualization system that best suit the datasets generated in different domains.

Course Policies

Recording of Lectures

Recording of the course are not allowed. The lecture notes will be shared throughout the term.

Copyright

Course materials are provided to you based on your registration in a class, and anything created by your professors and instructors is their intellectual property, unless materials are designated as open education resources. This includes exams, PowerPoint/PDF slides and other course notes. Additionally, other copyright-protected materials created by textbook publishers and authors may be provided to you based on license terms and educational exceptions in the Canadian Copyright Act (see <http://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>).

Before you copy or distribute others copyright-protected materials, please ensure that your use of the materials is covered under the Universitys Fair Dealing Copyright Guidelines available at <https://library.usask.ca/copyright/general-information/fair-dealing-guidelines.php>. For example, posting others copyright-protected materials on the open web is not covered under the Universitys Fair Dealing Copyright Guidelines, and doing so requires permission from the copyright holder.

For more information about copyright, please visit <https://library.usask.ca/copyright/index.php>, where there is information for students available at <https://library.usask.ca/copyright/students/rights.php>, or contact the Universitys Copyright Coordinator at <mailto:copyright.coordinator@usask.ca> or 306-966-8817.

Late Assignments

If an assignment is submitted after the specified due time and date it will be accepted for 48 hours with a 20% penalty. If this second deadline is missed, then the permission of the instructor must be obtained to hand in the assignment late.

Missed Assignments

If a student missed to submit an assignment for medical or other valid reasons, documentation must be provided to be considered for an alternative coursework assignment.

Grading Concerns

Percentage assessment for undergraduate courses is based on the literal descriptors, below, to provide consistency in grading among colleges. This is documented at <https://students.usask.ca/academics/grading/grading-system.php>.

The university-wide relationship between literal descriptors and percentage scores for undergraduate courses is as follows:

90-100 *Exceptional* A superior performance with consistent strong evidence of

- a comprehensive, incisive grasp of the subject matter;
- an ability to make insightful critical evaluation of the material given;
- an exceptional capacity for original, creative, and/or logical thinking;
- an excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently.

80-89 *Excellent* An excellent performance with strong evidence of

- a comprehensive grasp of the subject matter;
- an ability to make sound critical evaluation of the material given;
- a very good capacity for original, creative, and/or logical thinking;
- an excellent ability to organize, to analyze, to synthesize, to integrate ideas, and to express thoughts fluently.

70-79 *Good* A good performance with evidence of

- a substantial knowledge of the subject matter;
- a good understanding of the relevant issues and a good familiarity with the relevant literature and techniques;
- some capacity for original, creative, and/or logical thinking;
- a good ability to organize, to analyze, and to examine the subject material in a critical and constructive manner.

60-69 *Satisfactory* A generally satisfactory and intellectually adequate performance with evidence of

- an acceptable basic grasp of the subject material;
- a fair understanding of the relevant issues;
- a general familiarity with the relevant literature and techniques; an ability to develop solutions to moderately difficult problems related to the subject material;
- a moderate ability to examine the material in a critical and analytical manner.

50-59 *Minimal Pass* A barely acceptable performance with evidence of

- a familiarity with the subject material;
- some evidence that analytical skills have been developed; some understanding of relevant issues;
- some familiarity with the relevant literature and techniques;

- attempts to solve moderately difficult problems related to the subject material and to examine the material in a critical and analytical manner which are only partially successful.

<50 *Failure* An unacceptable performance.

Please contact the marker regarding any assignment marking concerns, with a cc to the instructor. Should you continue to have concerns, please escalate to the instructor. Please note that should your concern be a comparison with another's work, both must be submitted for regrading: we reserve the right to re-grade your work and the others work. Furthermore, the instructor will re-grade the entire work, not just selected portions.

Other Policies

Missed Examinations

1. *Midterm exams.* Students who have missed a midterm exam must contact their instructor as soon as possible. Arrangements to make up the exam may be arranged with the instructor. Missed midterm exams throughout the year are left up to the discretion of the instructor if a student may make up the exam or write at a different time. If a student knows prior to the midterm exam that she/he will not be able to attend, they should let the instructor know before the midterm exam.
2. *Final exams.* Final examinations may be scheduled at any time during the examination period (December 7–23); students should therefore avoid making prior travel, employment, or other commitments for this period. A student who is absent from a final examination through no fault of his or her own, for medical or other valid reasons, may apply to the College of Arts and Science Dean's office. The application must be made within three days of the missed examination along with supporting documentary evidence. Deferred exams are written during the February mid-term break for Term 1 courses and in early June for Term 2 and full year courses.

<http://students.usask.ca/academics/exams.php>

Incomplete Course Work and Final Grades

When a student has not completed the required course work, which includes any assignment or examination including the final examination, by the time of submission of the final grades, they may be granted an extension to permit completion of an assignment, or granted a deferred examination in the case of absence from a final examination.

Extensions past the final examination date for the completion of assignments must be approved by the Department Head, or Dean in non-departmentalized Colleges, and may exceed thirty days only in unusual circumstances. The student must apply to the instructor for such an extension and furnish satisfactory reasons for the deficiency. Deferred final examinations are granted as per College policy.

In the interim, the instructor will submit a computed percentage grade for the class which factors in the incomplete coursework as a zero, along with a grade comment of INF (Incomplete Failure) if a failing grade.

