

11.205 : INTRO TO SPATIAL ANALYSIS

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LAB INSTRUCTORS : Melissa Yvonne Chinchilla (myc@mit.edu), Mike Foster (mjfoster@mit.edu), Michael Thomas Wilson (mtwilson@mit.edu)

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LECTURE : Monday and Wednesday 2:30- 4pm, Room 9-354

LABS : (All in Room W31-301) Monday, Tuesday, Wednesday, Thursdays 5-7pm – To Be Assigned

Class Description:

Geographic Information Systems (GIS) are tools for managing data about where features are (geographic coordinate data) and what they are like (attribute data), and for providing the ability to query, manipulate, and analyze those data. Because GIS allows one to represent social and environmental data as a map, it has become an important analysis tool used across a variety of fields including: planning, architecture, engineering, public health, environmental science, economics, epidemiology, and business. GIS has become an important political instrument allowing communities and regions to graphically tell their story. GIS is a powerful tool, and this course is meant to introduce students to the basics. Because GIS can be applied to many research fields, this class is meant to give you an understanding of its possibilities.

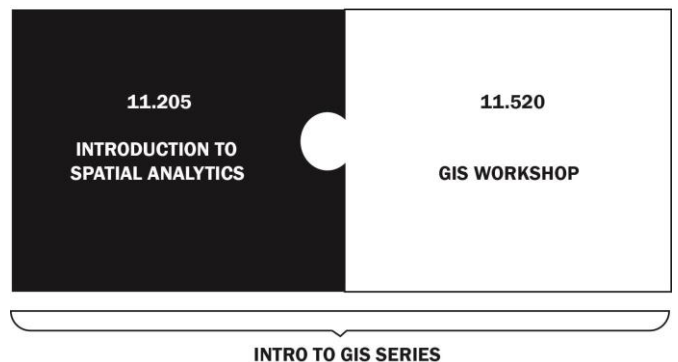


Learning Through Practice:

The class will focus on teaching through practical example. All the course exercises will focus on a relationship with the Bronx River Alliance, a local advocacy group for the Bronx River. Exercises will focus on the Bronx River Alliance's real-world needs, in order to give students a better understanding of how GIS is applied to planning situations.

11.205 and 11.520:

Introduction to Spatial Analysis (11.205) and GIS Workshop (11.520) are two modular courses which taken together make up and Introduction to GIS series. Introduction to Spatial Analysis is required by the MCP degree, students who have a previous background in GIS can test-out of this course. GIS Workshop Course (11.520) focuses on developing a research project using GIS as well as introduction to some advanced topics in data collection and web-mapping. Working on your own GIS project is the best way to learn GIS as it teaches you to apply the concepts you learn beyond the set-by-step tutorial you will learn in class. Students of all GIS backgrounds are welcome to take the GIS Workshop course. Experienced students may be interested in taking the GIS Workshop course, in order to test ideas for thesis or investigate projects that use spatial analysis. Taken together Introduction the Spatial Analysis and GIS Workshop Course give you a complete set of skills needed to start your own GIS project.



Course Objectives:

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- Provide an understanding of basic skills necessary to work with Geographic Information Systems (GIS), using ESRI's ArcGIS software.
- Learn about GIS data types.
- Learn spatial data visualization techniques and cartography.
- Learn about GIS and Local Government Data
- Learn about GIS and Census Data
- Learning Geo-Processing Tools.
- Learn about GIS and Decision Making

11.520

- Learn how to ask spatial research questions.
- Develop skills needed to work through a project that uses GIS as a management or visualization tool.
- Learn how to find publicly accessible data sets.
- Learn how to create GIS files using a variety of methods including GPS units.
- Learn about open source GIS
- Learn basic of visualizing data on the web.

Assignment & Grading:

11.205 GRADING	% of TOTAL	DUE
WEB PAGE	5%	9/11
EXERCISE #1	10%	9/18
EXERCISE #2	15%	9/25
PROBLEM SET (1)	20%	10/9
PROBLEM SET (2)	30%	10/23
EXERCISE #3	15%	10/31
CLASS PARTICIPATION	5%	NA

NO LATE ASSIGNMENTS WILL BE ACCEPTED!! I cannot accept late assignments the class is too short. If I allow late assignments it holds up grading and when other students get their assignments returned to them.

