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Instructor: Qunfang Wu   Email: qwu114@syr.edu

Office Hours: Friday 10-11AM   Phone: 315-949-8379

TA: Yujing Yuan (yyuan44@syr.edu)   TA Office Hours: Wednesday 4-5PM

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Course Description:

A broad introduction to data visualization for information professionals. Students will develop a portfolio of resources, demonstrations, recipes, and examples of various data visualization techniques. Additional work required for graduate students.

Additional Course Description:

Introduction to skills and techniques related to information visualization, through the R programming language, Adobe illustrator. These skills include data cleaning techniques, control of the R graphics environment, develop custom plots, visually explore data, use design concepts to visually communicate the story in the data, and discuss issues related to the ethics of data visualization. Conceptual themes will be presented alongside technical aspects of data visualization. Additional work and higher grading expected of graduate students.

Prerequisite / Co-requisite:

IST 387 / 687 or equivalent programming courses (Python, Java, SQL, C, C++, etc.)

Audience:

Students interested in data analytics and data science, with a focus on data/information visualization.

Credits:

3

Learning Objectives:

After taking this course, the students will be able to:
1.   Perform basic data cleaning and preparation on a wide range of data sets using R
2.   Identify stories in data sets through visual data exploration
3.   Create rich visual artefacts that communicate data stories

Texts / Supplies – Required:

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Visualize This: The FlowingData Guide to Design, Visualization, and Statistics, by Nathan Yau. Wiley Publishing, 2011. [VT in schedule]

Data Points: Visualization That Means Something, by Nathan Yau. Wiley Publishing, 2013. [DP in schedule]

Both texts are available online from the SU Libraries!

Additional Readings:
Additional readings will be provided as PDFs.

Course Requirements and Expectations:

In order to meet the goals of the class (see above), we will use a combination of lectures to introduce topics and concepts, hands-on-labs to introduce skills, group exercises and student presentations to enable peer-to-peer learning, and homework assignments to practice skills and gain deeper knowledge of course content. Because this class is a hybrid class being taught when social distancing rules are still in place, there are several additional considerations regarding face-to-face and virtual attendance. These are detailed below.

<u>**Attendance**</u>
Asynchronous Attendance: If you are well beyond this time zone (say, in China) you can attend the class asynchronously, by watching pre-recorded lectures. If this applies to you, you **must** contact me right away so that I can make sure group activities are organized appropriately for you. You will be responsible for following along by watching recorded lectures and will be responsible for participating in synchronous group activities with peers who are also in your time zone[1].

Synchronous Attendance. If you are in (or close to) this time zone, it is expected that you will attend *synchronously*, either in person via face-to-face classes or virtually. Whichever of these you choose is up to you, and you may at any point decide to switch from one to the other. However, please follow these guidelines:

- I recognize that life happens outside of class, and sometimes decisions get made that are not necessarily well thought out. **If you have broken social distancing rules** please, out of consideration for your peers and me, attend the class virtually. I will ask no questions and make no assumptions, and you will suffer no penalty for choosing virtual over face-to-face attendance.
- If attending virtually, please attend the class during your scheduled period. There will be virtual, synchronous group activities. Not participating in scheduled group activities will resulted in lost points on your grade.

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[1] Depending on the number of people available in a given time zone; other arrangements may be made if this is not possible.

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Face to Face Attendance and Etiquette. If you are attending a class session in person, you are expected to:
- Follow the Stay Safe Pledge expectations and wear a mask in class. Do not enter the classroom without a mask covering your nose and mouth. Cleaning supplies will be available to wipe down surfaces near you at the start of class. You are expected to wipe down these surfaces before you leave the classroom.
- No food or drink consumption will be allowed in the room during class.
- Be prepared to engage with your peers who are attending remotely, including replicating any of your questions/comments in the chat or working on classroom activities with peers virtually.
- Bring device to class - when attending in-person - to communicate with peers attending remotely.

Virtual Attendance and Etiquette. If you are at any point attending a class session remotely, you are expected to actively participate in the following ways:
- Please log in a few minutes before class begins to test your Internet connection and audio.
- Be professional when presenting yourself and your ideas on camera.
- Please mute yourself when you are not actively speaking. To share questions/comments, use the "raise hand" function and wait to be called on.
- You may post your questions/comments in the chat; someone will monitor the chat and communicate your post to the class. I may download and review the chat transcript from any class session.
- By default, **please turn your webcam on**; there are only 8 students in each section and visual feedback is important. If the Internet connection slows during the class session, I may ask you to turn your camera off.

