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/23989

Textbooks:

Required Technology:
Laptop - We will do programming exercises during most classes. Any reasonably current operating system can be used.
TEACHING PHILOSOPHY

This course will be taught online with lectures through Zoom platform. The instructor will share a URL with students to attend the class along with Lecture and lab assignment associated with each session. The students will be asked to take an online quiz during each session, which also will be counted as their attendance. The students are expected to follow the instructor throughout the sessions and study carefully the lecture and lab of the preceding week to make a progress. The proposed strategy will gradually build up students’ understanding and improves their progress.

Notes

1. The course takes the form of an online class that meets weekly for approximately 3 hours. The class consists of two parts. In the first part lectures will be taught via Zoom platform. In the second part Tableau tutorial and public data sets will be covered. Software tools such as Tableau and Microsoft Excel will be needed to complete the assignments. Python, R or other tools such as D3 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. The course also employs lecture capture technology to record class sessions. The lecture recordings will be available to students for study purposes and may also be reused in future course offerings.

3. Lab assignments will be given every single week 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 provide snapshots of the results and a brief discussion.

4. During each class (except Week 1), students will take an online quiz covering material from the preceding. The quiz will consist of 3 questions covering lecture and Tableau tutorial. Each quiz is due one week after it becomes published.

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, first trying to solve the problem by yourself. You can also search Q&A sites (e.g. StackOverflow) 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 participate in sharing information.

- You are welcome to post your question in discussion board. I will be monitoring and will respond as soon as I am able, usually within a day (longer during weekends, travel, etc.).
TECHNICAL SUPPORT AND ASSISTANCE

The UNT University Information Technology provides student IT services and technical support, including Canvas.

- UIT Homepage: https://it.unt.edu/uit
- Email: helpdesk@unt.edu
- Phone: 940.565-2324
- In Person: Sage Hall, Room 330

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 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.

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 class 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 the 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 discussion (5%)
- Knowledge assessment (10%)
- Practical assignment (30%)
- Literature review and presentation (20%)
- Final project paper and presentation (35%)

Grading

Participation in online discussion (5%).
Students are required to participate at least 5 times in online discussions, either post questions or contribute to ideas to solve questions. Active and constructive participations may lead to bonus points.

Knowledge assessment (10%).
Students are required to complete 14 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 (30%).
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.

Literature review and presentation (20%)
Students are required to pick at least one peer-reviewed publication on data visualization, write a literature review and make a 10-minutes presentation introducing the paper. Starting from the third week, in each weekly meeting after the first part lecture, we will schedule 3 students to present their literature review. Every student has to present at least once before the end of the semester.

Final project paper and presentation (35%)
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

<table>
<thead>
<tr>
<th>Points Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-900</td>
<td>A</td>
</tr>
<tr>
<td>899-800</td>
<td>B</td>
</tr>
<tr>
<td>799-700</td>
<td>C</td>
</tr>
<tr>
<td>699-600</td>
<td>D</td>
</tr>
<tr>
<td>599 and below</td>
<td>F</td>
</tr>
</tbody>
</table>
**Grading Table**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points Possible</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online Discussion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 5 discussion questions @ 10 points ea.</td>
<td>50 points</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Online Discussion Bonus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Max 30 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 14 quizzes @ 9 points ea.</td>
<td>100 points</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Practical Assignment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 10 labs @ 30 points ea.</td>
<td>300 points</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Literature Review</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Literature review paper @ 100 points</td>
<td>200 points</td>
<td>20%</td>
</tr>
<tr>
<td>• Literature review presentation @ 100 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Final Project</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Project paper @ 200 points</td>
<td>350 points</td>
<td>35%</td>
</tr>
<tr>
<td>• Project presentation @ 150 points</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assignment and Project Bonus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Max 70 points</td>
<td>70 points</td>
<td></td>
</tr>
<tr>
<td><strong>Total Points</strong></td>
<td>1000 points</td>
<td>100%</td>
</tr>
</tbody>
</table>

*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 paper. NO final exam is given this time.
COURSE CALENDAR

The contents of the course are organized into 17 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.

### Table 1. Lessons and Readings

<table>
<thead>
<tr>
<th>Lessons</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>Introduction</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>Fundamentals</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>Data and Image Models 1</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>Data and Image Models 2</td>
</tr>
<tr>
<td>Lesson 5</td>
<td>Exploratory Data Analysis</td>
</tr>
<tr>
<td>Lesson 6</td>
<td>Spatial Layout</td>
</tr>
<tr>
<td>Lesson 7</td>
<td>Text and Time</td>
</tr>
<tr>
<td>Lesson 8</td>
<td>Multidimension and Graphs</td>
</tr>
<tr>
<td>Lesson 9</td>
<td>Graphical Excellence</td>
</tr>
<tr>
<td>Lesson 10</td>
<td>Graphical Integrity</td>
</tr>
<tr>
<td>Lesson 11</td>
<td>User Interaction and Collaboration</td>
</tr>
<tr>
<td>Lesson 12</td>
<td>Evaluation</td>
</tr>
</tbody>
</table>

### Lesson Related Materials

#### Lesson 1:
- Download Tableau: [https://www.tableau.com/academic/students](https://www.tableau.com/academic/students) Register with your student email (end with unt.edu), you will get one year free trial.

