SRA 468: Visual Analytics for Security Intelligence

(Subject to Change)

Course description

SRA 468 brings the frontier issues in the areas of visual analytics to the class.in the context of security intelligence. This course surveys the theories, designs, and techniques for visualizing and analyzing security information, and also provides students with an opportunity to conduct intelligence analysis with empirical data.

The course consist of class lectures, labs, and team projects. The lectures focus on the theoretical, design, and technical foundations for visual analytics. The labs help student learn current technologies and tools used by intelligence analysts (e.g., ArcGIS, Tableau) and assist students to better understand the applications of theories and designs in real world. Through the team project, students can apply their knowledge and skills in a case of security intelligence.

Course Objectives

Upon completion of this course, each student should be able to:

- Discuss the importance of information visualization and visual analytics;
- Understand the basic theories of visual perception that guide visualization design;
- Choose appropriate visualization designs based on data types and tasks; and
- Conduct visual analytics with common software tools, such as ArcGIS.

Course Information

Credits	3
Course	SRA 468
Location	IST 208

Teaching Team

Instructor	Xiaolong "Luke" Zhang
Office Phone	(814)863-9462
Office Fax	(814)865-6426
Office Address	307D IST Building
Office Hours	11am to 12pm Wednesday or by appointment
E-mail	lzhang@ist.psu.edu
Homepage	http://zhang.ist.psu.edu

TA	Jian-Syuan Wong
Office Address	IST 327
Office Hours	2:15pm – 3:15pm Wednesday & Friday or by appointment
Email	jxw477@ist.psu.edu

Required Text

- Michael Law and Amy Collins, 2013, Getting to Know ArcGIS for Desktop, Third Edition, ESRI Press.
- Mitchell, A., 1999, ESRI Guide to GIS Analysis, v. 1, ESRI Press.
- Additional readings will be provided in the course website.

Tentative Schedule (Subject to Change)

Week 1: **08/22**

Course introduction
Introduction to visual analytics (readings: on the page of supplemental readings and resources)
Team project briefing

Week 2: **08/29**

ArcGIS introduction (readings: Chapter 1 & 2 of Getting to Know ArcGIS)
Lab: ArcGIS—Basic and Display (Chapter 3-10)
Visual analytics: case study 1
Project: understanding data and setting up goals
Due: Individual assignment 1 – Essay: On the roles of visualization in analytical processes

Week 3: **09/05**

Labor Day (no class)
Visual analytics: case study 2
Visual analytics: analytical process and sensemaking
Project: understanding data and setting up goals

Week 4: **09/12**

Lab: ArcGIS—Basic and Display (Chapter 3-10)
Cognitive foundations for visualization - I
Project: understanding data and setting up goals
Due: Individual lab report on ArcGIS—Basic and Display
Due: Team report 1: The objectives and data description

Week 5: **09/19**

Lab: ArcGIS—Data and Features (Chapter 11-16)
Cognitive foundations for visualization - II
Project: analyzing data with tools like Tableau, Excel, etc.

Week 6: **09/26**

Lab: ArcGIS—Data and Features (Chapter 11-16)
Information visualization (InfoVis): general ideas
JavaScript & D3 toolkit;

Week 7: **10/03**

Lab: ArcGIS—Data and Features (Chapter 11-16)
InfoVis: 1D, 2D, and multi-dimensional data;
JavaScript & D3 toolkit;
Project: analyzing data with tools like Tableau, Excel, etc.
Due: Individual lab report on ArcGIS—Data and Features

Week 8: **10/10**

Lab: ArcGIS—Case 1 (Chapter 17)
InfoVis: tree, and network;
Midterm I

Week 9: **10/17**

Lab: ArcGIS—Case 2 (Chapter 18-19)
InfoVis: categorical data, time serials;
Project: visualization designs
Due: Individual lab report on ArcGIS Case 1

Week 10: **10/24**

Lab: ArcGIS—Case 3 (Chapter 20)
InfoVis: document and text data
Project: visualization design
Due: Individual lab report on ArcGIS Case 2
Due: Team report 2: tools, visualization design, implementation (optional)

