

COURSE SYLLABUS
CISC 672: DATA VISUALIZATION

Summer 2024: May 6 – June 30

Instructor

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Course Description

Information visualization focuses on visualization techniques to help people understand, analyze, and make decisions based on data. This course will examine principles and techniques for developing effective visualizations, and provide experience in manipulating data and producing visualizations using Python and the Python libraries pandas, numpy, and plotly.

Textbooks

Recommended: McKinney, W, *Python for Data Analysis (3rd edition)*, O'Reilly Media, 2022.
Recommended: Munzner, T, *Visualization Analysis and Design*, A. K. Peters, 2014.

Software

We will use the Python environments IPython and Jupyter notebooks, and libraries including numpy, pandas, and plotly. All necessary software is public domain and available at no charge. We'll discuss software during our first session.

Learning Outcomes

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

- Understand and apply principles of information visualization.
- Develop skills in evaluating different visualizations techniques.
- Use Python and key libraries to extract, process, and visualize data.

Course Content

- Introduction to visualization: definitions, uses, and examples
- Characteristics of data
- Visual perception and encoding principles
- Techniques and practices
 - Tables and graphs
 - Trees and networks
 - Spatial data
 - Multivariate data
- Practice
 - IPython and Jupyter notebooks
 - Data manipulation using Python, numpy, and pandas
 - Visualization using plotly

Instruction Methods and Tools

- *Assignments:* There will be a total of four assignments. The first three assignments will take the form of IPython Jupyter notebooks which you will complete. The fourth assignment will be to develop a visualization project of your own choosing. Projects will be presented during the last week of the term. The schedule of assignments as well as the assignments themselves appear in the *Assignments* section of our course site.
- *Submission:* Homework assignments and projects should be submitted through our Canvas course site. Any additional submission instructions will be supplied with each assignment. Since you will have several weeks to complete each assignment, late assignments will not be accepted. However, partial credit will be given for partial submissions.
- *Modules:* A module comprising Jupyter notebooks, slides, and/or reading assignment, will be opened every week.
- *Discussion board:* We will use our discussion board to discuss course content and assignments, and to pose and answer questions. I will set up forums within the discussion board and participate actively. Students are welcome to create new forums and are expected to participate actively on the discussion board.
- *Synchronous sessions:* We will hold one Zoom session a week throughout the course. See the course *Announcements* for the schedule. Sessions will be used for presentation and discussion of course material and assignments. If you have questions or discussion points,

this is a good opportunity to raise them. Attendance is encouraged but not required, and sessions will be recorded and posted for playback.

- *Email:* You may email me throughout the term with any questions or comments. If they are of a general nature of potential interest to other students, your remarks probably belong on our discussion board. But if they apply only to your particular circumstances, it may be better for us to correspond directly via email.

Examinations and Quizzes

There will be no exams or quizzes in this course.

Grading Criteria

Grades will be determined as follows:

- 20% for each of the three homework assignments
- 10% for the final project proposal
- 30% for the final project
- Project presentation (held last week of class) are optional

Scores, which are represented as floating-point numbers, round up to the higher letter grade when they fall exactly on a threshold (e.g., 93.0 maps to A whereas 92.99 maps to A-). Students may not do additional work or redo previous work to raise a grade.