Stay Safe Pledge
Please note, that as part of the university's plan for re-opening, all students are expected to affirm their commitment to keeping themselves and the campus community safe by signing the Stay Safe Pledge: Syracuse University's Stay Safe Pledge reflects the high value that we, as a university community, place on the well-being of our community members. This pledge defines norms for behavior that will promote community health and wellbeing. Classroom expectations include the following: wearing a mask that covers the nose and mouth at all times, maintaining a distance of six feet from others, and staying away from class if you feel unwell. Students who do not follow these norms will not be allowed to continue in face-to-face classes; repeated violations will be treated as violations of the Code of Student Conduct and may result in disciplinary action.

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Grading:

Grading Tables

Grades	Grade points /credit	Percentage Range
A	**4.000**	92%-100%
A-	**3.667**	90%-91.9%
B+	**3.333**	87%-89.9%
B	**3.000**	83%-86.9%
B-	**2.667**	80%-82.9%
C+	**2.333**	77%-79.9%
C	**2.000**	73%-76.9%

Grades	Grade points /credit	Percentage Range
C-	**1.667**	70%-72.9%
D **	**1.000**	63%-69.9%
D- **	**.667**	60%-62.9%
F	**0**	below 60%

∗ see: http://www.syr.edu/registrar/students/grades/faq.html

Assignments and Grading:

Note that these point values vary from class to class as new opportunities present themselves. Thus, the numbers are approximate.

Assignment	Points
In-Class Labs	15 to 20
Quizzes	40 to 50
Homework	30
Group Reports & Feedback	5 to 10
Advanced Topic Presentation	5 to 10
Final Project	25
Total	~140

Because of the dynamic nature of the labs, the total points possible may be a few points higher or lower.

Course structure:
Each week will introduce new content. During the first part of the course, there will be a brief lecture on Mondays, followed by a lab session. As the semester progresses, the lecture will eventually disappear, and we will devote the entire session to a lab. Wednesdays will be devoted to lab work. On some Wednesdays, there will be a quiz (indicated in the schedule). There may also be homework for the week. All lab work, quizzes, and homework will be due at 9AM on the following Monday.

In-Class Labs:
In the real world of data visualization people work both alone and in teams to meet near and far deadlines. In this class we work in a lab setting to learn R and Adobe Illustrator skills and students are encouraged to work together to solve problems. Lab work for the week is worth are between 1 and 3 points. Labs are also dynamic. The nature of what we turn in at the end of the lab will depend on how fast we go and what questions students ask. Because of the nature of this work, I do not allow for makeups of labs.

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Homework & Quizzes:
These will be extensions of what we did in class or assignments out of the book. Homework may be in the form of quizzes on Blackboard, visualizations you create or some of the other assignments listed below. Quizzes often lean heavily on the reading and students who do not keep up with the readings, often do not do well on the quizzes. Homework and quizzes are usually due at 9AM next Monday. You can turn in assignments late, but there are consequences. First, 1 point will be automatically deducted. Second, late assignments may not be graded till the end of the semester.

Important: you may not receive credit if you do not follow the file naming convention specified on the assignment sheet. You may not receive credit if your file is of the wrong type. Unless otherwise specified, you will always turn in plots as .pdf files and R scripts as .R files.

Advanced Topic Presentations:
While this class is focused on creating visualizations using R, many other tools exist. Examples include D3, Tableau, and Gephi. In order to give students exposure to these and many other options, students will select, research and present on an "advanced topic." Graduate students will work individually, while undergraduates may work in groups of two.

Final Project:
The final project, including poster session, is worth a large percentage of your final grade. The final poster project leverages skills developed throughout the semester, including cleaning data, exploring data with visualization techniques, data aggregation, simple design and information organization skills, and quality graphic presentation of data visualizations. Key deliverables leading up to the final project will be due throughout the semester to help the students stay on track for this major deliverable.

Poster Session:
You **must** be present at the poster session at the end of the semester, with your poster, in order to get credit for your poster. The exact time and date of the poster session will be announced within the first few classes. Note that the requirements for posters change each semester. Past examples on Blackboard are provided for your reference.

University Attendance Policy

Attendance in classes is expected in all courses at Syracuse University. Students are expected to attend the first meeting of all classes for which they are registered (except for those who will be attending asynchronously). Students who do not attend classes starting with the first scheduled meeting may be academically withdrawn as not making progress toward degree by failure to attend. Instructors set course-specific policies for absences from scheduled class meetings in their syllabi.

