



Data Visualization and Communication

INFO 5709
Fall 2025

Learning Outcomes

This course is designed to enable students to combine statistical methods and graphic-centered computer-based treatment of structured and unstructured data. It includes theoretical considerations to visual design as well as practical computer scripting that will enable students to use visualization techniques and the necessary tools to visualize large sets of data and facilitate visual analysis.

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.

After successfully completing this course:

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

Required Resources

Course website: <https://unt.instructure.com/courses/92176>

Textbooks:

1. Tufte, E. R. (2001). The visual display of quantitative information (Vol. 2). Cheshire, CT: Graphics press. ISBN: 9780961392147 (required).
2. Camm, Cochran, Fry & Ohlmann, Data Visualization - Exploring and Explaining with Data, 1st Edition, © 2021 Cengage, 978-035-763-1348 (optional);
3. Munzner, T. (2014). Visualization Analysis and Design. A K Peters Visualization Series, CRC Press. (optional)
4. Knaflic, C. N. (2015). Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons. (optional)

Required Technology:

Laptop - We will do programming exercises during most classes. Any reasonably current operating system can be used.

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Class Meets

Classroom: Online

Monday

5:00pm – 8:00pm

Office Hours

Online by appointment

Teaching Assistants

Salleh Sonko

sallehsonko@my.unt.edu

TA Hours

Online by appointment

Prerequisites

No prerequisites

Course Communication

This course will have a website in UNT Canvas for online discussion and assignment submissions. Students are welcome to make an appointment with the instructor and/or the teaching assistant (TA) to discuss course-related questions during office hours.

TEACHING PHILOSOPHY

This course will be taught online using a "Flipped Classroom" mode, which means students will learn by themselves with the resources provided, and the online meeting time will be used to discuss questions about the course content and assignments. The instructor will provide the learning resources, including instructions for reading materials, slides, and video recording of lectures to assist students in learning. Students will learn by themselves at their own pace. The online meeting hours will be on Monday from 4:00pm-6:45pm (CST); Zoom at <https://unt.zoom.us/j/86041040482> or, you will receive a Zoom link invitation via email. Students are welcome to join the meeting with pass code INFO5709, ask questions, and discuss with their classmates about learning. Students could also request meeting at other times by making an appointment with the instructor through email. The students are expected to complete required quizzes and labs each week and a final course project at the end of the semester. The proposed strategy will gradually build up students' understanding and improve their progress.

Notes

1. The course takes the form of remote learning. Students will meet 1 time a week, every time for approximately 3 hours to solve questions in learning. Students will learn by themselves at their own pace by reading textbooks, slides, watching videos of lectures, and completing required assignments. The class consists of two parts. In the first part lectures will be taught. In the second part, public data sets, Tableau tutorial and D3.js tutorial will be covered. D3.js will be optional content for students who are interested in applying visualization in web front-end development. Software tools such as Tableau will be needed to complete the assignments. Text editor such as Sublime, Visual Studio Code and Web Browser such as Chrome is needed for D3.js practice. Python, R or other tools are optional and encouraged.
2. Course materials, assignments, projects, and papers will be available from the course site on Canvas, and students will submit all assignments through the tools available on Canvas.
3. Lab assignments will be given every class on how to use tools in Tableau. Each lab is due one week after the lab is assigned. The students are expected to follow the instructions of each lab assignment and make progress.

We will use **Canvas Discussions as an online forum** that you can use to ask/answer questions, get clarifications, point out my mistakes, etc. Be sure to check it regularly.

Here is my suggested general **strategy for working on assignments**:

- Start early – don't wait. That will give you time to work through the problems and get help as needed.
- When you run into a problem, try to solve the problem by yourself. You can also search online for solutions to technical questions, however search answers to assignment questions or sharing assignments online to get help is cheating.
- You are encouraged to post the problem and how you learn to solve it on discussion board. You will get bonus points for actively participating in sharing information.
- You are welcome to post your question on the discussion board. I will be monitoring and will respond as soon as I am able, usually within a day (longer during weekends, etc.).

TECHNICAL SUPPORT AND ASSISTANCE

The UNT University Information Technology provides student IT services and technical support, including Canvas. UNT uit Homepage: <https://it.unt.edu/uit>

- Email: helpdesk@unt.edu
- Phone: 940.565-2324

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

At the undergraduate level course, students are expected to have the following technology skills to fully participate in online learning. 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 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.

Minimum Technical Skills Needed

Students should be able to use the learning management system – Canvas to access course related materials and resource, keep up with emails regularly, create, modify or submit files according to instructors direction, such as proper file format, be able to download and install software when needed, and utilize the basics of the Microsoft Suite (Word, Excel, Power Point).

