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**STAT 436: Statistical Data Visualization**

**3 Credits**

**Course Designations and Attributes**

Natural Science

LAS Credit

Intermediate

**Course Description**

Techniques for visualization within data science workflows. Topics include data preparation; exploratory data analysis; spatial, tabular, and graph structured data; dimensionality reduction; model visualization and interpretability; interactive queries and navigation.

**Requisites**

(Stat 240 or 303), graduate/professional standing, member of Statistics Visiting International Scholars program

**Meeting Time and Location**

Tuesday/Thursday 4 – 5:15pm

Morgridge B2590

**Instructional Modality**

In-person

**Specify How Credit Hours are Met by the Course**  
The credit standard for this course is met by an expectation of a total of 135 hours of student engagement

with the courses learning activities (45 hours per credit), which include regularly scheduled: readings,

recorded lectures, in-class exercises, a midterm exam, portfolio assignments, and a group project, as described in this syllabus.

**Regular and Substantive Student-Instructor Interaction**

Participation in regularly scheduled lectures each week will include the opportunity for direct interaction between students and the instructor. The instructor will also frequently interact and post announcements in Canvas and email students about academic aspects of the class.

Instructional Staff & Office Hours

Office hours are times where instructors will be freely available for in-person or remote conversation with students. Students are encouraged to attend these hours when they have questions about anything course related; these questions need not be concrete, they can be as general as “I didn’t get this/I need help.” This time is dedicated to you, the students, as an opportunity to interact with and get live help from your instructors.

**Instructors**

Kris Sankaran ([ksankaran@wisc.edu](mailto:ksankaran@wisc.edu))

Morgridge 5669, and

[Zoom](https://uwmadison.zoom.us/j/8622164885) Link: <https://uwmadison.zoom.us/j/8622164885>

Fridays 3 – 5pm

~~Office Hours will be set by~~ [~~this poll~~](https://www.when2meet.com/?31640654-QkXrP)~~.~~

**Teaching Assistants**

Matt Sathitvudh ([sathitvudh@wisc.edu](mailto:sathitvudh@wisc.edu))

Tuesday 11:30am – 12:30pm

Wednesday: 1 – 2pm

Zoom Link: <https://uwmadison.zoom.us/j/5692594858>

Course Learning Outcomes

1. Develop a vocabulary of visual encodings that support exploration of geospatial, temporal, tree-structured, and network data, and demonstrate facility implementing them using packages in the R programming language.
2. Design dynamic queries that support interactive visualization of heterogeneous data, and demonstrate facility implementing them using the shiny package in the R programming language.
3. Design effective visualizations to summarize the results of dimensionality reduction and clustering algorithms.
4. Use visual artifacts derived from complex statistical and machine learning models to discuss the patterns they learn and mistakes they make.
5. Evaluate strengths and weaknesses of visualizations in relation to the tasks they support.

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Description automatically generated**

**Grading**

Think Tanks: 10%

Self-Assessments: 10%

Midterm: 20%

Homework: 35%

Group Project: 25%

Those numeric grades will be assessed on two scales, and your final letter grade will be determined by whichever you score higher on:

Absolute scale:

|  |  |
| --- | --- |
| If your numeric grade is in the range… | Your letter grade will be (at least): |
| 92 and higher | A |
| 88 - 91.99 | AB |
| 82 - 87.99 | B |
| 78 – 81.99 | BC |
| 70 – 77.99 | C |
| 60 – 69.99 | D |
| 59.99 and lower | F |

Percentile Scale:

|  |  |
| --- | --- |
| If your numeric grade is better than… | Your letter grade will be (at least): |
| 75% of Class | A |
| 65% of Class | AB |
| 45% of Class | B |
| 30% of Class | BC |
| 10% of Class | C |
| 5% of Class | D |
| 0% of Class | F |

For example, if a student has a final numeric grade of 84.5% (B), and that score is better than 70% of the class (AB), they will receive an AB.

Course Website, Learning Management System, Digital Instructional Tools

<https://canvas.wisc.edu/courses/481615>

<https://piazza.com/wisc/fall2025/fa25stat436001/home>

This class will use Piazza (link immediately above) as a question-and-answer forum for students. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.  Students are encouraged to use Piazza for content and logistical questions.

UW-Madison provides students with [technology guidelines and recommendations](https://it.wisc.edu/learn/guides/learning-online-technology-tips-tools/) for instruction. Students are encouraged to consult these resources prior to the start of the semester.

Required Textbook, Software & Other Course Materials

There is no required textbook for this course.

Weekly Assignments & Materials, Group Project Expectations, Deadlines, Helping Classmates, Late Work Policy

**Think Tank Posts**

Think Tank discussions are low-stakes spaces for students to engage with their own subjective opinions and preconceptions about data visualization. Each week, we will give students one or more prompts/questions and ask them to write a short reflection stating and justifying their opinion on the prompt. Students will post individual responses in discussion boards visible to other classmates.

**Weekly Readings and Recordings**

Each week, a series of readings and recorded videos will be posted. These are the medium by which course content will be communicated to the students. Self-assessments, individual homework assignments, and group projects will assess students’ comprehension of material taught in these postings.