A	93–100
A-	90–93
B+	87–90
B	83–87
B-	80–83
C+	77–80
C	73–77
C-	70–73
D+	67–70
D	60–67
F	< 60

Bibliography

- Beazley, D, and B. Jones, *Python Cookbook (3rd edition)*, O'Reilly Media, 2013.
- Beazley, D, *Python Distilled*, Addison Wesley Professional, 2021.
- Börner, K, *Atlas of Knowledge: Anyone Can Map*, MIT Press, 2015.
- Cairo, A, *The Functional Art: An Introduction to Information Graphics and Visualization*, New Riders, 2012.
- Cairo, A, *The Truthful Art: Data, Charts, and Maps for Communication*, New Riders, 2016.
- Few, S, *Now You See It: Simple Visualization Techniques for Quantitative Analysis*, Analytics Press, 2009.
- Few, S, *Show Me the Numbers: Designing Tables and Graphs to Enlighten (2nd edition)*, Analytics Press, 2012.
- Katz, J, *Designing Information: Human Factors and Common Sense in Information Design*, Wiley, 2012.
- McKinney, W, *Python for Data Analysis (3rd edition)*, O'Reilly Media, 2022.
- Munzner, T, *Visualization Design and Analysis: Principles, Techniques, and Practice*, A K Peters, 2014.
- Steele, J, and N. Iliinsky (eds), *Beautiful Visualization: Looking at Data through the Eyes of Experts*, O'Reilly Media, 2010.
- Tufte, E, *The Visual Display of Quantitative Information (2nd edition)*, Graphics Press, 2001.
- VanderPlas, J., *Data Science Handbook*, O'Reilly Media, 2016.
- Ware, C, *Visual Thinking for Information Design (2nd edition)*, Morgan Kaufmann, 2021.
- Wilke, C, *Fundamentals of Data Visualization*, O'Reilly Media, 2019.

College and University Policies and Procedures:

Students must comply with the policies published in the college's *Graduate Catalog* and the *NSU Student Handbook*, some of which are included or referenced below. The catalog is at <http://cec.nova.edu/about/catalogs.html>

The handbook is at

<https://www.nova.edu/publications/ustudenthandbook/>

1. Standards of Academic Integrity For the university-wide policy on academic standards, see the section Code of Student Conduct and Academic Responsibility in the NSU Student Handbook. Also see the section Student Misconduct in the Graduate Catalog.

Each student is responsible for maintaining academic integrity and intellectual honesty in his or her academic work. It is the policy of the college that each student must:

- Submit his or her own work, not that of another person
- Not falsify data or records (including admission materials and academic work)
- Not engage in cheating (e.g., giving or receiving help during examinations; acquiring and/or transmitting test questions prior to an examination; or using unauthorized materials, such as notes, during an examination)
- Not receive or give aid on assigned work that requires independent effort
- Properly credit the words or ideas of others according to accepted standards for professional publications (see the next section Crediting Words or Ideas)
- Not use or consult paper writing services, software coding services, or similar services for the purpose of obtaining assistance in the preparation of materials to be submitted for course assignments or for theses or dissertations.
- Not commit plagiarism (Merriam-Webster's Collegiate Dictionary (2004) defines plagiarism as "stealing or passing off ideas or words of another as one's own" and "the use of a created production without crediting the source.") (see Crediting Words or Ideas below)

Crediting Words or Ideas

When using the exact words from another work, quotation marks must be used for short quotations (fewer than 40 words), and block quotation style must be used for longer quotations. In either case, a proper citation must also be provided. Publication Manual of the American

Psychological Association, Sixth Edition, contains standards and examples on quotation methods.

When paraphrasing (summarizing, or rewriting) the words or ideas from another work, a proper citation must be provided. Publication Manual of the American Psychological Association, Sixth Edition contains standards and examples on citation methods. The New Shorter Oxford English Dictionary (1993) defines paraphrase as “An expression in other words, usually fuller and clearer, of the sense of a written or spoken passage or text...Express the meaning (of a word, phrase, passage, or work) in other words, usually with the object of clarification...”. Changing word order, deleting words, or substituting synonyms is not acceptable paraphrasing—it is plagiarism, even when properly cited. Rather than make changes of this nature, the source should be quoted as written.

Original Work

Assignments, exams, projects, papers, theses, dissertations, etc., must be the original work of the student. Original work may include the thoughts and words of others, but such thoughts or words must be identified using quotation marks or indentation and must properly identify the source (see the previous section Crediting Words or Ideas). At all times, students are expected to comply with the college’s accepted citation practice and policy. The college and its faculty are committed to maintaining high standards of academic integrity. Student work will be routinely submitted to plagiarism detection tools (such as those at www.turnitin.com) for review.

Work is not original when it has been submitted previously by the author or by anyone else for academic credit. Work is not original when it has been copied or partially copied from any other source, including another student, unless such copying is acknowledged by the person submitting the work for the credit at the time the work is being submitted, or unless copying, sharing, or joint authorship is an express part of the assignment. Exams and tests are original work when no unauthorized aid is given, received, or used before or during the course of the examination, reexamination, and/or remediation.

