# DSCI 605 Data Visualization (3 Credits)

Summer 2023: May 15th – July 21st, 2023

# Instructor

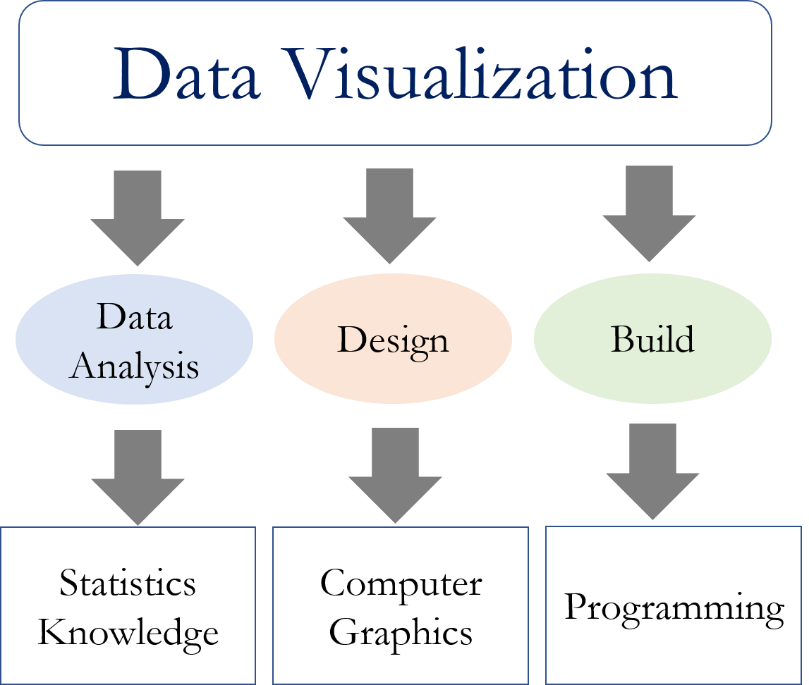
Dr. Aihua Li  
Assistant Teaching Professor of Data Science

**Office Hours:** Appointment based on request

Zoom link:<https://bsu.zoom.us/j/94564796516>  
**Contacting your instructor:**  For most questions, rather than emailing me directly, I encourage you post questions to the current week's discussion forum. Asking questions through the forum benefits all students, similar to raising your hand in a traditional classroom setting. For questions which are more personal in nature, please contact me through the course e-mail system in Canvas. Students are welcome to contact me via e-mail at any time; I will respond within 24 hours. If you want to a zoom meeting, please email me to ask for an appointment.

# Course Overview

In an increasingly globalized and digital society, there is a need to learn how to analyze “Big Data”, develop the ability to produce and critically interpret digital maps, charts and graphs. [Data visualization](https://www.mygreatlearning.com/blog/introduction-to-data-visualisation-why-is-it-important/) is a graphical representation of any data or information that enables you or decision-makers of any enterprise or industry to look into analytical reports and understand the concepts that might otherwise be difficult to grasp. Data visualization covers data analysis, graph design and codes development. DSCI 605 will provide a foundation in the principles, concepts, techniques and tools for visualizing information in large complex data sets and utilize open source data visualization software to train your hands-on experience for visualizing big data. Students will learn to evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding. Students will create their own data visualizations, and learn to use open source data visualization tools, especially R and JavaScript.



# Prerequisites

Ideally you have taken a course on computer graphics or statistics analysis, but this is not required. Some programming experience would be helpful.

# Course Objectives

The goal of this course is to introduce students to the needs and tasks of data visualization, and various techniques to produce effective visualization for various kinds of data. On completing this course, you will be able to:

* Identify the needs and tasks to provide data visualization.
* Analyze data visualization and list the essential components.
* Prepare data and design data visualization effectively.
* Create data visualization via commonly available software packages.
* Present data visualization to communicate with audience.