**Self-Assessments**

Every other week, students will take a Canvas quiz on the previous two week’s material. Students will have two attempts for these quizzes, and their highest score will be used as their final score for that assignment. After the first attempt, students will be shown which questions they got wrong, but not what the correct answers are. The purpose of the self-assessments is to show the student where the gaps are in their understanding of the week’s content, and give them an opportunity to remedy those gaps.

**Individual Homework Assignments**

Five individual homework assignments will be due throughout the course. On those assignments, there will be two different types of questions; *pre-written problems* and *portfolio visualizations*. Pre-written problems will ask you to complete pre-determined visualization tasks and answer questions. Portfolio visualizations will be more open ended, allowing you to choose a dataset, topic, and visualization strategy of your choice, within a certain set of constraints. The goal of these open-ended problems is for the student to develop a collection of visualization projects that can be shared beyond the class.

While students are responsible for their own submission on individual homework assignments, students are encouraged to provide some help to each other as defined by the “helping classmates” policy below. Please also see the generative AI policy further below in this syllabus.

**Group Project**

There will be four group project milestones due in this course, each of which will build on the previous. Project groups will be formed in Week 2; students will have the choice to self-select groups or be randomly assigned a group. Project Milestone 1 (due Week 6) will ask groups to define their study goals and identify high-level themes and challenges of visualizations in the relevant field. Project Milestone 2 (due Week 11) will ask groups to explore the design space and produce a set of preliminary visualizations. Individual students will review another group’s submission for Project Milestone 2 and provide feedback. Project Milestone 3 (due in Week 15), groups will turn in their final product based on instructor and peer feedback in Project Milestone 2.

Each project group will prepare a short “visualization share” at the start of the class for at least one session. These will count towards to the project component of the grade.

Exams

A midterm exam will take place in class at the end of Week 7. There is no final exam.

**Group Project Expectations**

It is required that each group member will:

* Communicate with their groupmates in a timely and reasonable manner as agreed upon by the group.
* Make their best effort towards each assignment.

It is expected and accepted that groupmates will have different levels of comfort with the material. “Best effort” means that you push yourself to grow, to explore, and to produce work that you are proud of. Your best effort may involve asking your groupmates or instructors for help, or providing help to your groupmates, depending on your background and comfort with the material. As above, we should treat others how we would want to be treated.

Alongside each group assignment, each individual student will be asked to submit an accountability review. This accountability review will ask for a short description of what the individual student contributed, and then a statement rating the contributions of their groupmates as one of three categories:

* Satisfactory: Groupmate communicated in a timely manner and made their best effort to contribute to the assignment.
* Unsatisfactory: Groupmate’s lack of effort concretely held the group back from progress. Examples include late/minimal communication or putting in bare minimum effort towards their work.
* Non-Contributor: Groupmate did not communicate at all or did not contribute anything.

If a student receives two or more ratings below satisfactory, they face a potential 25 percentage point penalty at the discretion of the instructor for that assignment. If a student receives two or more non-contributor ratings, they may face greater penalties including no credit for that assignment at the discretion of the instructor. The instructor also reserves the right to adjust or not adjust other members’ grades to account for the unsatisfactory contributions of a groupmate.

**Helping Classmates**

Student-to-student help is a key supporter of learning and sense of belonging. We want to set up conditions in which this assistance facilitates growth, rather than bypasses it. Our intent is that your groupmates not only serve as collaborators on the group project, but as supportive peers to consult when struggling with individual homework.

With that in mind, *conversations* about concepts that may appear in pre-written problems or self-assessments are encouraged. Conversations specifically encourage students to grapple with descriptions and understanding of high-level concepts, which fosters reflection and growth. Conversational descriptions of functions, arguments, and general structure of code are natural parts of these discussions. A good rule of thumb to follow is to have conversations without either party looking at their code. This will encourage you to think about the overall structure, goals, and workflow of your code rather than tempting you to cheat.

However, *providing or receiving ANY code for pre-written problems or answers for self-assessments are strictly forbidden.* In the same spirit as the generative AI policy further below in this syllabus, this ensures students develop strong foundations in the basic concepts, which is what pre-written problems and self-assessments are meant to test.

If a classmate makes a request to see your code for a pre-written problem or for self-assessment answers, please deny that request and cite this section of the syllabus. Providing either of those to a classmate constitutes academic misconduct.

You must come up with your own visualization on portfolio problems. However, reviewing, adapting, and learning from (but not copying) each other’s code is allowed on portfolio visualizations. This mimics the practical, real-world visualization process where thoughtful adaptation, refinement, and re-application of existing visualizations and code is encouraged; with permission and proper citation, of course.

**Late Work Policy**

My goal is for you to achieve the course learning objectives. Falling behind can hinder your ability to achieve the learning objectives. The late work policy is present to encourage you to stay on pace.

