# DATS 2102: Data Visualization for Data Science

**Instructor**: Junjun Yin
**Email**: j.yin@gwu.edu
**Semester**: Spring 2026
**Dates**: 01/13/26 – 04/27/26
**Class Time**: Tuesday & Thursday, 02:20 pm – 03:35 pm
**Location**: 212 Elliott School of International Affairs, 1957 E Street NW
**Office Hours**: Wednesday, 11:00 am – 12:30 pm (or by appointment)
**Office Location**: 2036 H St NW, Room 309

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## Course Description

This course introduces students to the core principles and practices of data visualization within the context of data science. Students will learn how to collect, process, analyze, and communicate data-driven insights using effective and ethical visualization techniques. Emphasis will be placed on hands-on programming with Python's visualization ecosystem (pandas, matplotlib, seaborn, plotly, altair, geopandas) and applying best practices for clarity, accuracy, and storytelling. The course will cover visualization theory, design principles, and practical skills, including geographic data mapping and visualizing results from machine learning models. By the end of the semester, students will be able to produce high-quality visualizations that effectively communicate data insights to diverse audiences.

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## Course Prerequisites

DATS 1001 and STAT 1051/1053/1111/1127, or permission of the instructor.

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## Learning Outcomes

As a result of completing this course, students will be able to: 1. Process and tidy real-world data using pandas. 2. Apply visual perception and design principles to create truthful, clear graphics. 3. Visualize univariate, bivariate, and multivariate patterns; compare groups effectively. 4. Map and analyze geographic data using geopandas, contextily, and folium/plotly. 5. Visualize relationships and communicate model context and uncertainty. 6. Build interactive, annotated visuals and simple data stories/dashboards. 7. Apply visualization to ML & NLP tasks (feature importance, confusion matrices/ROC, word clouds, BERTopic topic maps, embedding plots).

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## Course Workload

This is a 3-credit course. Students are expected to engage in 2.5 hours of direct instruction and a minimum of 5 hours of independent learning each week, for a combined minimum total of 7.5 hours per week or 112.5 hours over the semester.

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## Required Tools and Texts

**Tools**: Anaconda (or Python 3.10+), JupyterLab, VS Code, Google Colab, Quarto, or other tools that support Python programming and visualization.
**Core Libraries**: pandas, numpy, matplotlib, seaborn, altair, plotly, geopandas, mapclassify, contextily, folium, scikit-learn, umap-learn, sentence-transformers, BERTopic, wordcloud.

**Documentation & Guides**:
- Matplotlib
- Seaborn
- Plotly
- Altair
- GeoPandas
- Pandas

**Texts**: No required textbook. Recommended: *Fundamentals of Data Visualization* by Claus O. Wilke (available free online) and *Storytelling with Data* by Cole Nussbaumer Knaflic.

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## Weekly Topics & Schedule

| Week | Topic | Description |
|---|---|---|
| 1 | Getting Started | Python setup, Jupyter, Pandas basics, first plot with matplotlib, Quarto rendering. |
| 2 | Language of Graphs | Encodings, tidy data, seaborn & altair grammar. |
| 3 | Distributions & Variation | Hist/KDE/violin/ECDF, binning & outliers. |
| 4 | Wrangling with pandas | select/filter/mutate/groupby/merge, reshape, dates. |
| 5 | Perception & Principles | Cleveland–McGill, preattentive features, clutter. |
| 6 | Comparisons | Bars/dots/small multiples, ordering & baselines, log scales. |
| 7 | Text, Labels, & Tables | Direct labeling, captions, tables. |
| 8 | Mapping I & II | Choropleths, CRS, spatial joins, geopandas, mapclassify, folium. |

| Week | Topic | Description |
|---|---|---|
| 9 | Color & Accessibility | Sequential/diverging/qualitative palettes, pitfalls. |
| 10 | Relationships & Modeling | Scatter/line, smoothing, statsmodels, model checks. |
| 11 | Uncertainty | Error bars, intervals, bootstrap visuals. |
| 12 | Visualization for ML/NLP | Feature importance, confusion/ROC-PR, word clouds, BERTopic, UMAP embeddings. |
| 13–14 | Final Project Workshops | Scoping, refinement, narrative. |

## Assignments & Grading

| Assignment | Weight |
|---|---|
| Weekly Notebooks & Exercises | 30% |
| Mid-Semester Visualization Project | 20% |
| Final Project | 40% |
| Participation & Peer Feedback | 10% |

## Final Project

The final project will synthesize the skills learned throughout the course. Students will: - Propose a project idea by Week 9. - Develop a prototype by Week 13. - Submit the final project by April 30.

Requirements: - Multiple well-designed visualizations with an accompanying narrative. - At least one map or ML/NLP visualization. - Accessibility considerations (color choice, labeling, alt text). - A reproducible Jupyter Notebook and any necessary datasets or data sources.

Projects will be graded on clarity, creativity, technical proficiency, and adherence to visualization best practices.