2. Writing Skills

Students must demonstrate proficiency in the use of the English language. Grammatical errors, spelling errors, and writing that fails to express ideas clearly will affect their grades and the completion of their academic programs. The faculty will not provide remedial help concerning grammatical errors or other writing difficulties. It is the student’s responsibility to proofread and edit his or her work, which, in both form and content, should be letter-perfect. Work that is not properly edited will be rejected.

3. Disabilities and ADA

NSU complies with the American with Disabilities Act (ADA). The university’s detailed policy on disabilities is contained in the NSU Student Handbook. Student requests for accommodation based on ADA will be considered on an individual basis. Students with disabilities should

discuss their needs with NSU's ADA Coordinator before the commencement of classes if possible.

4. Communication by Email

Students must use their NSU email accounts when sending email to faculty and staff and must clearly identify their names and other appropriate information, e.g., course or program. When communicating with students via email, faculty and staff members will send mail only to NSU email accounts using NSU-recognized usernames. Students who forward their NSU-generated email to other email accounts do so at their own risk. CEC uses various course management tools that use private internal email systems. Students enrolled in courses using these tools should check both the private internal email system and NSU's regular email system. NSU offers students web-based email access. Students are encouraged to check their NSU email account and their course management email daily.

5. The Temporary Grade of Incomplete (I)

The temporary grade of Incomplete (I) will be granted only in cases of extreme hardship. Students do not have a right to an incomplete, which may be granted only when there is evidence of just cause. A student desiring an incomplete must submit a written appeal to the course professor at least two weeks prior to the end of the term. In the appeal, the student must: (1) provide a rationale; (2) demonstrate that he/she has been making a sincere effort to complete the assignments during the term; and (3) explain how all the possibilities to complete the assignments on time have been exhausted. Should the course professor agree, an incomplete contract will be prepared by the student and signed by both student and professor. The incomplete contract must contain a description of the work to be completed and a timetable. The completion period should be the shortest possible. The completion date will not typically extend beyond 30 days from the last day of the term for master's courses or beyond 60 days from the last day of the term for doctoral courses. The incomplete contract will accompany the submission of the professor's final grade roster to the program office. The program office will monitor each incomplete contract. When the incomplete contract ends the course professor will assign a grade based upon the work completed. No student may graduate with an I on his or her record.

6. Grade Policy Regarding Withdrawals

Course withdrawal requests must be submitted to the program office in writing by the student. Requests for withdrawal must be received by the program office by the withdrawal deadline (see dates in the academic calendar in the catalog and program brochures or websites). Withdrawals sent by email must be sent from the student's assigned NSU email account. Requests for withdrawal received after 11:59 p.m. on the withdrawal deadline date will not be accepted. Failure to attend class or participate in course activities will not automatically drop or withdraw a student from the class or the university. Students who have not withdrawn by the withdrawal deadline will receive letter grades that reflect their performance in the course. When a withdrawal request is approved, the transcript will show a grade of W (*Withdrawn*) for the course. *Students with four withdrawals will be dismissed from the program.* Depending on the

date of withdrawal, the student may be eligible for a partial refund (see the appropriate catalog section Refund Policy Regarding Withdrawals).

7. Acceptable Use of Computing Resources

Students must comply with the university's *Policy on Acceptable Use of Computing Resources* (see *NSU Student Handbook*).

8. Academic Progress, Grade Requirements, and Academic Standing

Students must be familiar with the college's policies, which are contained in its catalog.

9. Student Research Involving Human Subjects

Students must be familiar with the university's policy (see paragraph in catalog).

10. Responsibility for Payment of Tuition and Fees

Once registered, students are personally responsible for the payment of their tuition and fees. Returned checks, cancelled credit cards, employer or agency refusal to pay, ineligibility for financial aid, and other reasons for non-payment may result in a direct bill to the student, and/or referral to a collection agency.

Payment and refund policies are based on the view that a student registering for a class is reserving a place in that class and that tuition and fees cover the opportunity to secure that place in the class. Since no other person can purchase that place, the student is responsible for the tuition and fees associated with it. Simply not attending does not constitute a reason for non-payment.