Week 11: **10/31**

Collaborative Visual Analytics Exercise
InfoVis: task, information space
Project: result analysis; design improvement

Week 12: **11/7**

Collaborative Visual Analytics Exercise
InfoVis: coordinated multiple views
Project: result analysis; design improvement
Due: Individual assignment 2 – Essay: Revisit the roles of visualization in analytical processes

Week 13: **11/14**

Collaborative Visual Analytics Exercise
InfoVis: 3D and evaluation
Midterm II
Due: Team report 3: preliminary findings

Week 14: Thanksgiving holiday: no class

Week 15: **11/28**

Advanced Issues
Project: build-up story
Due: Collaborative exercise report

Week 16: **12/05**

Project Presentation
Team report write-up.
Due: Team final report (Introduction, data analysis, tools & technology, visualization designs; design implementation, findings, conclusion) (Due 12/11)

Course Prerequisites

IST 110; SRA 111

Examinations and Quizzes

This course has no exam. The course will have three pop-up quizzes.

Grading Policy

Individual essays	15% (7.5% each)
Individual lab reports	20% (5% each)
Group project reports	30% (10% each)
Group project presentation	5%
Group final project report	10%
Midterms	15% (7.5% each)
Class participation	5%
Extra credit (participating in research studies in IST)	up to 3% (1% point for each participation)

A	95 and above
A-	90-95
B+	85-90
B	80-85
B-	75-80
C+	70-75
C	65-70
D	60-65
F	below 60

Course Policies:

Classes, Exams, and Assignments:

- **Exams:** There will be NO make-up examinations unless pre-approved by the instructor.
- **Group assignment:** Each group submits a report through Penn State Course Management System.
- **Late Policy:** No late submission is accepted.
- **Attendance:** Attending class is required. If you cannot come, please let the instructor know beforehand. You will be expected to engage in class discussion actively. I encourage you to read various resources, such as information technology trade press or technology section in newspaper, to know the current hot issues and try to think about what roles database technology may play. You are also encouraged to use weblogs, or blogs, to keep personal journals of your readings and share your journals with others. Your class participation will count 5% of your final course grade. Class participation includes class attendance and active involvement in the class activity.
- **Readings:** Some sections in the textbook will be assigned as reading materials. Students are expected to read the materials that will be discussed in the class before the class meeting.

Academic Integrity:

- According to the Penn State Principles and University Code of Conduct: **Academic integrity is a basic guiding principle for all academic activity at Penn State University, allowing the pursuit of scholarly activity in an open, honest, and responsible manner. In according with the University's Code of**

Conduct, you must not engage in or tolerate academic dishonesty. This includes, but is not limited to cheating, plagiarism, fabrication of information or citations, facilitating acts of academic dishonesty by others, unauthorized possession of examinations, submitting work of another person, or work previously used without informing the instructor, or tampering with the academic work of other students.

- Any violation of academic integrity will be investigated, and where warranted, punitive action will be taken. For every incident when a penalty of any kind is assessed, a report must be filed. This form is used for both undergraduate and graduate courses. This report must be signed by both the instructor and the student, and then submitted to the dean.

Affirmative Action & Sexual Harassment:

- The Pennsylvania State University is committed to a policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by Commonwealth or Federal authorities. Penn State does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, gender, sexual orientation, or veteran status. Direct all inquiries to the Affirmative Action Office, 211 Willard Building.

Americans with Disabilities Act:

- IST welcomes persons with disabilities to all of its classes, programs, and events. If you need accommodations, or have questions about access to buildings where IST activities are held, please contact us in advance of your participation or visit. If you need assistance during a class, program, or event, please contact the member of our staff or faculty in charge.

An Invitation to Students with Learning Disabilities:

- It is Penn State's policy to not discriminate against qualified students with documented disabilities in its educational programs. If you have a disability-related need for modifications in your testing or learning situation, your instructor should be notified during the first week of classes so that your needs can be accommodated. You will be asked to present documentation from the Office of Disability Services (located in 116 Bouclé Building, 863-1807) that describes the nature of your disability and the recommended remedy. You may refer to the Nondiscrimination Policy in the Student Guide to University Policies and Rules.