BRANDEIS UNIVERSITY
INTERNATIONAL BUSINESS SCHOOL

BUS 240 f2: Information Visualization
Course Syllabus
Fall 2018

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Class Hours: *TuTh 2:00 PM – 3:20 PM*.
Location: *Sachar International Hall*

Office Hours: Mondays10:30 – 11:45 AM
Tuesdays 10:30 – 11:45 AM, 3:30 – 4:30 PM
Thursdays 3:30 – 4:30 PM, 6:30 – 7:30 PM
and by appointment

Office: Sachar 1C (at the rear of the computer cluster)

TA's: Siqi Zhang and Yaxian Lin

WORLD
READY

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**Overview
Catalog Description**

Modern computer graphics provide many ways to tame "big data," allowing users not only to view multidimensional information, but to interactively explore, combine, and interpret massive volumes of information using software tools including R and Tableau.

Meets for one-half semester and yields half-course credit.

Course Description

Among the most promising developments in data analytics is the growth in Information visualization capabilities. Across numerous disciplines, tools and techniques are emerging that help people interactively analyze and understand the flood of data now available. Not only is there is staggering growth not only in the availability of tools, but also in the domains in which these techniques are deployed.

Visualization can tap into the ways in which humans rapidly and intuitively process information, taking advantage of IT tools to move beyond tabular displays and simple graphs. The theory and techniques of data visualization not only make information accessible, but can open paths to exploration of cause and effect.

This module provides an overview of the field of Data Visualization, presenting current theory and best practices to students. We will rely heavily on hands-on learning, interspersed with readings, cases, lectures and occasional guest speakers. Although we naturally will use particular software, the lessons are aimed at principles so that students can continue to refine their skills as new tools emerge. Students will learn to evaluate and assess existing visualizations as well as develop their own information-rich interactive displays.

Learning Goals and Objectives

Upon successful completion of this module, students will be able to:

- Create complex data visualizations the address the needs of business users;

- Understand and apply strategies of analytical design;

- Use visualization packages and original coding to produce effective visualization products

- Acquire, parse, and analyze abstract data sets

- Make specific recommendations for improvement and enhancement of visualizations created by others;

- Demonstrate agility in rapidly creating prototype visualizations

Intended Audience

Graduate students at IBS in various degree programs, of different nationalities and different work experience.

Delivery Method and Instructional Approach

Course will take place in a classroom and will include online elements for accessing materials and submitting work on the Brandeis learning management system (LATTE).

This course will use both standard classroom lecture-structure and a flipped classroom. For certain class days, the students will access lecture-style materials prior to class where they will then apply the concepts and topics while their work is facilitated by the instructor and TAs. On other days, the instructor will present his lecture within the designated class-time while students are expected to complete any assignments outside of class.

Required Readings	Cairo, Alberto (2013) *The Functional Art*, New Riders, 2013
	Yau, Nathan (2011). *Visualize This: The FlowingData Guide to Design, Visualization and Statistics*. Wiley
	Other required readings as posted on LATTE site.
Recommended Readings	See "Learn More" tab on LATTE.

Assessments	1. 8 individual on-line chapters at DataCamp.com (Note: 4 assignments, consisting of 8 chapters)
	2. 2 individual peer-reviewed visualization tasks (LATTE Workshops)
	3. 1 pair visualization assignment (done with 1 partner)
	4. 2 team-based assignments
	5. several short Forum entries in response to reading-related prompts
	6. "Speed" presentations (team-based) instead of final exam

Course grade weightings		
	Course engagement	10%
	(includes Forum entries and in-class participation)	
	Peer-reviewed visualizations (2)	20%
	Individual DataCamp assigned chapters (8)	20%
	Pair visualization assignment	10%
	Team-based longer assignments (average of 2)	40%
	TOTAL	100%

Prerequisites

BUS 211f <u>or</u> permission of instructor.

Other Course Technology

     All of the software we will use in this course can be accessed on the public computer clusters at IBS and/or on your personal laptops. If you do use a laptop, the class schedule below indicates dates when it will be useful to have it with you.

     Most of the data we will analyze will come from a variety of open-access and IBS-supported website and databases. Additionally, we will use the following tools:

- **R**: R is a free software environment for statistical computing and graphics, and is widely used by both academia and industry. In this module we will use R mainly for data visualization. The advantage of the R software is that it can work on both Windows and Mac-OS. It is ranked no. 1 in the KDnuggets 2013 poll on top languages for analytics, data mining, and data science. RStudio is a user friendly environment that has become popular.