Success in the Online Course

Since there are lots of students attending the class, they are expected to turn off their audio during the meeting time to prevent noise spreading. Students can communicate with classmates and the instructor by both audio and chat. The instructor broadcasts the information using announcement via Canvas and students are informed through their UNT email. So, students are expected to check their emails at least once a day. They also should monitor their grades every single week and track their academic progress regularly. In cases of missed grades, students should contact the instructor within 7 days.

Student Academic Support Services

- Code of Student Conduct: provides Code of Student Conduct along with other useful links
- Office of Disability Access: exists to prevent discrimination based on disability and to help students reach a higher level of independence
- Counseling and Testing Services provides counseling services to the UNT community, as well as testing services, such as admissions testing, computer-based testing, career testing, and other tests
- UNT Libraries
- UNT Learning Center provides a variety of services, including tutoring, to enhance student academic experience
- UNT Writing Center offers free writing tutoring to all UNT students, undergraduate and graduate, including online tutoring
- Succeed at UNT: information regarding how to be a successful student at UNT

ASSESSMENT & GRADING

Assessments

A student's grade is composed of the following:

- Participation in online class participation and discussion (10%)
- Knowledge assessment (20%)
- Practical assignment (40%)
- Final project paper and presentation (40%)

Grading

Participation in online class and discussion (10%).

Students are required to participate in **online discussions**, either posting questions or contributing ideas to solve questions.

Knowledge assessment (20%).

Students are required to complete 12 quizzes based on course content. The quizzes are designed to test whether students have read textbooks and watched lectures in time, and whether they have grasped the knowledge covered in the lectures. There are extra points. A few mistakes in quizzes are allowed.

Practical assignment (40%).

The class will have **10 lab assignments**. The assignments are designed to help students understand important concepts, methods to work with different types of data and gain hands-on experience of using Tableau or other tools for data manipulation and visualization.

Final project paper and presentation (30%)

At the end of this semester, students are required to work on a data visualization project independently, write a paper on the project and record a video presentation for the project.

Total Points Possible for Semester/Grading Scale = 1000

1000-900 = A	899-800 = B
799-700 = C	699-600 = D
599 and below = F	

Grading Table

Assignment	Points Possible	Percentage of Final Grade
Online Discussion <ul style="list-style-type: none">10 discussion questions @ 10 points ea.	100 points	10%
Knowledge Assessment <ul style="list-style-type: none">12 quizzes @ 18 points ea.	200 points	20%
Practical Assignment	400 points	40%

<ul style="list-style-type: none">10 labs @ 40 points ea.		
Final Project	300 points	30%

<ul style="list-style-type: none"> • Project paper @ 200 points • Project presentation @ 100 points 		
Total Points	1000 points	100%

Note: bonus points will add to total points until total points reach 1000.

Final Examination:

The final grade is calculated based on grade points of online discussions, assignments, labs, quizzes, and term project. NO final exam is given this time.

COURSE CALENDAR

The contents of the course are organized into 13 weeks. Please refer to Table 1 for lessons, topics. Table 2 lists the preliminary schedule. It **will be updated** according to progress – do not depend on this version for assignment due dates, instead refer to the assignment due dates on canvas.

Table 1. Lessons and Readings

Lesson 1	Introduction
Lesson 2	Graphical Excellence
Lesson 3	Graphical Integrity
Lesson 4	Fundamentals
Lesson 5	Data and Image Models 1
Lesson 6	Data and Image Models 2
Lesson 7	Exploratory Data Analysis
Lesson 8	Spatial Layout
Lesson 9	Text
Lesson 10	Time
Lesson 11	Multidimension and Graphs
Lesson 12	User Interaction and Collaboration
Lesson 13	Evaluation
Lesson 14	AI for Data Visualization
Lesson 15	Case Study

Lesson Related Materials

Lesson 1:

- Download Tableau: <https://www.tableau.com/academic/students> Register with your student email (end with unt.edu), you will get one year free trial.
- Steven Johnson, [How the Ghost Map Helped End a Killer Disease](#) at TedSalon2006, 2006.
- Matejka, Justin, and George Fitzmaurice. Same stats, different graphs: generating datasets with varied appearance and identical statistics through simulated annealing. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems. ACM, 2017.
- Hans Rosling, [Let my Dataset Change your Mindset](#) at TED@State, 2009.
- Laramee, Robert S, How to read a visualization research paper: Extracting the essentials. Computer Graphics and Applications, IEEE 31.3 (2011): 78-82.
- Segel, Edward, and Jeffrey Heer. Narrative visualization: Telling stories with data." IEEE transactions on visualization and computer graphics 16.6 (2010): 1139-1148.

