DASC 3240 Data Visualization in Science
Spring 2024-25

1. Instructor(s)

Name: Masayuki USHIO

Contact Details: Room CYT-2013 (Lift 35/36), ushio@ust.hk,

2. Meeting Time and Venue

Lectures:	**Date/Time:**	Monday and Wednesday (10:30–11:50)
	Venue:	CYT G009B
Tutorials:	**Date/Time:**	Thursday (18:00–18:50)
	Venue:	Room 2304 (Lift 17/18)

3. Course Description

Credit Points: 3 Pre-requisite: DASC 2220 Exclusion: COMP 4462

Data visualization is the graphical representation of applied data science. It can also provide us with a powerful way to communicate data-driven findings, motivate analyses, and detect flaws in an infographic or dashboard. This course illustrates how to use the techniques of data visualization and discovery tools to explore, visualize and analyze data. By the end of the course, students will be able to utilize tools and packages in R or Python to enhance their skills on science communication.

4. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Elaborate the basic concept of visualization tools.
2	Do simple data processing given a variety of data formats with R/ Python.
3	Formulate a visualization solution to some real-data problems and interpret the results by graphs.
4	Implement some visualization techniques with R or Python.
5	Apply the conceptual and practical skills to interpret data in physics, chemistry, life science and ocean science as well as other disciplines with data.

5. Course Assessments

- Weekly Assignments (40%)
- Final Project (60%)

Assessment Task	Contribution to Overall Course (%)	Due Date
Weekly Assignments (Total 8 assignments)	5% each, 40% in total	Before the first class in each week
Final Project	60%	17:00, 16 May 2025

6. Major References

- Claus O. Wilke, "Fundamentals of Data Visualization", StackAbuse. ISBN 9781492031086, https://clauswilke.com/dataviz/
- Hadley Wickham, Danielle Navarro, and Thomas Lin Pedersen, "ggplot2: Elegant Graphics for Data Analysis (3rd edition)", https://ggplot2-book.org/
- Holz Yan, "from Data to Viz" https://github.com/holtzy/data_to_viz (MIT license)

7. Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Assignments	ILO1, ILO2, ILO3, ILO4	This task assesses students' knowledge of and ability to implement basic data visualization (ILO1, ILO2, ILO3, and ILO4).
Final Project	ILO1, ILO2, ILO3, ILO4, ILO5	This task assesses students' knowledge of and ability to implement basic data visualization (ILO1, ILO2, ILO3, and ILO4), and application of the conceptual and practical skills to interpret data (ILO5).

8. Final Grade Descriptors

Grades	Short Description	Elaboration on Subject Grading Description
A	Excellent Performance	Students demonstrate a deep and thorough understanding of the fundamental principles of data visualization, including layout, color usage, licensing, and tools for visualizing data. They are able to produce graphs that accurately and effectively represent the key features of raw data. Their code is correct, well-formatted, and easily understandable by others. They can accurately interpret graphs in any format.
B	Good Performance	Students demonstrate a strong understanding of the fundamental principles of data visualization, including layout, color usage, licensing, and tools for visualizing data. They are able to produce graphs that accurately represent the key features of raw data. Their code is generally correct and well-formatted, and it can be understood by others with careful review. They can accurately interpret graphs in most formats.
C	Satisfactory Performance	Students demonstrate a satisfactory understanding of the basic principles of data visualization, including layout, color usage, licensing, and tools for visualizing data. They are able to produce graphs that represent the key features of raw data, although they may overlook some important details. Their code is generally correct, but the graphs may not always be reproducible by others. They can accurately interpret graphs in standard formats.
D	Marginal Pass	Students demonstrate a minimal understanding of the basic principles of data visualization, including layout, color usage, licensing, and tools for visualizing data. They are able to produce graphs, but their graphs may lack some key features of the raw data. Their code may work, but it is difficult for others to read and often fails to reproduce the graphs. They can interpret graphs in common formats, but they often misinterpret graphs in less common or more complex formats.
F	Fail	Students have not met the minimum requirements for the course. They demonstrate a lack of understanding of the core concepts and tools in data visualization. They are unable to produce graphs in most formats. Their code does not work, and graphs cannot be generated. They are unable to interpret graphs in most formats.

