INFO4907: Data Visualization

Summer 2023

Instructor:	Junhua Ding, Ph.D.	**Lecture Time:**	M, Th: 7:00pm - 10:00pm
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Course Information

- INFO4907 (Sections 001): Data Visualization, 3 Credit Hours
- Online lecture time: Monday, Thursday: 7:00pm to 10:00pm.
- Lecture delivering: online via Zoom: https://unt.zoom.us/
- Course management at Canvas: https://unt.instructure.com/
- No pre-requisites.

Office Hours

- By appointment.
- Teacher Assistant: Huyen Nguyen, email: huyennguyen5@my.unt.edu

Textbooks

1. *The Visual Display of Quantitative Information*, 2nd Ed., by Edward R. Tufte, Graphics Pr, 2001. ISBN: 9780961392147. (**optional**)
2. *Envisioning Information*, by Edward R. Tufte, Graphics Pr, 1990. ISBN: 9780961392116, (**optional**).
3. *Visualizing Data*, by William S. Cleveland, Hobart Press, 1993, ISBN: 9780963488404, (**optional**).
4. *Reading materials* see Appendix I.

Software The following software will be used in this course.

- Tableau.
- Microsoft Excel, and MySQL.

Objectives

Well designed **Data Visualization** would improve comprehension, memory, inference, and decision making. This course introduces techniques, algorithms and tools for creating effective data visualizations based on principles and techniques from graphic design, visual art, perceptual psychology and cognitive science. Emphasis is placed on the identification of patterns, trends, and differences among data sets.

The objectives of this course:

1. Students will be able to master the fundamentals of communication and alignment around concepts required for effective data visualization.
2. Students will be able to select and use techniques, algorithms and tools for creating visualization of real-world data.
3. Students will be able to use software tools to create static and interactive visualization for data from a variety of disciplines.
4. Students will be able to use data visualization to support decision-making and critical thinking.

Topics

The following is the tentative schedule with the covered topics. Actual schedule may be adjusted according to progress:

1. The Purposes of Data Visualization
2. Data and Image Models
3. Exploratory Data Analysis
4. Data Visualization in Practices: Charts, Patterns, Dashboards, and Story Telling.
5. Perception
6. Interaction
7. Using Space Effectively: 2D
8. Spatial Layout
9. Deconstructing Visualizations
10. Color
11. Tree and Graph Visualization
12. Time Visualization
13. Text Visualization

Teaching Philosophy

This course will be taught online with traditional lectures through Zoom platform, but on-class discussions via Zoom are strongly encouraged. Although software tools such as Tableau and Microsoft Excel will be needed to complete the assignments, no tutorial will be given in the lectures on how to use the tools.

This course employs lecture capture technology to record class sessions. Students may occasionally appear on video. The lecture recordings will be available to you for study purposes and may also be reused in future course offerings.

Technical Assistance

UIT Help Desk: http://www.unt.edu/helpdesk/index.htm. The University of North Texas provides student technical support in the use of Zoom and Canvas and supported resources. The student help desk may be reached at:

- Email: helpdesk@unt.edu
- Phone: 940.565-2324
- In Person: Sage Hall, Room 130

Hours

- Monday-Thursday 8am-midnight
- Friday 8am-8pm
- Saturday 9am-5p
- Sunday 8am-midnight

Canvas technical requirements: https://clear.unt.edu/supported-technologies/canvas/requirements

Minimal Technical Skills and Resources Needed

Each student needs an Internet connected computer that can run Zoom software. The computer should include a video camera, a microphone and a speaker for attending the online lectures and participating online discussions. Students are strongly encouraged to test their system for running Zoom and Canvas software at least one day before the first lecture.

Communication

Students can email their questions to the instructor and the teacher assistant (TA). They are also encouraged to talk to the instructor and TA during the office hours. Emails are normally respond within 24 hours, and all assignments, quizzes, projects, and papers should be graded within 4 days after the submission deadline.

Grading Policy

Grading will be based on assignments to be assigned as the course proceeds.

Grades will be computed as follows:

- 2 Project Assignments: 40%
- 4 Quizzes: 60%
- **Grading Scale**: A: 90-100; B: 80-89; C: 70-79; D: 60-69; F: 59 or below.

All assignments, projects, quizzes and term paper requirements are post in Canvas, and students are required to uploaded their work into Canvas. Late submission of quizzes won't be graded, but late submission of other work will be graded with reduced points. The final grade is calculated based on grade points of assignments, project, and quizzes.

Incompletes

A grade of incomplete (I) will be given only for a justifiable reason (such as a serious illness or military service) and only if you are passing the course. It is your responsibility to contact the instructor to request an incomplete and discuss requirements for completing the course. If you do not remove the incomplete within the timeframe agreed upon with the instructor or within one calendar year, you will receive a grade of an F. Please refer to http://essc.unt.edu/registrar/academic-record-incomplete.html for more information.

Withdrawal

A grade of withdraw (W) or withdraw-failing (WF) will be given depending on your participation and grades to date. If you simply disappear and do not file a formal UNT withdrawal form, you may receive a grade of an F.