All Assignments will be posted on the stellar website.

Materials:

Hard Drive: It is recommended that everyone get an external hard drive to hold data for your assignment and final project. I suggest a minimum of a 40 GB hard drive, but even the cheapest mobile drive comes at 1TB. The "WD My Passport 1 TB" costs roughly \$69.99 on amazon, which is an amazing amount of data. This drive will be useful for this class and beyond.

Book: I have scanned most of "**GIS for the Urban Environment**" by Julie Maantay and John Ziegler, but you might be interested in purchasing as most of the readings come from that book. Amazon often has great prices.

Readings: Any articles and book chapters assigned are provided on the Stellar site.

HELPI! : There are various ways to get help for this class.

Discussion Forum on Stellar: If you have a question, it is likely that others might have that question too, or have already found a solution to the same issue. I encourage you to post questions to the discussion forum on Stellar first. Both the TA's and lab instructors will be answering questions that arrive at the discussion forum, before we answer questions received via our personal email. So please try to use the discussion board first.

Teaching Assistants and Office Hours: The Teaching Assistants will have office hours. This will be time in which you can work on assignments and ask the TA's for help - I strongly suggest taking advantage of the TA during their office hours.

GIS Laboratory in the Libraries: Located in Rotch library, this is a great resource for GIS data and technical questions. The GIS Laboratory collects GIS data and might have data you need for your final project. The GIS lab also has technical consultants available for questions regarding the acquisition of data as well as the technical questions related to performing certain GIS operations. Seek them out. They can be researched by contacting gishelp@mit.edu.

ESRI User Forums: There are two websites that are great resources for technical GIS software questions. The old ESRI user forums and the new forums websites - <http://forums.arcgis.com/> (New)

General Comment about Email:

I will not always be able to respond to email right away. Therefore it is very important that you try to use the other resources you have available such as the **discussion forum on Stellar**, the **TA's**, and our **office hours**. **There are a lot of ways to find help for this class, please don't let an unanswered email hold you back.** If I have not answered and email by the next time I see you in class please be sure to remind me at class. It is likely I did not see your email yet.

ABBREVIATED WEEKLY SCHEDULE

DATE	WEEK	Exercise Given	Exercise Due
9/3	Week 0 : Getting Started : Lab Set-Up : What Is GIS : Labs only Wednesday and Thursday	MAP BLOG	Always Due Midnight Thursday
9/8	Week 1 : Making Maps and Spatial Analysis Overview	Exercise 1	MAP BLOG
9/15	Week 2 : Joining Data Working with Parcel Data Map Design	Exercise 2	Exercise 1
9/22	Week 3 : Census and American Community Survey	Problem Set 1	Exercise 2
9/29	Week 4 : Geoprocessing Analytics and GIS	Problem Set 2	Work on Problem Set 1
10/6	Week 5 : Geocoding and Finding Address Locations		Problem Set 1
10/13	Week 6: No Lecture : Wednesday Guest Lecture - Labs Work on Problem Set 2	Must Add 11.520 by this Week	Work on Problem Set 2
10/20	Week 7 : Raster Decision Making, Suitability Analysis and GIS	Exercise 3	Problem Set 2
10/27	Week 8 : ONLY CLASS FOR 11:520		Exercise 3

WEEKLY SCHEDULE

Week 0 – *Getting Started and What is GIS? (9/3/2014)*

- Familiarize with Lab
- Desktop Environment Setup
- Webspaces and Blog Setup
- What is GIS?

Readings:

Longley - Chapter 2

Juliana Maantay and John Ziegler, *GIS for the Urban Environment*, ESRI Press, 2006 - Chapter 1

Resources:

DUSPVIZ - What is a Website - <http://duspviz.mit.edu/workshop-what-is-a-website>

DUSPVIZ - Fancy Web Maps - <http://duspviz.mit.edu/workshop-fancy-web-maps>

Scripts - <http://scripts.mit.edu>

Find fun maps and put one on your new website/blog

Exercise 0 Assigned: Adding blog post about GIS Project to newly created web site.