     R Software: http://www.r-project.org/index.html.
     RStudio: http://www.rstudio.com/products/RStudio/#Desk

- **Tableau**: Tableau provides an environment for data management and visualization, as well as some basic statistical functions. It is one of the fastest-growing tools available for laptops and desktops, and there are free Academic versions for Windows and Mac-OS.

- **DataCamp:** www.datacamp.com offers an excellent free (to us) instructional platform. For some technical skills, you will complete some independent

Student Engagement: Classroom and other Contributions

individual assignments at your own pace via DataCamp. By moving these skill lessons out of the classroom, we will have more in-class time to discuss complex topics and solve problems together.

Class participation is important in this course both as a means of developing understanding and as an indicator of student progress. Participation can take many forms, and each student is expected to contribute actively, freely, and effectively to the classroom experience by raising questions, demonstrating preparedness and proficiency in the analysis of assignments and cases, and explaining the implications of analyses in context. Homework-based discussion and presentations are an important part of participation. ***To this end, regular class attendance is required, and students should use name cards****.* We meet only twelve times, so absence can become a serious problem. Even if you must arrive late or leave early, be here.

With assistance from the TA, I will evaluate the quality of your contributions in class each evening, as well as the quality of your contributions via email, LATTE discussion, etc. These will all be factored together in determining your ultimate Engagement grade. In general, absence from class reduces your contribution grade.

Your engagement in the course will also take the form of a few short Forum posts in response to assigned reading and to other student comments.

DataCamp assignments

Early in the term, you'll receive a link to join our DataCamp course group. To access the assignments, you need to be in the group.

We'll use DataCamp to introduce several important technical details of the r packages `ggplot2` and `ggvis`. There are four on-line assignments to complete comprising 8 chapters in all. Each chapter should take 30 to 60 minutes. You must complete these by yourself prior to the deadline.

Scoring will be as follows:

DataCamp score achieved	Points earned
80 – 100	3
60 - < 80	2
40 - < 60	1
< 40 or missed deadline	0

Other Assignments and Projects

a) There will be two "Peer-Reviewed" LATTE WORKSHOP assignments in which you (a) prepare some visualizations by yourself and then (b) review and comment on a classmate's work.

b) One assignment will be done in pairs – you and one partner will collaborate on designing and creating a visualization.

c) Two other assignments will be "Projects" requiring more significant time and analysis. The projects will be prepared in teams of four to five students (I will assign you to a team).

   a. The 2nd project also includes a "Speed Session". In place of a final exam, we will spend 80 minutes during which every team will have 5 minutes to present and demonstrate their interactive dashboard.

All assignments should be submitted via LATTE upload prior to the start of class. Papers should be professional in appearance and use clear, grammatically correct business English. Consistent with the orientation of the module, all work should reflect an understanding of the impact of visual appeal.

Workload Expectations

Success in this two- credit course is based on the expectation that students will spend a minimum of 9 hours of study time per week for six weeks in preparation for class (readings, papers, discussion sections, preparation for exams, etc.)."

Academic Integrity

You are expected to follow the University's policies on academic integrity (see http://www.brandeis.edu/studentaffairs/srcs/ai/index.html). Instances of alleged dishonesty will be forwarded to the Office of Campus Life for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University.

Disabilities

If you are a student with a documented disability on record at Brandeis and wish to have a reasonable accommodation made for you in this class, please see me immediately.

Course Teams

Working with partners is an excellent way to gain understanding of this subject. Most of the assignments in the course must be done as individuals, but you will be assigned to a team for the two projects. As you work in your teams to complete assignments, with a few caveats:

- Be sure that you are neither carrying nor being carried by the group; each member of the group is entitled to learn and is expected to contribute.
- Even in the context of group work, each student is responsible for the quality and timeliness of the submitted work.
- If your team is experiencing performance problems, please speak with me at once.

Course Outline

Note: for each session, you should complete the assigned reading *before* coming to class. See list of deliverables on next page; detailed assignments will be distributed in class each week and posted on LATTE, and all assignments and handouts will also be available on our LATTE site. Watch LATTE closely for updates.