# Course Format

* The course format for Summer 2023 is asynchronous online.
* Students are required to have access to high speed Internet and speaker/microphone.
* Students are required to get familiar with distance learning and Canvas. Review resources given in Module 0\_Start Here and familiarize yourself with Canvas.
* Lecture: Videos and PowerPoints to cover theories and concepts.
* Quiz or Discussion: Quiz will be given to make you underhand the basic theory and rules.
* Lab: You need to complete some labs to enhance your hands-on experience in R.
* Reading assignments: Read ahead the materials provided for next week.

# Course Materials

The course materials consist of readings from the textbooks, journal articles, PowerPoints, online and other resources; software like Excel, R, JavaScript will also be used.

***Course Texts:***

We will use the following textbooks (recommended, but not required):

* Tamara Munzner, Visualization Analysis and Design, CRC Press, 2014.
* Hadley Wickham, ggplot2 Elegant Graphics for Data Analysis. <https://ggplot2-book.org/>

***Other Resources***

* <https://www.cs.ubc.ca/~tmm/vadbook/>
* Peer-reviewed journals: Most related journal subscriptions are available through the Library. I will also provide other reading materials during the semester.

# Course Approach

* We will use the Canvas system for content organization and submission of assignments. Course materials will be delivered weekly as videos, assigned readings, and links to external resources such as fantastic lectures on YouTube, articles, examples and tutorials.
* Reading ahead is important. I will assign reading homework which will be covered next week. Complete weekly reading assignments and think about some questions. After the next lecture, check if you can find the answers.
* Weeks begin on a Monday at 8 am and close on following Monday at 8am. All student work turned in later than Monday 8am of the given week will be considered late.
* The course will run for 10 weeks including the spring break. There will be about 16-module content.
* This is 10-week 3-credit course. It means the course will be a bit tensive for each week. **Your workload may be more or less depending on your prior experience with the topics we will cover. You will need to contribute 10-15 hours for this course for each week.** I will post announcements, lab assignments, and supplemental reading materials on Canvas. Please check your email regularly to ensure you do not miss any class announcements.

# Course Assignment

**A total of 600 points is possible in this course** from Reading/Lecture assignments, Labs, Quizzes, Participation/Discussions, and Final Project Deliverables.

1. **Reading/Lecture Assignments**

Videos and PowerPoints will cover theories and concepts. You are expected to go through the assigned readings ahead of the week so that you have an easier time understanding the material presented in next lecture video.

Total Points: 5 points for each lecture and 5 points for each reading assignment, **60** points total for 10weeks

1. **Labs**

There will be 6 labs to serve as hands-on introduction to data visualization in R, JavaScript, and D3.js. All labs will be submitted online via Canvas with word documents or other required files.

However, please do commit to learning and not just copying the lab report, finished maps, or steps from a classmate. Anyone caught cheating will be turned over to the departmental chair for academic dishonesty.

Total Points: 50 points per lab / **300** points total for **6** labs

1. **Quizzes**

Quizzes will be given to make you understand the basic theory and rules. There will be 6 quizzes covering material from the lectures and readings. The quizzes are for the understanding of the theory and skills.

Total Points: 30 points for each quiz / **60** points total for **2** quizzes

1. **Participation/Discussions**

* Participation is ESSENTIAL for the class. Participation through discussion board entries will be counted to your course grade. A total of 10 discussion entries will be assigned. Participation will be gauged by activity on the Canvas discussion board through asking and answering questions posed by your classmates and the instructor. If you have some tips that are easier to use in certain situations, please share them with us through the discussion board.

Total Points: 5 points for each Discussion/**30** points total for **6** discussions.

1. **Final Project**

Our class will focus on developing one data visualization project to solve a specific problem. You will choose R or JavaScript to code your program. You will construct your report including Dataset Collection (find your datasets at an assigned week), Description of the Deliverables, and Documentation on Data and Methods, and five-slide Project Presentation.

