Information Visualization

Course
Name: Information Visualization
Number: **LIS9721/LIS9821/CS9639** (This is a cross-listed course)
Term: Fall 2015
Location: MC 15a
Lectures: Mondays, 9:00am to 11:55am

Instructor
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Instructor Bio:
My research is quite interdisciplinary, dealing with such areas as information science, human-information interaction, visualization, health informatics, data analytics, big data, knowledge work, cognitive technologies, interface design, information systems, and digital games.

Course Description
One of the most important things in information science is figuring out how to represent information/data to help people access it, use it, and work with it. Information can be represented in different ways. In the past, text has been the main method for encoding information. That is changing. Researchers are developing techniques for encoding and communicating all kinds of information visually (i.e., graphically). Indeed, humans grasp visual information much faster than textual information. Information visualization (IV) is the study of how to represent information in a visual form to help people perceive its shape, make sense of its elements and their properties, discover its underlying patterns and trends, and be able to access it and use it effectively to perform higher-order tasks such as decision making and planning. Information can be visually displayed on paper or other static media. However, as computers have become more powerful, researchers have discovered that not only information need not always be represented textually, but also it does not always need to be presented in a static form. Indeed, massive amounts of information can be effectively represented visually and dynamically. Computer-based information visualizations can create a coupling between the human mind and interactive, dynamic information. Well-designed information visualization tools allow people to access and interact with large amounts of information to make sense of it. Because of its novel concepts and techniques, information visualization holds much promise in improving the interface and utility of digital libraries, search tools, web sites, and other similar information tools and interfaces.

In this course, we will study what information visualization is, how information/data can be presented visually, how to interact with information to perform tasks, what the applications of information visualization are, how humans process visual information, how people navigate information spaces, and what activities and environments can benefit from information visualization techniques. Information visualization has applications in library and information science, health information science, computer science, digital humanities, journalism, history, and media studies—to name a few—(example include: **social networks, text visualization, search engines, digital libraries**, **digital games, learning tools, geographic visualization tools, health analytics, data analytics tools,** and **decision support tools**). Students can also

apply what they learn in **usability design of web sites**, as well as **human-computer interaction**. This is primarily a **design course** and is very open and flexible. **You do not need to have any specific background to take this course.** However, you need to have some general knowledge of databases, information systems, and computers. We will refer to these in the course of our study of information visualization. Additionally, you should be comfortable with a course that has an interdisciplinary approach. All students will benefit from taking this course, particularly those who are interested in learning about the role of new technology when trying to creatively solve problems as well as the challenges that arise when dealing with the massive volumes of existing data.

Course Objectives
- Learn the principles and key concepts involved in information visualization
- Learn a variety of existing techniques and systems in information visualization
- Become familiarized with some of the literature in the area
- Become prepared, if desired, to pursue a Ph.D. or future research in the area
- Gain a background that will aid in the design of new, innovative visualizations
- Learn how to design and evaluate different types of visually-based information systems and interfaces

Reference Materials
1. (**R1**) Kamran Sedig & Paul Parsons (2015). *Towards a science of visual representations of information: A pattern-based framework*. Synthesis Lectures on Visualization. Morgan & Claypool Publishers. (Will be available online through Western Library)
2. (**R2**) Kamran Sedig & Paul Parsons (2013). Interaction design for complex cognitive activities with visual representations: A pattern-based approach. *AIS Transactions on Human-Computer Interaction*, 5 (2):84–133. (Available online)
3. (**R3**) Christian Tomisnki (2015). *Interaction for visualization*. Synthesis Lectures on Visualization. Morgan & Claypool Publishers. (Available online through Western Library)
4. (**R4**) Dependent on students

Structure and Method of Evaluation
Through a combination of lectures, panel-based seminars, projects, and classroom discussions, you will gain a critical understanding of a wide range of issues involved in visualization of data and interactive visualizations.

1. Lectures
2. Panel-based seminars
3. Design project of your choice
4. Class discussions and participation

The term is divided into 3 portions: lectures, seminars, and project presentations.

Method of Evaluation
Your final mark will be based on 3 things:
1. **Panel-based seminar (25%)**: Depending on the number of students registered in the course, in small groups you will read assigned articles/chapters and have a panel presentation. You will summarize and analyze the articles, find other related literature, and identify relevant information visualization tools that incorporate the concepts and ideas in the chapters.