Session # & Date	Topics and Readings to do <u>before</u> class	DataCamp assignment due by class	Deliverable Due by class time
	Theme 1: Foundations		

#1 Thurs Oct 25	**Business Uses of Visualization & Available Technologies**
	• **WATCH** on LATTE
	   o Carver video #1 on LATTE
	   o Hans Rosling (Gapminder.org) TED talk
	• Yau: Intro & Chap 1
	• Cairo Chap 1
	• WATCH: Carver lecture video
			Forum post responding to Rosling video;
			
			Complete your "Data Science Profile"

#2 Thu Nov 1	**Human Perception & Cognition: Visual Thinking Process** • Ware, Chapter 11 (on LATTE) • **WATCH**: Cairo: The Functional Art Intro (LATTE) • Cairo, Chap 5 • Yau, Chap 3 (to p. 75, skim the rest) • **INSTALL** Tableau desktop • **WATCH**: Intro to Tableau (link on LATTE) **Introduction to the tool kit: out-of-the-box software (Tableau) and custom programming (R)**		Forum Post

Session # & Date	Topics and Readings to do before class	DataCamp assignment due by class	Deliverable Due by class time
	Theme 2: Exploration and Discovery		
#3 Tues Nov 6	**Methods for Detecting and Displaying Patterns** • **WATCH** Cairo, Chap 2 video • Skim: Cairo Chap 2 • William S. Cleveland and Robert McGill, "Graphical Perception: Theory, Experimentation and the Application to the Development of Graphical Models", *J. Am. Stat. Assoc.*, Vol. 79, No. 387, pp. 531-554, 1984 (LATTE)		Visualization I (LATTE WORKSHOP— see LATTE for details)
#4 Thurs Nov 8	**Design choices: Matching Data Types, Plots and Objectives** • **WATCH**: Carver video #2 on LATTE • Hadley Wickham, "A Layered Grammar of Graphics", Journal of Computational and Graphical Statistics, Vol 19, No. 1, pp. 3-28, 2010. • Yau, Ch. 4 & 5	**Data Visualization with ggplot2 (Part 1) Introduction.** (1 chapter)	
# 5 Tues Nov 13	**Making Complex Relationships Visible** • Yau Ch. 6 & 7 • Cairo, Ch. 6 • B. Schneiderman, "The Eyes Have it" (1996)		Visualization 2 in pairs
#6 Thurs Nov 15	**Special considerations for time-based and geographic data** • Yau, Ch. 8	**Data Visualization with ggplot2 (Part 3) Plots for specific data types (1)** (1 chapter)	
	Theme 3: Presentation Graphics		
#7 Tues Nov 20	**Static Visuals that Inform and Persuade** • Cairo, Ch. 8 • WATCH Carver Video #3 (LATTE)	**Data Visualization with ggplot2 (Part 3) Plots for specific data types (2)** (1 chapter)	
Thurs Nov 22	**Thanksgiving Day – no classes**		
#8 Tues Nov 27	**Automating and Animating** • Yau, Ch. 2 (pp. 22-38) • Package **rvest** intro (see links on LATTE)		**Project 1**
	Theme 4: Interactive Story-Telling		
#9 Thurs Nov 29	**Planning Ahead: Prototyping and Story-Boarding** • Yau, Ch. 9 • Cairo, Ch. 8 (revisited) • Berinato, *Good Charts,* Chap 4 (LATTE)	**Data Visualization with ggvis – 5 chapters (full course)**	

Session # & Date	Topics and Readings to do before class	DataCamp assignment due by class	Deliverable Due by class time
#10 Tues Dec 4	**Incorporating User Controls** • **WATCH**: Carver video #4, LATTE • Cairo, Ch. 9 • Kirk, *Data Visualization*, Chap7 (LATTE) • Skim: Herr & Shneiderman 2012 (LATTE)		Visualization 3: LATTE WORKSHOP
# 11 Thurs Dec 6	**Dashboards for Business Intelligence and Decision Support** • Few, "Thirteen Common Mistakes in Dashboard Design" Ch. 3 in *Information Dashboard Design* (2006) • Simon, *Visual Organization,* "Coda" (2014)		
	Theme 5: Bringing it All Together		
# 12 Tues Dec 11	**Project "Speed Presentations" instead of final exam**		
Fri Dec 14	• Submit final project before midnight		**Project 2**

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