**Please discuss your research topics/plans with me prior to embarking on the final project** – If you have any difficulties, do not hesitate to contact me. Plan on creating a PowerPoint presentation that you will submit for sharing with the rest of your classmates during the last week of the course. It is your responsibility to see me during the office time through zoom meetings so that I can approve your proposed project. I will do my best to steer you towards a project that is more in line with your interest. In addition to the PowerPoint presentation, I will expect students to turn in a report with the elements outlined by the due-date given in the schedule.

Total Points: 20 points for data collection, 80 points for Project Deliverables (code and result), 15 points for project presentation, and 35 points for report (Totally **150** points for a final project).

# Technology Resources/Requirements

* Many of the materials required for this course are online, so I expect you to have very good internet connection.
* You will also be expected to utilize CANVAS, Google Drive, Google Docs, MS Word/ PowerPoint/ Excel., RStudio and JavaScript.
* Email Requirements: University policy establishes email as one of the official modes of communicating with students.

# Course Content

The course will cover topics as followed:

* Introduction to data visualization
* Graphics components for data visualization
* Data types and data analysis
* Common visualization idioms
* Temporal visualization with R
* Spatial visualization with R
* Interactive plot and multiple view layout in R
* Introduction to JavaScript
* Final project

Here is a tentative schedule for the course. It is subject to change and will be updated during the semester. The slides for each lecture are also subject to change until it has been taught.

**The Course Schedule for 10 weeks**

|  |  |
| --- | --- |
| **Welcome to DCSI 605** | |
| 05/15-05/21 | **Module 1: Introduction to Data Visualization** |
| Content | * Lecture:  1. Introduction to data visualization 2. Graphics Components for Data Visualization  * Discussion: Programming for making a data visualization * Reading assignment: Online material to be posted |
| 05/22-05/28 | **Module 2: Data Manipulation with R and R Markdown file** |
| Content | * Lecture:  1. Data type and data structure in R 2. Introduction to data manipulation 3. Introduction to R Markdown  * Lab: Data Manipulation * Discussion: Find two potential datasets for your final project; * Reading Assignment: Online material to be posted |
| 05/29-06/04 | **Module 3: Common Visualization Idioms and Rule of thumb in data visualization** |
| Content | * Lecture: Common Visualization Idioms  1. Introduction to ggplot2 2. Introduction to common visualization idioms  * Lab: Boxplot and Bubble plot * Discussion: 1) Are you sure you want a pie chart? 2) Does a scatter plot prove the causation? 3) How to choose an appropriate graph for your goal? * Reading Assignment: Online material to be posted |
| 06/05-06/11 | **Module 4: Data Reduction** |
| Content | * Lecture:  1. Introduction to data reduction techniques 2. Spatial resampling  * Lab: Spatial resampling * Quiz which covers the topics in Modules 1-3 * Discussion: Assess your potential datasets for your final project * Reading: Online material to be posted |
| 06/12-06/18 | **Module 5: Temporal Visualization** |
| Content | * Lecture:  1. Introduction to time series  * Lab: Time series plot * Discussion: * Reading Assignment: Online material to be posted |
| 06/19-06/25 | **Module 6: Spatial Visualization** |
| Content | * Lecture:  1. Introduction to spatial visualization  * Lab: Spatial mapping * Reading Assignment: Online material to be posted |
| 06/26-07/02 | **Module 7: Interactive plot and Multiple view layout in R** |
| Content | * Lecture:  1. Introduction to interactive plot 2. Multiple-view layout  * Lab: Introduction to interactive plot and multiple-view layout * Reading Assignment: Online material to be posted |
| 07/03-07/09 | **Module 8: JavaScript** |
| Content | * Lecture:  1. Introduction to JavaScript 2. Introduction to D3.js  * Lab: D3.js graphing * Reading Assignment: Online material to be posted * Quiz which covers the topics in Modules 4-7. |
| 07/10-07/21 | **Module 9: Finalize project-code for your visualization and write report** |
| Content | * Clean the data * Code the data visualization * Write the report * Draft the presentation * Submit all the required documents |