ADA Statement

The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must f irst register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

Class Policy

- **Attendance Policy:** You are expected to attend class via Zoom. You are responsible for announcements and assignments given in class. If you miss a class, it is up to you to obtain notes and any other information that was provided in the class. Those who do not attend class or review the recorded lectures in a timely manner can count on doing poorly in this course.
- **Academic Integrity Policy:** Academic Integrity Standards and Consequences. According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University. [Insert specific sanction or academic penalty for specific academic integrity violation.
- **Emergency Notification & Procedures:** UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Blackboard for contingency plans for covering course materials.
- **Acceptable Student Behavior:** Student behavior that interferes with an instructors ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Center for Student Rights and Responsibilities to consider whether the student's conduct violated the Code of Student Conduct. The university's expectations for student conduct apply to all instructional forums, including university and electronic classroom, labs, discussion groups, field trips, etc. The Code of Student Conduct can be found at deanofstudents.unt.edu/conduct.
- **Access to Information - Eagle Connect:** Students access point for business and academic services at UNT is located at: my.unt.edu. All official communication from the University will be delivered to a students Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail: eagleconnect.unt.edu/
- **Student Evaluation Administration Dates:** Student feedback is important and an essential part of participation in this course. The student evaluation of instruction is a requirement for all organized

classes at UNT. The survey will be made available during weeks 13, 14 and 15 [insert administration dates] of the long semesters to provide students with an opportunity to evaluate how this course is taught. Students will receive an email from "UNT SPOT Course Evaluations via IASystem Notification" (no-reply@iasystem.org) with the survey link. Students should look for the email in their UNT email inbox. Simply click on the link and complete the survey. Once students complete the survey they will receive a confirmation email that the survey has been submitted. For additional information, please visit the SPOT website at http://spot.unt.edu/ or email: spot@unt.edu.

- **Sexual Assault Prevention:** UNT is committed to providing a safe learning environment free of all forms of sexual misconduct, including sexual harassment sexual assault, domestic violence, dating violence, and stalking. Federal laws (Title IX and the Violence Against Women Act) and UNT policies prohibit discrimination on the basis of sex, and therefore prohibit sexual misconduct. If you or someone you know is experiencing sexual harassment, relationship violence, stalking, and/or sexual assault, there are campus resources available to provide support and assistance. UNTs Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victims compensation applications, contacting professors for absences related to an assault, working with housing to facilitate a room change where appropriate, and connecting students to other resources available both on and off campus. The Survivor Advocates can be reached at SurvivorAdvocate@unt.edu or by calling the Dean of Students Office at 940-565- 2648. Additionally, alleged sexual misconduct can be non-confidentially reported to the Title IX Coordinator at oeo@unt.edu or at (940) 565 2759.

Important Notice for F-1 Students taking Distance Education Courses

- **Federal Regulation:** To read detailed Immigration and Customs Enforcement regulations for F-1 students taking online courses, please go to the Electronic Code of Federal Regulations website at http://www.ecfr.gov/. The specific portion concerning distance education courses is located at Title 8 CFR 214.2 Paragraph (f)(6)(i)(G).

  The paragraph reads:

  (G) For F-1 students enrolled in classes for credit or classroom hours, no more than the equivalent of one class or three credits per session, term, semester, trimester, or quarter may be counted toward the full course of study requirement if the class is taken on-line or through distance education and does not require the student's physical attendance for classes, examination or other purposes integral to completion of the class. An on-line or distance education course is a course that is offered principally through the use of television, audio, or computer transmission including open broadcast, closed circuit, cable, microwave, or satellite, audio conferencing, or computer conferencing. If the F-1 student's course of study is in a language study program, no on-line or distance education classes may be considered to count toward a student's full course of study requirement.

- **University of North Texas Compliance:** To comply with immigration regulations, an F-1 visa holder within the United States may need to engage in an on-campus experiential component for this course. This component (which must be approved in advance by the instructor) can include activities such as taking an on-campus exam, participating in an on-campus lecture or lab activity, or other on-campus experience integral to the completion of this course.

  If such an on-campus activity is required, it is the students responsibility to do the following:

  1. Submit a written request to the instructor for an on-campus experiential component within one week of the start of the course.
  2. Ensure that the activity on campus takes place and the instructor documents it in writing with a notice sent to the International Student and Scholar Services Office. ISSS has a form available that you may use for this purpose.

Because the decision may have serious immigration consequences, if an F-1 student is unsure about his or her need to participate in an on-campus experiential component for this course, s/he should contact the UNT International Student and Scholar Services Office (telephone 940-565-2195 or email: internationaladvising@unt.edu) to get clarification before the one-week deadline.

- **Student Verification:** UNT takes measures to protect the integrity of educational credentials awarded to students enrolled in distance education courses by verifying student identity, protecting student privacy, and notifying students of any special meeting times/locations or additional charges associated with student identity verification in distance education courses. See UNT Policy 07-002 Student Identity Verification, Privacy, and Notification and Distance Education Courses at https://policy.unt.edu/policy/07-002.