It is a federal requirement that students who do not attend or cease to attend a class to be reported at the time of determination by the faculty. Faculty should use "ESPR" and "MSPR" in Orange Success to alert the Office of the Registrar and the Office of Financial Aid. A grade of NA is posted to any student for whom the Never Attended flag is raised in Orange SUccess. More

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information regarding Orange SUccess can be found here, at:
http://orangesuccess.syr.edu/getting-started-2/
Students should also review the University's religious observance policy and make the required
arrangements at the beginning of each semester

Course Specific Policies on attendance, late work, make up work, examinations if outside normal class time, etc.:

Attendance and Participation:
I do not directly grade on attendance or participation. Labs and lab quizzes serve the function of taking
attendance. Labs and lab quizzes will not be announced in advance, and, as noted above, *cannot be
made up and cannot be late*.

Syracuse University Policies:

Syracuse University has a variety of other policies designed to guarantee that students live and
study in a community respectful of their needs and those of fellow students. Some of the most
important of these concerns:

Diversity and Disability (ensuring that students are aware of their rights and responsibilities
in a diverse, inclusive, accessible, bias-free campus community) can be found here, at
https://www.syracuse.edu/life/accessibilitydiversity/

Religious Observances Notification and Policy (steps to follow to request
accommodations for the observance of religious holidays) can be found here, at:
http://supolicies.syr.edu/studs/religious_observance.htm

Orange SUccess (tools to access a variety of SU resources, including ways to communicate
with advisors and faculty members) can be found here, at:
http://orangesuccess.syr.edu/getting-started-2/

Disability-Related Accommodations:

Syracuse University values diversity and inclusion; we are committed to a climate of mutual
respect and full participation. There may be aspects of the instruction or design of this course
that result in barriers to your inclusion and full participation in this course. I invite any student to
meet with me to discuss strategies and/or accommodations (academic adjustments) that may be
essential to your success and to collaborate with the Office of Disability Services (ODS) in this
process.

If you would like to discuss disability-accommodations or register with ODS, please visit their
website at http://disabilityservices.syr.edu./ Please call (315) 443-4498 or email
disabilityservices@syr.edu for more detailed information.

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ODS is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible to begin this process.

Academic Integrity Policy:

Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

Educational Use of Student Work

Student work prepared for University courses in any media may be used for educational purposes, if the course syllabus makes clear that such use may occur. You grant permission to have your work used in this manner by registering for, and by continuing to be enrolled in, courses where such use of student work is announced in the course syllabus.

I intend to use academic work that you complete this semester in subsequent semesters for educational purposes. Before using your work for that purpose, I will either get your written permission or render the work anonymous by removing all your personal identification.

ISchool Values

(See https://ischool.syr.edu/about/vision-and-values/*)*

The culture, curriculum, and decision making at the iSchool are guided by our shared values. I endorse these values.

Excellence

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We are a student-centered institution committed to learning and intellectual diversity. As a community of scholars and practitioners, we pursue research and teaching excellence through the development, integration, and application of knowledge.

Discovery and Innovation

We value discovery and innovation to advance the information fields. We identify new opportunities, respond creatively to emerging issues, and lead our fields through partnerships and learning communities.

Integrity

As information professionals, we uphold intellectual honesty and responsibility. We carefully consider the implications of our actions, taking fairness and equity into consideration. We contribute to, and promote, the highest standards for the ethical use of information and technology.

Diversity and Inclusion

We strive for diversity in our community and celebrate difference. We embrace a multiplicity of voices to address social and technical challenges through interdisciplinary analysis and solutions.

Global Citizenship and Engagement

We enable our iSchool community to participate actively as global citizens working to advance the common good. We have a responsibility to inform and improve society, and to influence policy through pedagogy, research, and advocacy.

Discrimination or Harassment

The University does not discriminate and prohibits harassment or discrimination related to any protected category including creed, ethnicity, citizenship, sexual orientation, national origin, sex, gender, pregnancy, disability, marital status, age, race, color, veteran status, military status, religion, sexual orientation, domestic violence status, genetic information, gender identity, gender expression or perceived gender.

Any complaint of discrimination or harassment related to any of these protected bases should be reported to Sheila Johnson-Willis, the University's Chief Equal Opportunity & Title IX Officer. She is responsible for coordinating compliance efforts under various laws including Titles VI, VII, IX and Section 504 of the Rehabilitation Act. She can be contacted at Equal Opportunity, Inclusion, and Resolution Services, 005 Steele Hall, Syracuse University, Syracuse, NY 13244-1120; by email: titleix@syr.edu; or by telephone: 315-443-0211.