Week 1 – *Cartography and Map Design (9/8 and 9/10)*

- Case Study : Power of Maps
- Map Design and Cartographic Standards

Readings:

- Terry A. Slocum, Robert B. McMaster, Fritz C. Kessler, and Hugh H. Howard, *Thematic Cartography and Geographic Visualization, Third Edition* (2009) - Chapter 1 - Introduction.
- Juliana Maantay and John Ziegler, *GIS for the Urban Environment*, ESRI Press, 2006 - Chapter 4 pg. 105-115
- John Krygier and Dennis Wood, *Making Maps: A Visual Guide to Map Design for GIS, Second Edition*, Guildford Press. 2011, Chapters 8 and 9

Case Study Readings: Power of Visualization

- Laura Kurgan, *Close-Up at a Distance, Mapping Technology and Politics*, (Chapter 9 Million Dollar Blocks), 187-204
- Rob Kitchen, Chris Perkins, and Martin Dodge, *Rethinking Maps: New frontiers in cartographic theory*, Routledge, 2009 - Chapter 1

Exercise 0 : Due - September 11, 2014 Midnight to Stellar

Exercise 1 Assigned: The Basics: Creating Maps and Working with Data

Week 2 – *Spatial Data - Types, Structures, and Representation (9/15 and 9/17)*

- Relational Databases
- Querying and Working with Tables
- Vector vs. Raster
- Nominal and Ordinal Data
- Geodatabases, Shapefiles, and formats
- Topology

Readings:

- John Krygier and Dennis Wood, *Making Maps: A Visual Guide to Map Design for GIS, Second Edition*, Guildford Press. 2011, Chapter 3 - Mapable Data
- Juliana Maantay and John Ziegler, *GIS for the Urban Environment*, ESRI Press, 2006 - Chapter 8, Chapter 4 pg. 93-105

Case Study Readings: Mining Parcel Data

- Marnie Purciel, et al. *Creating and validating GIS measures of urban design for health research*. *Journal of Environmental Psychology* 29 (2009) 457–466.

Web Sites to Explore:

- Visualizing Map Pluto - <http://blog.visual.ly/visualizing-nycs-mappluto-database/>

- Municipal Arts Society : Accidental Skyline Tool <http://www.mas.org/urbanplanning/accidental-skyline/>
- OASIS MAP : <http://www.oasisnyc.net/map.aspx>
- Cambridge Map Viewer : <http://www.cambridgema.gov/GIS/interactivemaps/Cambridgecityviewer.aspx>

Exercise 1 Due : Midnight September 18th

Exercise 2 Assigned: Working with Spatial Data

Week 3 – Quantitative Mapping: Census Data and the ACS (9/22 and 9/24)

- History of Census/American Community Survey
- Census Geometry
- Calculating New Variables and Making New Table Fields
- Census Variables
- Estimation Methods

Readings:

- Juliana Maantay and John Ziegler, *GIS for the Urban Environment* , ESRI Press, 2006 - Chapter 6
- Mark Monmonier, *How to Lie with Maps*, University of Chicago Press, 2nd Edition, 1996 – Chapter 10 - Data Maps
- Alan Peters and Heather MacDonald, *Urban Policy and the Census*, ESRI Press 2011 - Chapters 1-2
- Tritch, Teresa, “ How to get Better Insurance Data, Without Encouraging Conspiracy Theories”, New York Times, April 25, 2014

Web Site to Explore:

- Census Data Visualization Site : <https://www.census.gov/dataviz/>
- Mapping the Census : New York Times <http://projects.nytimes.com/census/2010/map>
- Where we Came From State by State : <http://www.nytimes.com/interactive/2014/08/13/upshot/where-people-in-each-state-were-born.html?>
- Mapping America Every Block : <http://projects.nytimes.com/census/2010/explorer>
- Where Poor and Uninsured Americans Live : <http://www.nytimes.com/interactive/2013/10/02/us/uninsured-americans-map.html?>
- Mapping Uninsured Americans : <http://www.nytimes.com/newsgraphics/2013/12/18/uninsured-map/>