2. **Project (50%)**: You will work on a design project to learn how to apply the concepts and techniques that you learn in the course to solve a real-world problem. You will choose your own problem and work in a team comprised of 3 to 5 people, depending on the number of students registered in the course.
3. **Participation (25%)**: You are expected to attend classes, study lecture notes, engage in class presentations, and participate in class discussions and presentations. Your participation mark will depend on your *intelligent, informative, and regular* contribution to and engagement in class discussions.

Lectures

The first portion of the course is comprised of lectures. Lectures will provide an overall formal framework for an understanding of IV. The first few weeks of the course will cover a great deal of material to prepare you for working on your projects. Lecture notes will be shared with you after each class. You need to study them carefully, as they provide you with the fundamental IV concepts you need to know.

Panel-based seminars

The second portion of the course is comprised of seminars. One of the objectives of the course is to expose you to a wide range of concepts and techniques in IV and to help you develop a deep understanding of the subject matter. As such, this portion of the course involves a great deal of reading and research. It is hoped that the material covered in this part of the course will help you expand your knowledge of many aspects of this fast-growing area, allowing you to either get a job in this area or do further graduate research. We will have 8 seminars based on 8 sets of readings—selected from the chapters in the reference materials (above). Depending on the number of students registered in the course, you will form 8 groups comprised of 2 to 4 people each. Each group will carefully study and analyze their selected readings, do further research to compare those ideas with other references, find IV tools that incorporate those ideas, analyze and present those tools, and so on. The purpose is to engage the whole class in deep discussion and examination of presented ideas. Since ALL students in class are supposed to study the references carefully, the purpose of the seminar is not for the presenters to just give a summary of the materials; rather, they must use their readings to do further investigation and discuss their findings and new ideas with their colleagues in class. Each seminar will be 70 to 75 minutes long, with each portion (i.e., presentation and class discussion) being approx. 35 minutes. The order of the seminars will be as follows:

Date	Presenter Group	Tentative Reference	Chapters
10/26	1	R1	TBD
10/26	2	R1	"
11/2	3	R1	"
11/2	4	R1	"
11/9	5	R2	"
11/9	6	R2	"
11/16	7	R3	"
11/16	8	R3	"

As you conduct the seminars as a group, you have to make sure that all the members of the group study the readings carefully and can answer questions that can arise from the material. You should give yourselves ample time to study the readings and prepare for your seminars.

Seminar presentation marks will be based on the following criteria
- Coverage of the relevant concepts and ideas in the readings (both depth and breadth): **4%**
- Understanding and handling of questions posed by others in the class: **4%**
- Engaging others in the discussions: **4%**
- Oral clarity, preparedness, and delivery: **3%**
- Extra research and going beyond the assigned readings: **3%**
- Finding appropriate IV tools to exemplify the studied concepts: **3%**
- Quality of PowerPoint presentation: **1%**
- Timing (pacing of the presentation to finish on time): **3%**

At least 24 hours before each seminar, you must deposit a PowerPoint presentation of your seminar in OWL.

Projects
The third portion of the course is comprised of project presentations. This component of the course is structured to make you gain experience in designing new IV systems by applying the theoretical concepts learnt in the course to a concrete problem. In consultation with me, you will form teams of several people. Each team will select a problem, which you try to solve by designing an IV system using the concepts, techniques, and strategies studied in the course. The design does not need to be implemented. But, *your design should contain enough detail to allow another independent group to implement it*. **Remember**: the selection of your project should be problem-driven.

Teams: There will be a few teams, each consisting of 4 to 6 people, depending on the number of registered students. Each team will decide what project to do in consultation with me.

Partial: You will solve only some parts of the problem that you identify, not the whole problem. In order to make these projects realistic, the problem your team identifies will, most probably, be too large to solve in its entirety; therefore, your team will not be able to address all its aspects before the end of the term. One of your first tasks, and the major purpose of the proposal, is to identify the key problem, its content, and its features and what it is that you want to solve through your design. Your team will need to figure out what the major issues are that you want to solve and narrow the scope of the project. However, you should be aware that you will not get this right the first time. Your understanding of the depth and breadth of the problem will evolve.

Breakdown of the project marks (adds up to **50%**):

Proposal *1%*	The most important thing here is to **identify a problem** (not a solution or technique) that exists out there and that you want to solve. The proposal will be 2 pages long (exclusive of the title sheet), describing the problem you have identified to solve, why you think this problem is worth solving, how and why you think that using IV will address the problem, who the users of the system are, what the scope of your project will be in dealing with this problem, and who your team members are and their backgrounds relevant to the project. In order to develop your proposal, do some brainstorming to identify an existing problem. Problems can be from any domain. Generate a list of issues that you think users would want addressed.
Final design *25%*	This will consist of detailed drawings and functional descriptions of your visualization design. **Interactive slides of your design in PowerPoint will be submitted through OWL**. This should also contain a *roadmap* to all the screens of your system. **Remember**: the more thoroughly you have considered the concepts and techniques in the course, the

better your design is likely to be. Since the purpose of the project is for you to learn how to apply the design concepts you learn, the more visualization and interaction techniques and ideas you incorporate in your design, the higher your mark. We will discuss this in more detail later during the course.