# Grading

* There are 1200 points for the whole semester (16 weeks).

|  |  |  |
| --- | --- | --- |
|  | Graduate | Points |
| Lecture and reading | 10% | 60 |
| Labs | 50% | 300 |
| Quizzes | 10% | 60 |
| Participation/Discussion | 5% | 30 |
| Final Project (Collect data, Code your project, Present your result and Write a final report) | 25% | 150 |
| Total | 100% | 600 |

**Grading Scale**

|  |  |  |
| --- | --- | --- |
| A 93-100% | B- 80-81.9% | D+ 68-69.9% |
| A- 90-92.9% | C+ 78-79.9% | D 62-67.9% |
| B+ 88-89.9% | C 72-77.9% | D- 60-61.9% |
| B 82-87.9% | C- 70-71.9% | F 0-59.9% |

# Course Policies

**Attendance/Lateness/Late work Policy:**

Your preparedness, participation, and completion of weekly activities on time will significantly impact your course grade, and hence regularity and timeliness are desirable in order to complete this course successfully. It is recommended that you log into your course 3 to 4 times a week and check your official Ball State email account daily to view announcements and prepare for and complete assignments. Complete all assignments, quizzes, tests, and any other activities by the stated due date.

Late assignments will be penalized. The only exception to this is if the instructor is contacted with a valid reason at least 24 hours in advance of the due date/time. An extension may be granted in extreme cases. Any assignment, take home exam or research project, turned in later (3 days maximum) than the due date will be deducted 10% off the actual points each day after the due date. *After three days of the due date, your assignment will earn a zero automatically.*

Extra credit opportunity will *occasionally* come in the form of bonus point questions on quizzes, exams or lab assignments.

**Assignment Submission Policy:**

All assignments should be submitted as Word documents with extensions of .doc or .docx unless otherwise indicated in the assignment description. Assignments, unless otherwise indicated should be submitted using the assignment link in the module.

* All course submissions MUST INCLUDE THE **COURSE NUMBER, SECTION and Your name** for it to be counted. For example, when you are required to submit a word document, please name it like this: DSCI605\_M3lab\_Ava Li. In this file name, DSCI605 is the course number, M3lab is section that from the assignment title and Ava Li is your name.
* Students are responsible for all material submitted correctly for assignments. Please make sure you submit the correct version of your documents.
* This syllabus may be amended at any time by the instructor as necessary. Students will be notified of any changes in class.

**Feedback Policy:**

Questions of a personal nature, such as questions about your grade or anything personal intended for the instructor, please use your BSU email. The instructor will typically respond to messages within 24 hours of receiving them during week days (Monday-Friday) and within 48 hours on the weekend. I will read every discussion post but I will not always personally comment on the posts. I will make every effort to grade your quizzes, assignments, and discussions no later than within 5 business days of submission. Please feel free to email me before that time if you have any questions or concerns about your performance in class. Please send your emails **in time.**

* Emails must include the **COURSE NUMBER AND SECTION** in the subject line in order to be answered.
* When asking for help to fix the code error, please send me your original code and data (if necessary), **state the error clearly**.
* You are responsible for checking your email and the Canvas Course site for any updates. Please check them frequently. **Make sure that you have Canvas Announcements notifications turned on.**

**Grading Policy:**

It is my policy that appropriate evaluation of your academic performance is an integral part of your learning experience. In the absence of mistake, fraud, bad faith or incompetence, I will be the key decision-maker on the assignment of grades. Please make your documents and/or graph readable and organized clearly.

**Course Withdrawal Statement:**

The course withdrawal period ends **XXX.**  Before this date, students can elect to receive a “W” for the course by completing and submitting the proper form. The instructor’s permission is not required.  For details, see <https://www.bsu.edu/about/administrativeoffices/registrar/registration-activities/withdraw-from-classes> as well as Degree Requirements and Time Limits in the current Undergraduate Catalog OR Withdrawal Procedures in the current graduate catalog.