Lesson 2 & 3:

- Tufte, E. R. (2001). The visual display of quantitative information (Vol. 2). Cheshire, CT: Graphics press. ISBN: 9780961392147

Lesson 4 - 9:

- Cynthia Brewer, [ColorBrewer: Color Advice for Maps](#)
- David Borland and Russell M. Taylor II, Rainbow Color Map (Still) Considered Harmful, CG & A, March/April 2007 (vol. 27 no. 2), pp. 14-17
- Munzner, T. (2014). Visualization Analysis and Design. A K Peters Visualization Series, CRC Press.

Lesson 10:

- YH Fua, MO Ward, and IA Rundensteiner (1999), Hierarchical Parallel Coordinates for Exploration of Large Datasets, Proceedings of IEEE Visualization '99, pp. 43-50.
- Stolte, C., Tang, D., and Hanrahan, P., Polaris: a system for query, analysis, and visualization of multidimensional databases, Commun. ACM 51, 11 (Nov. 2008), 75-84.
- Mark A. Livingston, Jonathan W. Decker, Evaluation of Trend Localization with Multi-Variate Visualizations. IEEE Trans. Vis. Comput. Graph. 17(12): 2053-2062 (2011)

Lesson 11:

- Andy Cockburn, Amy Karlson, and Benjamin B. Bederson. A review of overview+detail, zooming, and focus+context interfaces. ACM Computing Surveys 41(1), pp. , 2008.
- Jack J. van Wijk and Wim A.A. Nuij, Smooth and Efficient Zooming and Panning, Proc. InfoVis 2003, p. 15-22
- Beth Yost and Chris North (2006), The Perceptual Scalability of Visualization, IEEE Transactions on Visualization and Computer Graphics, vol. 12, no. 5, pp. 837-844.
- Jonathan C. Roberts. On Encouraging Multiple Views for Visualization. In IEEE Information Visualization, pages 8-14, July 1998.

Lesson 12:

- Robert Kosara, Christopher G. Healey, Victoria Interrante, David H. Laidlaw, and Colin Ware. User Studies: Why, How, and When?. IEEE Comput. Graph. Appl. 23, 4 (July 2003), 20-25.
- Ben Shneiderman, Catherine Plaisant, Strategies for evaluating information visualization tools: multi-dimensional in-depth long-term case studies, BELIV '06 Proceedings of the 2006 AVI workshop on BEyond time and errors: novel evaluation methods for information visualization.
- Tory, M., Moeller T. Evaluating Visualizations: Do Expert Reviews Work? IEEE Computer Graphics and Applications, 25(5), 2005, 8-11.
- Heidi Lam, Enrico Bertini, Petra Isenberg, Catherine Plaisant, Sheelagh Carpendale, Empirical Studies in Information Visualization: Seven Scenarios, TVCG, December 2011

Lesson 14: AI for Data Visualization

- AI + Visualization: Key players — Tableau Pulse, ChartGPT, VizGPT, Dataiku, Power BI Copilot.
- How AI is transforming dashboard and graph creation.
- Tool demos: Auto-generation of visualizations using simple prompts.
- Class discussion: Pros and cons of AI-assisted design.

Lesson 15: Creating Visualizations with Tableau AI and Power BI

- Introduction to Tableau AI and Power BI, Differences from Python-based tools
- Importing data, basic chart types, and building dashboards
- Creating interactive visualizations and sharing insights
- Prompt engineering basics for visualization: how to ask AI properly.
- Common formats: bar charts, scatter plots, pie charts, network graphs.
- Practical: Create a basic interactive dashboard in Tableau or Power BI and compare with Python-based visualizations.
- Group activity: Generating advanced and complex visuals (e.g. graphs, charts) from sample datasets (CSV, JSON) using AI (e.g., VizGPT).

Study Schedule and Due Dates

(Assignments and in-class practice will be due at **midnight** of the specified week/day. Term project final report will be due on **Dec 10 midnight**)