Federal and state law, and University policy prohibit discrimination and harassment based on sex or gender (including sexual harassment, sexual assault, domestic/dating violence, stalking, sexual exploitation, and retaliation).

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If a student has been harassed or assaulted, they can obtain confidential counseling support, 24-hours a day, 7 days a week, from the Sexual and Relationship Violence Response Team at the Counseling Center (315-443-4715, 200 Walnut Place, Syracuse, New York 13244-5040). Incidents of sexual violence or harassment can be reported non-confidentially to the University's Title IX Officer (Sheila Johnson Willis, 315-443-0211, titleix@syr.edu, 005 Steele Hall). Reports to law enforcement can be made to the University's Department of Public Safety (315-443-2224, 005 Sims Hall), the Syracuse Police Department (511 South State Street, Syracuse, New York, 911 in case of emergency or 315-435-3016 to speak with the Abused Persons Unit), or the State Police (844-845-7269).

I will seek to keep information you share with me private to the greatest extent possible, but as a professor I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and crimes I learn about to help make our campus a safer place for all.

Course evaluations:

There will be an end of course evaluation for you to complete this term. This evaluation will be conducted online and is entirely anonymous. You will receive an official notification in your email account with the evaluation website link and your passcode. Please take the time and fill out this evaluation as your feedback and support of this assessment effort is very much appreciated. The school carefully reviews ratings and comments that you submit, and these factor into decisions about course, program and instructor development.

Use of Blackboard

This course involves the use of Syracuse University's Blackboard system as an online tool. The environment is composed of a number of elements that will help you be successful in both your current coursework and your lifelong learning opportunities. To access Blackboard, [http://blackboard.syr.edu] use your Syracuse University NetID & Password. This specific course will appear in your course list.

To search for answers to your Blackboard questions, visit the Answers self-help knowledge [https://answers.syr.edu/display/blackboard01/Blackboard]. If you have problems logging in or need assistance with Blackboard, contact the ITS Service Center at: help@syr.edu or 315.443.2677. The Syracuse University Blackboard support team will assist you.

Course Schedule: Week, topic for the week, and required readings are in the columns below. Content for each week is split across the Monday/ Wednesday session. Readings should be done before class on Monday. Quizzes, if any, will be on Wednesday. Lab work for the week is due at 9AM next Monday.

Please note that this schedule is subject to change; please check Blackboard regularly for updates.

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Week	Topic	Required Reading and Assignment
1	**What is information visualization? What is R?** *Learning Outcomes* - Students will be able to: • Differentiate between Information Visualization and other prominent forms of visualization • Describe the two main purposes of Information Visualization: exploration and communication • Describe the 7 basic steps of visualization • Describe the purpose of the 4 windows of RStudio • Create variables in R • Create simple single variable plots in R, such as pie and bar charts, histograms • Use R's help system to lookup the available parameters for plotting functions	*Lab*: R and Basic Plots *Readings*: • VT: Chapters 1 and 2 • DS: Chapters 1 and 2 • Ben Fry, Visualizing Data *Quiz 1*: covers readings and lecture
2	**Working with Data** *Learning Outcomes* – Students will be able to: • Describe the process of data exploration • Discuss the role of context markers in visualization • Differentiate between common data types • Open data files • Use R functions to explore and clean data • Use R to retype, subset and filter data	*Lab*: Exploring Data in R *Readings*: • Wiley and Pace: Chapter 3 (on Blackboard) • DP: Chapter 1 • DP: Chapter 4: pp189-199 • VT: Chapters 3 and 4 *Homework 1*: Reproduce Figures in VT Chapter 4 *Quiz 2*: covers readings and lecture