- **Use of Student Work:** A student owns the copyright for all work (e.g. software, photographs, reports, presentations, and email postings) he or she creates within a class and the University is not entitled to use any student work without the students permission unless all of the following criteria are met:

  - The work is used only once.
  - The work is not used in its entirety.
  - Use of the work does not affect any potential profits from the work.
  - The student is not identified.
  - The work is identified as student work.

  If the use of the work does not meet all of the above criteria, then the University office or department using the work must obtain the students written permission.

Appendix I: Recommend Reading Materials. We may update the list during the class progress

1. *Decision to launch the Challenger*, In Visual Explanations. Tufte. https://magrawala.github.io/cs448b-fa17/assets/docs/challenger.pdf
2. *Graph Visualization: A Survey.* Herman, Melancon, Marshall. http://www.ivan-herman.net/professional/Publications/StarGraphVisuInInfoVis.pdf
3. *Graphs in Statistical Analysis.* F. J. Anscombe. The American Statistician. http://www.jstor.org/stable/2682899
4. *Exploratory Data Analysis*, Wikipedia. http://en.wikipedia.org/wiki/Exploratory_data_analysis
5. *Perception in visualization.* Healey. http://www.csc.ncsu.edu/faculty/healey/PP/index.html
6. *Graphical perception.* Cleveland & McGill. http://www.jstor.org/stable/2288400
7. *The Value of Visualization.* Van Wijk. http://www.win.tue.nl/~vanwijk/vov.pdf
8. *Postmortem of an example*, Bertin. https://magrawala.github.io/cs448b-fa17/assets/docs/Bertin-Postmortem.pdf
9. *Visual information seeking*, Ahlberg & Shneiderman. ftp://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/3131html/3131.html
10. *The visual design and control of the trellis display.* Becker, Cleveland and Shyu. http://polisci.msu.edu/jacoby/uic/manuscripts/95.8.color.pdf
11. *Graphical Methods for Data Presentation.* Cleveland. https://www.jstor.org/stable/2683401?seq=1#page_scan_tab_contents
12. *Chapter 11: The Cartogram: Value-by-Area Mapping.* In Cartography. Dent. https://magrawala.github.io/cs448b-fa17/assets/docs/Dent-Chap11.pdf
13. *A general cartographic labeling algorithm*, Edmondson, Marks & Shieber. http://www.eecs.harvard.edu/shieber/Biblio/Papers/gen-label.pdf
14. *Graphical Overlays: Using Layered Elements to Aid Chart Reading.* Kong and Agrawala. http://vis.berkeley.edu/papers/grover/
15. *Color Naming Models for Color Selection, Image Editing and Palette Design.* Heer and Stone. http://vis.stanford.edu/papers/color-naming-models
16. *Color guidelines*, Brewer, http://www.personal.psu.edu/faculty/c/a/cab38/ColorSch/ASApaper.html
17. *Centrality and Prestige of Social Network Analysis.* (pp. 169-198) Wasserman & Faust. https://magrawala.github.io/cs448b-fa17/assets/docs/WassermanFaustCentrality.pdf
18. *Text visualization techniques: Taxonomy, visual survey, and community insights,* by K. Kucher and A. Kerren, 2015 IEEE Pacific Visualization Symposium (PacificVis), Hangzhou, China, 2015, pp. 117-121, doi: 10.1109/PACIFICVIS.2015.7156366. https://ieeexplore.ieee.org/abstract/document/7156366
19. *Large Teams Have Developed Science and Technology; Small Teams Have Disrupted It.* L. Wu, D. Wang, and J. A. Evans. https://arxiv.org/pdf/1709.02445.pdf

Appendix II: Tutorials

- **SQL (Structured Query Language)** is a standardized programming language that is used to manage data and perform various operations. Many data visualization tools and database management systems use SQL to query data from a data source, update data, combine data from multiple data sources, and other functions. Therefore, a data visualization specialist should know the basics of SQL even if they may not explicitly use SQL to access the data. For example, a data visualization specialist may need to combine several tables in a data source using the SQL "join" operation.

  Here is a list of some online resources that will help you understand the basics of SQL: W3 Schools, Introduction to SQL: the link: https://www.w3schools.com/sql/sql_intro.asp

- **Tableau** is an enterprise data visualization and analytics tool. Heres a list of some Tableau resources to help you use Tableau for basic data visualization and data analytics. It is important to point out that mastering the data visualization principles introduced in the lectures is critical for creating meaningful data visualizations. Knowing the functions of the tool is just the first step which will allow you to tell the story within your data.

  1. Tableau, Tutorial: Get Started with Tableau Desktop, the link: https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm

  2. Guru99, Tableau Tutorial for Beginners: Learn Basics in 3 Days, the link: https://www.guru99.com/tableau-tutorial.html

  3. Simplilean, Tableau for beginners: Youtube video: https://www.youtube.com/watch=v=xwj2p4LSD1k&ab_channel=Simplilearn