Table 2. Study Schedule and Due Dates for Quizzes/ Labs

Week	Date	Metting Date	Lesson	Assignments
1	Aug 18 – Aug 22	Aug 18	Introduction Online	
2	Aug 25 – Aug 29	Aug 27	Lesson 1, Lab 1	Discussion
3	Sep 01 – Sep 05	Sept 01	Lesson 2, Lab 2	Discussion
4	Sep 08 – Sep 12	Sept 08	Lesson 3, Lab 3	Discussion
5	Sep 15 – Sept 19	Sept 15	Lesson 4, Lab 4	Lab1,2,3 & Quiz1,2,3 /Sept 15
6	Sep 22 – Sep 26	Sept 22	Lesson 4, Lab 5	Discussion
7	Sep 29 – Oct 02	Sept 29	Lesson 5	Discussion
8	Oct 06 – Oct 10	Oct 06	Lesson 6, Lab 6	Lab 4,5,6 & Quiz4,5,6 /Oct 06
9	Oct 13 – Oct 17	Oct 13	Lesson 7, Lab 7	Discussion
10	Oct 20 – Oct 24	Oct 20	Lesson 8, Lab 8	Discussion
11	Oct 27 – Oct 31	Oct 27	Lesson 9, Lab 9	Lab7,8,9 & Quiz7,8,9 / Oct 27
12	Nov 03 – Nov 07	Nov 03	Lesson 10, Lab 10	Discussion
13	Nov 10 – Nov 14	Nov 10	Lesson 11	Discussion
14	Nov 17 – Nov 21	Nov 17	Lesson 12	Discussion
15	Nov 24 - Nov 28	Nov 24	Thanksgiving Break	Lab 10, 11 & Quiz10,11,12/Nov 24
16	Dec 01 - Dec 05	Dec 01	Project	Final Project Paper and Deliverables Due on Dec 10 Midnight

COURSE EVALUATION

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. 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 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.

COURSE POLICIES

Assignment Policy

Students should submit the assignments and term project reports at class site in canvas.unt.edu.

Late Work and Missed Work

Students are expected to submit assignments and projects on time. **The due dates are Mondays 11:59pm of the week specified in Table 2.** If an extenuating circumstance such as a medically diagnosed illness or family emergency arises, which prevents you from submitting your assignments, you should contact the instructor and the TA as soon as possible before the due date. Late work without the permission of the instructor will receive a grade with a 10% penalty (or 10 points out of 100) per day after the due date. A student who is having trouble with assignments is strongly encouraged to contact the instructor and the TA as early as possible for personal advising.

Grade Dispute

Your grade is determined by your performance on the learning assessments and is assigned individually (not curved). All assessment scores will be posted on the course page. If you would like to review any of your grades, or have questions about how something was scored, please email me to schedule a time for us to meet online. Any grade disputes must be submitted in writing and within one week of receiving the grade.

Instructor Responsibilities and Feedback

- Helping students grow and learn
- Providing clear instructions for projects and assessments
- Answering questions about assignments
- Identifying additional resources as necessary
- Providing grading rubrics
- Reviewing and updating course content
- The instructor and TA will respond to students' emails and questions posted to the discussion boards within two days except for the weekends
- Assignments, grades and feedback will be returned to the students within one week after the submission deadline.

Course Incomplete Grade

The UNT Graduate Catalog (<http://catalog.unt.edu/index.php?catoid=16>) describes and explains grading policies. A grade of Incomplete (I) will be given only for a justifiable reason and only if the student is passing the course. The student is responsible for meeting with the instructor to request an incomplete and discuss requirements for completing the course. If an incomplete is not removed within the time frame agreed to by instructor and student, the instructor may assign a grade of F.

Withdrawal

The UNT Graduate Catalog (<http://catalog.unt.edu/index.php?catoid=16>) describes and explains withdrawal policies and deadlines. The UNT semester course schedule lists specific deadlines regarding withdrawal. A grade of Withdraw (W) or Withdraw-Failing (WF) will be given depending on a student's attendance record and grade earned. Please note that a student who simply stops attending class and does not file a withdrawal form may receive an F.

Attendance Policy

Attendance is not required for each class meeting. Prior to the meeting, please prepare your questions to discuss. Please be muted when you join the meeting first, then unmute yourself when you need to ask questions or talk.

Students' Responsibility for Their Learning

The students are required to follow course schedule and finish the class work, assignments, and term projects. Students are expected to study at least 15 hours per week to achieve satisfactory class performance.

UNT POLICIES

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.

ADA Policy

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodation at any time; however, ODA notices of 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 accommodation for every semester and must meet with each faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

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.

Retention of Student Records

Student records pertaining to this course are maintained in a secure location by the instructor of record. All records such as exams, answer sheets (with keys), and written papers submitted during the duration of the course are kept for at least one calendar year after course completion. Course work completed via the Blackboard online system, including grading information and comments, is also stored in a safe electronic environment for one year. Students have the right to view their individual record; however, information about student's records will not be divulged to other individuals without proper written consent. Students are encouraged to review the Public Information Policy and the Family Educational Rights and Privacy Act (FERPA) laws and the University's policy. See UNT Policy 10.10, Records Management and Retention for additional information.

Acceptable Student Behavior

Student behavior that interferes with an instructor's 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 Dean of Students 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 student's Eagle Connect account. For more information, please visit the website that explains Eagle Connect and how to forward e-mail: eagleconnect.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 based on 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. UNT's Survivor Advocates can assist a student who has been impacted by violence by filing protective orders, completing crime victim's 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.

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 student's permission unless all 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 the above criteria, then the University office or department using the work must obtain the student's written permission.