In the case where the student has a passing percentage grade but the instructor has indicated in the course outline that failure to complete the required coursework will result in failure in the course, a final grade of 49% will be submitted along with a grade comment of INF (Incomplete Failure).

If an extension is granted and the required assignment is submitted within the allotted time, or if a deferred examination is granted and written in the case of absence from the final examination, the instructor will submit a revised assigned final percentage grade. The grade change will replace the previous grade and any grade comment of INF (Incomplete Failure) will be removed.

A student can pass a course on the basis of work completed in the course provided that any incomplete course work has not been deemed mandatory by the instructor in the course outline and/or by College regulations for achieving a passing grade.

<http://policies.usask.ca/policies/academic-affairs/academic-courses.php>

For policies governing examinations and grading, students are referred to the **Assessment of Students** section of the University Policy *Academic courses: class delivery, examinations, and assessment of student learning*.

Academic Integrity

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the **Student Conduct & Appeals** section of the **University Governance Office** and avoid any behaviour that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic misconduct is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the regulations on *Academic Misconduct*, and the standards of respect and behaviour required to avoid *Non-academic Misconduct*. Students should familiarize themselves with the **process for handling violations**.

You are encouraged to complete the Academic Integrity Tutorial to understand the fundamental values of academic integrity and how to be a responsible scholar and member of the USask community at

<https://library.usask.ca/academic-integrity.php#AcademicIntegrityTutorial>.

Collaboration Policy

[This is my recommended policy; you can choose something else, if you wish. Please review the Academic Misconduct regulations to know what the default is. In all cases, you are recommended to state what materials are permitted for assessments and exams, both here in the syllabus and on each assignment and exam.]

You may neither possess work from other students (including those not enrolled in this course) nor share your work (rough drafts, finished answers, or graded assignments) with another student at any time during the course: **before and after** any assignment is due. Study groups and group discussion are encouraged; but if you plan to employ these then you must adhere to a *no-recording* policy:

Collaboratively, you may discuss and sketch on a non-permanent surface (e.g. white board), but no written-on-paper and no typed-into-computer activities are allowed. Every student must leave the discussion without a record (no written notes or document, no computer file, no photograph, and no audio/video recording) and must reproduce the result from their own memory. The impermanent surface must be erased before commencing to construct your answer..

Information found online can be used for understanding only, essentially as a mechanical collaborator in the policy above. But, you cannot submit anything you find online as your own work, and you must complete your own work without referring to the online information once you've started writing your answer. If you need to refer back to the online information, you must erase your partial answer and reconstruct it again *ab initio*.

Offering another's work (especially that found online) as your own is academic misconduct, as above. If you afford yourself the benefit of the above *no-recording* policy, you must name all of the individuals with whom you discussed the work and online sources you consulted. Furthermore, one student's unauthorized possession of other students' work (even after the due date) is also *prima facie* evidence of academic misconduct on the part of both students, even if one is not registered in this class.

System Outages

[This is my policy, you can adopt it if you wish, or make your own.]

System (canvas, labs, network) outages of 6 hours or longer, in the 24 hours before a deadline, automatically grant a 24-hour extension. Shorter outages, even if they overlap with a deadline, do not. Most systems allow re-submission, students are counseled to submit early, and submit regularly as progress is made.

Examinations with Access and Equity Services (aes)

Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may

have disabilities should contact AES for advice and referrals at any time. Those students who are registered with AES with mental health disabilities and who anticipate that they may have responses to certain course materials or topics, should discuss course content with their instructors prior to course add / drop dates. In order to access AES programs and supports, students must follow AES policy and procedures. For more information or advice, visit <https://students.usask.ca/health/centres/access-equity-services.php>, or contact AES at 306-966-7273 or <mailto:aes@usask.ca>. In particular, assignment accommodations are expected to be exercised occasionally (i.e. not for every assignment) and with a minimum of 24-hours notice before the deadline. Otherwise, the occurrence will be addressed as an *acute* situation under the missed/late policy, just like any other student.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

Student Supports

Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS web site <https://library.usask.ca/studentlearning/>.

Teaching, Learning and Student Experience

The Teaching, Learning and Student Experience unit (TLSE) focuses on providing developmental and support services and programs to students and the university community. For more information, see the SESD web site <https://students.usask.ca>.

Financial Support

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact Student Central (<https://students.usask.ca/student-central.php>).

Aboriginal Students' Centre

The Aboriginal Students Centre (ASC) is dedicated to supporting Aboriginal student academic and personal success. The centre offers personal, social, cultural and some academic supports to Métis, First Nations, and Inuit students. The centre is also dedicated to intercultural education, bringing Aboriginal and non-Aboriginal students together to learn from, with, and about one another in a respectful, inclusive, and safe environment. Students are encouraged to visit the ASCs Facebook page to learn more: <https://www.facebook.com/aboriginalstudentscentre/>

International Student and Study Abroad Centre

The International Student and Study Abroad Centre (ISSAC) supports student success in their international education experiences at the U of S and abroad. ISSAC is here to assist all international undergraduate, graduate, exchange and English as a Second Language students and their families in their transition to the U of S and Saskatoon. ISSAC offers advising and support on all matters that affect international students and their families and on all matters related to studying abroad. Please visit <https://students.usask.ca> for more information.

Treaty Acknowledgement

As we gather here today, we acknowledge we are on Treaty Six Territory and the Homeland of the Métis. We pay our respect to the First Nation and Métis ancestors of this place and reaffirm our relationship with one another.