9. Communication and Feedback

Marks for the assessments and Final Project will be communicated via Canvas within two weeks of the assessment date.

10. Course AI Policy

In this course, students are allowed to use generative AI to assist them in various ways. However, appropriate credit must be given for any use of generative AI. Additionally, students must review, analyze, and revise the output from AI to ensure it is better suited for the assessments or projects. Students must not copy, paste, and submit the output as if it is entirely their own work.

11. Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity – HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

DASC 3240 Spring 2024-25 Tentative Course Schedule

Lectures: Monday and Wednesday (10:30–11:50)

Venue: CYT G009B

Wk	L#	Date	Topic	Format	Assignments
1	1	3 Feb (Mon)	Course introduction Basics in figure and data presentation I	Lecture	
	2	5 Feb (Wed)	Basics in figure and data presentation II	Lecture	
2	3	10 Feb (Mon)	Basics in figure and data presentation – Exercise	Hands-on	
	4	12 Feb (Wed)	R and RStudio – I. Overview and installation	Lecture + hands-on	
3	5	17 Feb (Mon)	R and RStudio – II. R basics	Lecture + hands-on	
	6	19 Feb (Wed)	Data manipulation and ggplot2	Lecture + hands-on	
4	7	24 Feb (Mon)	Plotting data – Basics and more	Lecture + hands-on	
	8	26 Feb (Wed)		Assignments	Yes
5	9	3 Mar (Mon)	Scatterplot and regression	Lecture + hands-on	
	10	5 Mar (Wed)		Assignments	Yes
6	11	10 Mar (Mon)	Visualization of high dimensional data: PCA and others	Lecture + hands-on	
	12	12 Mar (Wed)		Assignments	Yes
7	13	17 Mar (Mon)	Visualization of spatial data: Maps and images	Lecture + hands-on	
	14	19 Mar (Wed)		Assignments	Yes
8	15	24 Mar (Mon)	Understanding variations and uncertainties in plots	Lecture + hands-on	
	16	26 Mar (Wed)	Understanding and interpreting plots	Lecture + hands-on	
9	17	31 Mar (Mon)		Assignments	Yes
		2 Apr (Wed)	Mid-term break	No class	
10	18	7 Apr (Mon)	Random topics in data visualization and programming	Lecture + hands-on	
	19	9 Apr (Wed)	plotly – Interactive plots	Lecture + hands-on	
11	20	14 Apr (Mon)	gganimation – Creating animation	Lecture + hands-on	
	21	16 Apr (Wed)		Assignments	Yes
12		21 Apr (Mon)	Easter Monday	No class	
	22	23 Apr (Wed)	Integrating R and Python	Lecture + hands-on	
13	23	28 Apr (Mon)	Preparing publication-ready plots	Lecture + hands-on	
	24	30 Apr (Wed)		Assignments	Yes
14		5 May (Wed)	Buddha's Birthday	No Class	
	25	7 May (Wed)	Course Review and Q&A session		

DASC 3240 Spring 2024-25 Tentative Schedule for Tutorials

Tutorials: Thursday (18:00–18:50)

Venue: Room 2304 (Lift 17/18)

Wk	T#	Date	Topic	
1	1	6 Feb (Thu)	Setting up R/RStudio environment	Technical support for the setup
2	2	13 Feb (Thu)	Setting up R/RStudio environment	Technical support for the setup
3	3	20 Feb (Thu)	R and basic statistics	
4	4	27 Feb (Thu)	R and basic statistics	
5	5	6 Mar (Thu)	Scatterplot and regression	Follow-up section for scatterplot
6	6	13 Mar (Thu)	Visualization of high dimensional data: PCA and others	Follow-up section for dimension reduction
7	7	20 Mar (Thu)	Maps and images	
8	8	27 Mar (Thu)	Understanding uncertainty	
9		3 Apr (Thu)	Mid-term break	No Class
10	9	10 Apr (Thu)	Setting up environment for animation	Technical support for the setup
11	10	17 Apr (Thu)	Setting up environment for Python	Technical support for the setup
12	11	24 Apr (Thu)	Setting up environment for Python	Technical support for the setup
13		1 May (Thu)	Labor Day	No Class
14	12	8 May (Thu)	Course Review and Q&A session	