Final report
9%

This will be 8 pages long (exclusive of the cover sheet), consisting of the following sections: an executive summary of your document; a brief description of the problem; an analysis of the information space (e.g., data set), representations, presentation techniques, and interactions that you have used in your system; an outline of the concepts, ideas, techniques, and IV systems that you have considered when designing your system; your justifications (based on what has been studied in the course) for your design choices and decisions; and your final thoughts on what you think is missing and how your design can be improved. Make sure that the writing of this report is coordinated among the members of your group.

In-class group
presentation
3%

You should not be stressed over this presentation, as **it will be very informal**. To make it easier for yourselves, this presentation should be based on your final report. This will be a 30-minute long presentation (presentation + questions and discussion). The main purpose of this presentation is to share with your classmates what you have done and why. For the benefit of your classmates, you will describe the evolution of the design: your motivation for choosing the project, your design, etc. Everyone is encouraged to ask questions from the team and make suggestions for the improvement of the design. Presenting groups are encouraged to bring goodies and share them with your classmates to celebrate the completion of their projects.

Group
explanation
12%

Each group will explain and defend their project design to me (i.e., the instructor) in a closed session. The session will be up to 45 minutes long and will take place during the final week of the class. Teams should schedule this session with me ahead of time. I will read your final reports prior to the meeting. All members of the group must be present for this session. I will ask the design team questions about their design. Some questions will be intended for the entire team. Other questions will be for individuals. There will be an overall mark for the entire team. This mark will reflect my assessment of the team's understanding of the IV concepts, techniques, and ideas and how and why they have been used in the project.

Peer
evaluation

At the end of the course, you will evaluate your team-mates or peers in terms of how cooperative they were, how much effort they put into the project, whether they attended your meetings, whether they did what they were assigned to do, etc. Each of you should get *at least 7.5 out of 10* on the peer evaluation to get a passing mark on the project. When you have finished your projects, you will send me an email giving a mark to each of your project peers (0 to 10). If there is a member who does not contribute to the project during the term, you should inform me.

Class Discussions and Participation

Not only you are supposed to attend lectures, but also you are expected to keep up with lecture notes. You must study all suggested readings in order to engage in class discussions and presentations. Your participation mark will depend on

your intelligent, informative, and regular participation in class discussions. When asked questions in the class, you should give well-considered answers based on the material being studied in the course. You should generate discussions in the class, pose questions, answer questions, bring new ideas to class, etc. In other words, you should fully participate in the course and not be a passive observer. **Additionally**, computers during lectures should *only* be used for the purpose of note taking. Checking of one's email, chatting with friends, browsing websites on the Internet, and similar activities will result in deduction of the participation mark. Additionally, the use of other electronic devices (e.g., cell phones) is not allowed during lectures.

Important Dates (tentative)

Date	What is due
9/28	Project proposal
10/12	Thanksgiving holiday (no classes)
10/26	Start of seminars
11/23	Start of in-class group presentations of the projects
11/30	Final project reports and designs due
12/7	Group explanation of projects

Late Assignments
There will be a deduction of 10% per day for late assignments.

Written Materials and Deliverables
All written reports (for all assignments) should include a cover sheet: title of the report (e.g., project proposal, research paper, final report), title, course number, date, and name of each student (**make sure you do not put your IDs on the cover sheet**). The number of pages specified for each component does not include the cover sheet. Written reports should be single-spaced, and in font "Times New Roman", size 12. Pages should be numbered. **All your assignments should be submitted electronically as MS Word and PowerPoint files.**

Email Policy
All course-related emails should come from your UWO account. **No emails from other accounts will be read or accepted.** Also, any email you send should have "LIS9721/CS9639: <subject>" in the subject line (**e.g., LIS9721/CS9639: Project Proposal**). Otherwise, you may not receive a reply. If you do send me an email, I generally answer within 5 days, depending on the volume of emails I have received during that week. However, I always try my best to reply to your emails as soon as I can. Please do not expect replies to emails during weekends.

Plagiarism
Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Discipline for Graduate Students at http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_grad.pdf)

Research papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Accessibility

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.