#### Lesson 2:
- Cynthia Brewer, *ColorBewer: Color Advice for Maps*

#### Lesson 3:
Lesson 11:

Lesson 12:
- Heidi Lam, Enrico Bertini, Petra Isenberg, Catherine Plaisant, Sheelagh Carpendale, Empirical Studies in Information Visualization: Seven Scenarios, TVCG, December 2011

Study Schedule and Due Dates

(Assignments and in-class practice will due on Monday midnight of the specified week. Term project final report will due on May 8 midnight)

Table 2. Study Schedule and Due Dates

<table>
<thead>
<tr>
<th>Academic Week</th>
<th>Dates</th>
<th>Meeting Date</th>
<th>Study Focus</th>
<th>Quizzes/Assignment/Project Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>January 13 - 19</td>
<td>Jan 15</td>
<td>Lesson 1, Lab 1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>January 20 - 26</td>
<td>Jan 22</td>
<td>Lesson 2, Lab 2</td>
<td>Quiz1</td>
</tr>
<tr>
<td>3</td>
<td>January 27 - February 2</td>
<td>Jan 29</td>
<td>Lesson 3, Lab 3</td>
<td>Lab1 – Quiz2</td>
</tr>
<tr>
<td>4</td>
<td>February 3 - 9</td>
<td>Feb 5</td>
<td>Lesson 4, Lab 4</td>
<td>Lab2 – Quiz3</td>
</tr>
<tr>
<td>5</td>
<td>February 10 - 16</td>
<td>Feb 12</td>
<td>Lesson 5, Lab 5</td>
<td>Lab3 – Quiz4</td>
</tr>
<tr>
<td>6</td>
<td>February 17 - 23</td>
<td>Feb 19</td>
<td>Review</td>
<td>Lab4 – Quiz5</td>
</tr>
<tr>
<td>7</td>
<td>February 24 - March 1</td>
<td>Feb 26</td>
<td>Lesson 6, Lab 6</td>
<td>Quiz6</td>
</tr>
<tr>
<td>8</td>
<td>March 2 - 8</td>
<td>Mar 4</td>
<td>Lesson 7, Lab 7</td>
<td>Lab5 – Quiz7</td>
</tr>
<tr>
<td>9</td>
<td>March 9 - 15</td>
<td>No Meeting</td>
<td>Spring Break</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>March 16 - 22</td>
<td>Mar 18</td>
<td>Lesson 8, Lab 8</td>
<td>Lab6 – Quiz8</td>
</tr>
<tr>
<td>11</td>
<td>March 23 - 29</td>
<td>No Meeting</td>
<td>Conference Travel</td>
<td>Lab7 – Quiz9</td>
</tr>
<tr>
<td>12</td>
<td>March 30 – April 5</td>
<td>Apr 1</td>
<td>Lesson 9, Lab 9</td>
<td>Lab8 – Quiz10</td>
</tr>
<tr>
<td>13</td>
<td>April 6 - 12</td>
<td>Apr 8</td>
<td>Lesson 10, Lab 10</td>
<td>Lab9 – Quiz11</td>
</tr>
<tr>
<td>14</td>
<td>April 13 - 19</td>
<td>Apr 15</td>
<td>Lesson 11</td>
<td>Lab10 – Quiz12</td>
</tr>
<tr>
<td>15</td>
<td>April 20 - 26</td>
<td>Apr 22</td>
<td>Lesson 12</td>
<td>Quiz13</td>
</tr>
<tr>
<td>16</td>
<td>April 27 - May 3</td>
<td>Apr 29</td>
<td></td>
<td>Quiz14</td>
</tr>
<tr>
<td>17</td>
<td>May 4 - 8</td>
<td>No Meeting</td>
<td>Finals, Work on the Final Project</td>
<td>Final Project Paper and Deliverables Due at May 8 Midnight</td>
</tr>
</tbody>
</table>
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. The survey will be made available during weeks 13, 14 and 15 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.

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 in my office. 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 feedbacks 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

It is mandatory for students to attend each class meetings. Prior to the meeting, please preview the readings and install required R packages. You may take much longer time to work on in-class submissions or lose points in the submissions if you don't attend class.

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 12-15 hours per week to achieve satisfactory class performance. Students do not have programming experience are required to find extra materials to study.

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 accommodations 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 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. 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 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 student’s written permission.