**Academic Integrity Policy:**

See the Ball State University Policy on Academic Honesty and student ethics policy <https://www.bsu.edu/about/administrativeoffices/vice-provost/student-services/academic-integrity>.

The course instructor takes the following situation very seriously.

* Failure to cite work that was completed by or with another person or persons (unless a group project)
* Giving a false impression of completed work (computer generated artifacts) as your own when in fact it is not
* Copying homework from fellow students or from other online or printed resources

**Students with Disabilities:**

Some elements of this course may not be accessible to persons with some types of disabilities. If you need course adaptations or accommodations because of a disability, please contact Ball State’s Disabled Student Development (DSD) office. DSD coordinates services for students with disabilities. Documentation of a disability needs to be on file in that office before any accommodations can be provided. Disabled Student Development can be contacted at 765-285-5293 or dsd@bsu.edu. Further online information for students may be found at the BSU Disabled Student Development web page.

**Academic Integrity:**

Students are expected to adhere to University guidelines as presented in the Code of Student Rights and Responsibilities as outlined in the student handbook.

Etiquette Statement: Please remember the following in all forms of communication in this course:

• Be mindful to not use language that could be considered strong or offensive.

• Keep all writings and correspondence as professional as possible.

• Keep writing to a point and stay on topic.

• Double-check all writing to make sure that it clearly conveys the exact intended message.

**Data Privacy Information:**

It's important that you know how to protect your data and privacy. Visit [IT's policies page](https://www.bsu.edu/about/administrativeoffices/information-technology/about/policies-procedures-forms)for information about Ball State data and privacy policies. To learn about what data is collected and what steps you can take, visit the privacy information pages for specific technologies used in this course below.

**Technical Information:**

Become familiar with the class interface before the semester begins and seek help if necessary. BSU provides resources to help you. A lack of Canvas knowledge is not an acceptable excuse for late or incomplete work.

*Technical Equipment:*

In order for you to be successful in this type of course (e.g. online delivery, distance education), you will need the technology listed in the “Technology for Online and Distance Education Students.”

*Technical Assistance:*

If you have technical questions, you can contact Ball State's Help Desk. In addition, the Help Desk staff has put together many how-to video clips in its Tech Clips section that can guide you through many of the most common questions. The helpdesk can be contacted at: 1765-285-1517 or email at helpdesk@bsu.edu.

**Special Services:**

If you need course adaptations or accommodations because of a disability, please contact me as soon as possible. Ball State's Disability Services office coordinates services for students with disabilities; documentation of a disability needs to be on file in that office before any accommodations can be provided. Disability Services can be contacted at 765-285-5293 or [dsd@bsu.edu](mailto:dsd@bsu.edu).

**BSU Diversity Statement:**

Ball State University aspires to be a university that attracts and retains a diverse faculty, staff and student body. We are committed to ensuring that all members of the community are welcome through valuing the various experiences and worldviews represented at Ball State and among those we serve.

We promote a culture of respect and civil discourse as expressed in our [Beneficence Pledge.](https://nam05.safelinks.protection.outlook.com/?url=http%3A%2F%2Fcms.bsu.edu%2Fabout%2Fadministrativeoffices%2Fstudentrights%2Fpoliciesandprocedures%2Fbeneficence&data=02%7C01%7Cmbegum%40bsu.edu%7C7c387d3fabac41256bd308d83e6dd472%7C6fff909f07dc40da9e30fd7549c0f494%7C0%7C0%7C637327989650946428&sdata=iRWWLPFRCEG7JBfl4X4SO6bWl7j95Jf%2Bi1YxPp0YrhM%3D&reserved=0#_blank)For Bias Incident Response information, please click[here](https://www.bsu.edu/campuslife/multicultural-center/bias-incident-reporting#_blank) or e-mail [reportbias@bsu.edu](mailto:reportbias@bsu.edu).