## Assignments & Grading

Incomplete grades may be given to undergraduate students only if for reasons beyond the student's control (such as medical or family emergency) s/he is unable to complete the final work of the course. Faculty should not assign an Incomplete grade if not asked by the student. A contract must be signed by the instructor and the student and filed in the department office. A copy should be submitted to the Academic Advising office in Phillips 107. A student has up to a calendar year to finish the coursework for the class, and when completed a grade change form must be submitted to the Academic Advising office to update the grade. For further policy and

contract information for undergraduate students, please consult with your advisor and also visit the website for Columbian College of Arts and Sciences Academic Advising.

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## Grading Scale

The grading scale below determines your final letter grade.

- 93+ – 100 = A
- 90+ – 92 = A-
- 87+ – 89 = B+
- 83+ – 86 = B
- 80+ – 82 = B-
- 77+ – 79 = C+
- 73+ – 76 = C
- 70+ – 72 = C-
- 67+ – 69 = D+
- 63+ – 66 = D
- 60+ – 62 = D-
- Less than 60 = F

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## Course AI Policy

Students are welcome to use AI tools (such as ChatGPT, Copilot, or similar) as a supplement to their learning in this course. However, AI may not be used to complete graded assignments, projects, or exams in place of a student's own work. Any use of AI tools must be acknowledged and documented in the submitted work (e.g., a short note in the notebook or report specifying how the tool was used). Submitting AI-generated work as your own without attribution is a violation of the GW Code of Academic Integrity. If in doubt, ask the instructor before using an AI tool.

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## University Policies

**Academic Integrity Code**

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact Conflict Education and Student Accountability (CESA), formerly known as Student Rights and Responsibilities (SRR), to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the University and may include a

transcript notation. For more information, refer to the CESA website at students.gwu.edu/code-academic-integrity or contact CESA by email cesa@gwu.edu or phone 202-994-6757.

**University policy on observance of religious holidays**
Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see provost.gwu.edu/policies-procedures-and-guidelines.

## Use of Electronic Course Materials and Class Recordings

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

## Academic Support

**Academic Commons**
Academic Commons is the central location for academic support resources for GW students. To schedule a peer tutoring session for a variety of courses visit go.gwu.edu/tutoring. Visit academiccommons.gwu.edu for study skills tips, finding help with research, and connecting with other campus resources. For questions, email academiccommons@gwu.edu.

**GW Writing Center**
GW Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at gwu.mywconline.

## Support for students in and outside the classroom

**Disability Support Services (DSS)** 202-994-8250
Any student who may need an accommodation based on the potential impact of a disability

should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

**Student Health Center** 202-994-5300, 24/7
The Student Health Center (SHC) offers medical, counseling/psychological, and psychiatric services to GW students. More information about the SHC is available at healthcenter.gwu.edu. Students experiencing a medical or mental health emergency on campus should contact GW Emergency Services at 202-994-6111, or off campus at 911.

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## GW Campus Emergency Information

**GW Emergency Services**: 202-994-6111
For situation-specific instructions, refer to GW's Emergency Procedures guide.

**GW Alert**
GW Alert is an emergency notification system that sends alerts to the GW community. GW requests students, faculty, and staff maintain current contact information by logging on to alert.gwu.edu. Alerts are sent via email, text, social media, and other means, including the Guardian app. The Guardian app is a safety app that allows you to communicate quickly with GW Emergency Services, 911, and other resources. Learn more at safety.gwu.edu.

**Protective Actions**
GW prescribes four protective actions that can be issued by university officials depending on the type of emergency. All GW community members are expected to follow directions according to the specified protective action. The protective actions are Shelter, Evacuate, Secure, and Lockdown (details below). Learn more at safety.gwu.edu/gw-standard-emergency-statuses.

**Shelter**
- Protection from a specific hazard
- The hazard could be a tornado, earthquake, hazardous material spill, or other environmental emergency.
- Specific safety guidance will be shared on a case-by-case basis.

**Action**:
- Follow safety guidance for the hazard.

**Evacuate**
- Need to move people from one location to another.
- Students and staff should be prepared to follow specific instructions given by first responders and University officials.

**Action**:

- Evacuate to a designated location.
- Leave belongings behind.
- Follow additional instructions from first responders.

**Secure**

- Threat or hazard outside of buildings or around campus.
- Increased security, secured building perimeter, increased situational awareness, and restricted access to entry doors.

**Action**:

- Go inside and stay inside.
- Activities inside may continue.

**Lockdown**

- Threat or hazard with the potential to impact individuals inside buildings.
- Room-based protocol that requires locking interior doors, turning off lights, and staying out of sight of corridor window.

**Action**:

- Locks, lights, out of sight
- Consider Run, Hide, Fight

- **Classroom emergency lockdown buttons**
  Some classrooms have been equipped with classroom emergency lockdown buttons. If the button is pushed, GWorld Card access to the room will be disabled, and GW Dispatch will be alerted. The door must be manually closed if it is not closed when the button is pushed. Anyone in the classroom will be able to exit, but no one will be able to get in.

**Please note that the syllabus may be updated during the semester to better meet the learning objectives. The instructor reserves the right to modify this syllabus as needed, and the students will be notified promptly of any changes.*