Week	Topic	Required Reading and Assignment
	• Create rough data exploration plots	
3	**Skill Building with R** *Learning Outcomes* – Students will be able to: • Find datasets from online data libraries such as Data Planet • Describe ways to make comparisons with visualizations • Describe ways to identify and show relationships in data • Differentiate between single and multi-dimensional plots • Use R to make simple multi-dimensional plots • Identify the appropriate plot type for a given set of data	*Lab:* Visualizing multi-dimensional data *Readings*: • Wiley and Pace: Chapter 2 (on Blackboard) • Wiley and Pace: Chapter 4 (on Blackboard) *Homework 2*: Explore a provided dataset to answer several questions.
4	**Dplyr & GGPlot** *Learning Outcomes* – Students will be able to: • Load packages that extend R • Create plots of 3 or more dimensions using ggplot • Create complex multi-plot layouts Explain the concept of a graphical language as implemented by ggplot	*Lab: Dplyr & GGPlot2* *Readings*: • Chapters 3,4,12 of R for Data Science *Homework 3*: Create plots using GGPlot2
5	**Telling Stories & Making Maps** *Learning Outcomes* - Students will be able to: • Describe a dataset • Identify questions that might be answered with the data • Identify elements of a visual artifact that make it compelling	*Lab*: Maps *Readings:* • DP: Chapters 2 and 3 • Few: Chapter 3 *Homework 4*: Visualize your data: creating a visual report of your dataset

Week	Topic	Required Reading and Assignment
	• Interpret the meaning(s) of a data visualization • Prepare geographic based data for plotting • Create national, regional and world map plots in R • Enhance cognitive apprehension of complex maps through the use of design elements	*Homework 5*: Tell the story in a dataset *Quiz 3*
6	**Graphic Design Principles: Color, tools and R color functions** *Learning Outcomes* – Students will be able to: • Describe the use of contrasting and harmonious color in visualization • Describe how hue, saturation and value combine to make a color • Use online tools to choose and create color schemes • Use R's color setting and transformation functions • Use color to provide visual cues in visualizations	*Lab*: Working with color *Readings*: • DP: Chapter 4
7	**Using Illustrator** *Learning Outcomes* – Students will be able to: • Use illustrator to modify R plots • Add context elements to a data visualization • Use Illustrator to modify plot colors, type face and layout • Explain the difference between raster and vector graphics	*Lab:* Illustrator Intro *Readings:* VT: Chapter 4 (Illustrator parts) *Homework 6:* Illustrator portions of VT Ch 4 plots
8	**Graphic Design Principles: Type Face & Layout, R plot area control**	*Lab: Making posters*

Week	Topic	Required Reading and Assignment
	Learning Outcomes – Students will be able to: • Describe how type face and layout work together to create a visual hierarchy • Describe how visual hierarchies direct viewers attention • Explain how lines, gutters, grids and colors can be used to highlight visual elements • Critically assess example posters and discuss useful and detracting design elements	*Readings*: • DS: Chapter 5 • VT: Chapter 6 • Few: Chapter 4 *Ethics Assignment:* Preparing for class discussion and quiz *Quiz 4*
9	**Ethics and Project Group Feedback** *Learning Outcomes* – Students will be able to: • Critically assess visualizations • Identify the audience for a visual artifact • Identify visual credibility markers • Discuss the ethical concerns around visual artifacts	**Readings:** • The credibility of Image Base Research and Evaluation • Practices of Looking • Watch "Chasing Ice" via Netflix *Assignment*: Work in progress report for final poster project *Quiz 5*
10	**Viz-a-thon** Students are given a new dataset and must work together in small groups to explore the data to find the story, then create a mini-poster using R and Illustrator *Learning Outcomes* – Students will be able to: • Demonstrate knowledge of the process of creating a visual artifact	*Assignment*: Work in groups to visualize data and create mini-posters

Week	Topic	Required Reading and Assignment
	• Work in a group to create a mini-poster from an unknown dataset	
11	**Advanced Topics, Student Presentations & Discussion** *Learning Outcomes* – Students will be able to: • Describe advanced visualization tools used in the market place • Have knowledge of a range of additional R packages used in data cleaning and visualization not otherwise covered in class • Apply design skills learned in class to slide deck creation	*Assignment*: Advanced topic presentation on Mon, April 19 (No class on Wed, April 21)
12	**Social Network Visualization and Analysis** *Learning Outcomes* – Students will be able to: • Prepare social network data for visualization • Adjust parameters for social network visualization to identify important patterns	*Lab*: Social network visualization *Readings*: • VT: Chapter 7
13	**Interactivity in R Plotting: Shiny** *Learning Outcomes* – Students will be able to: • Create an online interactive visualization portfolio	*Lab*: RStudio's Shiny extension
14	**Visualizing social media** **Learning Outcomes** – Students will be able to: • Handle data in JSON format from the Twitter API	*Lab:* Processing Twitter data

Week	Topic	Required Reading and Assignment
	• Apply visualization techniques to actual data for social media analytics	
May 12	**Final Project Poster Session (last class)** Students present a poster they created themselves at the all-iSchool poster session	