Late submissions to homework, think tanks, and self-assessments will be penalized by 10% per day. For example, say we score your work as 95% on an individual homework assignment with an 11:59pm Sunday deadline. If you submitted that on Sunday or earlier, you would receive the full 95%. If you submitted it on Monday, you would receive 85%. A Wednesday submission would receive a 75%, and so on. We offer up to two 24 hour grace periods for homework submission and four 24 hour grace periods for think tanks and self-assessments (combined). For assignments for which you use the grace period, the late penalties will begin starting 24 hours after the due date. You would not be penalized for any submission within the first 24 hours, between 24 – 48 hours late would be penalized 10%, 48 – 72 late would be penalized 20% etc. It is your responsibility to track many grace periods you have used.

**Late work will receive zero credit for: all group project milestones and the peer review.** Weimplement this policy for two reasons; one, these assignments thrive on a cycle of reflection, summary, and feedback, which can only be implemented if submissions are on time. Two, we should treat others how we would want to be treated; in each of these assignments, your fellow groupmates are relying on you, and that warrants a respect for deadlines that exceeds individual assignments where your submission only affects yourself. Please also see Group Project Expectations above.

Exceptional, unforeseeable, emergency circumstances will be dealt with by the instructor on a case-by-case basis. Please email me at [ksankaran@wisc.edu](mailto:ksankaran@wisc.edu) if you have questions! I reserve the right to relax or uphold late penalties at my discretion.

**Generative AI Policy**

There is evidence that while generative AI tools like ChatGPT and GitHub Copilot can dramatically [improve programming productivity](https://doi.org/10.1145/3661145), they can also have [negative effects on learning](http://dx.doi.org/10.2139/ssrn.4895486). In this course, we will take a middle path.

Generative AI is **NOT** allowed on *exercise sheet problems from individual in-class exercises or homework assignments.* Thiswill ensure students have strong foundations in the basics of each concept, as these (parts of) assignments are designed to assess.

Generative AI is also **NOT** allowed for *any* *written* *part of any assignment* (e.g. anything turned in that is not code). Authentic, critical thought about the shortcomings, advantages, and trade-offs of visual choices, as well as concise but effective descriptions of visualization processes and workflows, are core learning outcomes of this class as listed above. Writing about data visualization is an important practical skill, and this policy encourages you to develop that skill.

However, on *group projects and* *portfolio visualizations*, generative AI **IS**allowed to assist you with *programming/coding* (not writing, see previous paragraph). These situations are intended to mimic a practical, real world visualization workflow, where you also have the freedom to choose the datasets, topics, and visualization strategies.

Teaching & Learning Data Transparency Statement

*The privacy and security of faculty, staff and students’ personal information is a top priority for UW-Madison. The university carefully evaluates and vets all campus-supported digital tools used to support teaching and learning, to help support success through*[learning analytics](https://teachlearn.provost.wisc.edu/learning-analytics/)*, and to enable proctoring capabilities. View the university’s full*[teaching and learning data transparency statement](https://teachlearn.provost.wisc.edu/teaching-and-learning-data-transparency-statement/)*.*

Privacy of Student Records & the Use of Audio Recorded Lectures Statement

*View* [more information about *FERPA*](https://registrar.wisc.edu/ferpa-facstaff/)*.*

Lecture materials and recordings for this course are protected intellectual property at UW-Madison. Students in this course may use the materials and recordings for their personal use related to participation in this class. Students may also take notes solely for their personal use. If a lecture is not already recorded, you are not authorized to record my lectures without my permission unless you are considered by the university to be a qualified student with a disability requiring accommodation. [Regent Policy Document 4-1] Students may not copy or have lecture materials and recordings outside of class, including posting on internet sites or selling to commercial entities. Students are also prohibited from providing or selling their personal notes to anyone else or being paid for taking notes by any person or commercial firm without the instructor’s express written permission. Unauthorized use of these copyrighted lecture materials and recordings constitutes copyright infringement and may be addressed under the university’s policies, UWS Chapters 14 and 17, governing student academic and non-academic misconduct.

Course Evaluations

Students will be provided with an opportunity to evaluate this course and your learning experience. Student participation is an integral component of this course, and your confidential feedback is important to me. I strongly encourage you to participate in the course evaluation.

UW-Madison uses a digital course evaluation survey tool called [AEFIS](https://kb.wisc.edu/luwmad/page.php?id=81069). For this course, you will receive an official email two weeks prior to the end of the semester, notifying you that your course evaluation is available. In the email you will receive a link to log into the course evaluation with your NetID. Evaluations are anonymous. Your participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

Students’ Rules, [Rights & Responsibilities](https://guide.wisc.edu/undergraduate/#rulesrightsandresponsibilitiestext)

Diversity & Inclusion Statement

[Diversity](https://diversity.wisc.edu/) is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

Academic Integrity Statement

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

Accommodations for Students with Disabilities Statement

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA. (See: [McBurney Disability Resource Center](https://mcburney.wisc.edu/))

[Academic Calendar & Religious Observances](https://secfac.wisc.edu/academic-calendar/)

*You can use the link above to provide your students with information about the current and future academic calendars, along with the university’s religious observance policy. As the start-date for the fall 2021 semester coincides with Rosh Hashanah, it is particularly important to reach out to your students and share your plans to provide flexibility for the first day of class.*