Case Study: Health Care and The Census

- Dulin, Michael F., Thomas M. Ludden, Hazel Tapp, Joshua Blackwell, Brisa Urquieta de Hernandez, Heather A. Smith, and Owen J. Furuseh. "Using geographic information systems (GIS) to understand a community's primary care needs." *The Journal of the American Board of Family Medicine* 23, no. 1 (2010): 13-21.
- Abrams, Rachel, “In Ambitious Bid, Walmart Seeks Foothold in Primary Care Services” New York Times August 7th 2014
- Tavernse, Sabrina and Robert Gebeloff “Millions of Poor Are Left Uncovered by Health Law” New York Times, October 2, 2013

Exercise 2 Due : Midnight September 25th

Problem Set 1 Assigned: Bronx River Alliance - Bi-Lingual Signage

Week 4 – Spatial Data Formats and Geoprocessing (9/29 and 10/1)

- Data Formats
- Concepts of Spatial Analysis
- Geoprocessing Tools (Buffer, Clip, Dissolve, Update, Union, etc)

Readings:

- Juliana Maantay and John Ziegler, *GIS for the Urban Environment* , ESRI Press, 2006 - Chapter 9, pg 209-218
- Jochen Albrecht, *Combining Spatial Data, Key Concepts and Techniques in GIS*, London: Sage UK, 2007

- Schlossberg, Marc, "GIS, the US Census and Neighborhood Scale Analysis". Planning, Practice & Research, vol. 18, No. 2-3, pp.213-217, May-August, 2003

Case Study: Transportation Catchment Areas and GIS

- Anderson, Jonas and Alex Landex, "GIS-based Approaches to Catchment Area Analysis of Mass Transit" ESRI User Conference.
- Frank, Lawrence, Mark Bradley, Sarah Kavage, James Chapman, and T. Keith Lawton. "Urban form, travel time, and cost relationships with tour complexity and mode choice." *Transportation* 35, no. 1 (2008): 37-54.
- Cox, Wendell, "Region's Transportation and land-use policies have little effect on traffic congestion." The Seattle Times, May 1, 2012

Problem Set 2 Assigned: Bronx River Alliance - Transportation/Bi-Lingual Signage

Week 5 - Geocoding and Address Finding (10/6 and 10/8)

- What is Geocoding?
- Geocoding Process
- Terminology
- Geocoding Datasets
- Common Errors and Problems

Readings:

- Juliana Maantay and John Ziegler, *GIS for the Urban Environment*, ESRI Press, 2006 - **Chapter 7 pg 182-189**
- Paul A. Zandbergen, *Influence of street reference data on geocoding quality*, Geocarto International, Vol. 26, No. 1, February 2011, 35-47
- Timothy C. Hart, Paul A. Zandbergen, (2013) "Reference data and geocoding quality: Examining completeness and positional accuracy of street geocoded crime incidents", *Policing: An International Journal of Police Strategies & Management*, Vol. 36 Iss: 2, pp.263 - 294

Case Study : Geo-coding to Understand Arts and Culture

- Currid, Elizabeth and Sarah Williams, "The Geography of Buzz: art, culture and the social milieu in Los Angeles and New York", *Journal of Economic Geography*, (July, 2009) pg 1-29

Problem Set 1 Due: Midnight October 9th

Week 6 – No Monday Lecture (10/13) / (October Break) Will Have Guest Lecture on Wednesday (10/15)

Open Lab Sessions will be held Tuesday –Thursday during lab time to help with Problem Set

Week 7 – Raster Decision Making and Suitability (10/20 -10/22)

- Raster Data Format
- Map Algebra
- Overlay
- Suitability Analysis
- Decision Making and GIS

Readings:

- Juliana Maantay and John Ziegler, *GIS for the Urban Environment*, ESRI Press, 2006 - Chapter 9, pg 219-239, Chapter 12, pg 300-305
- Paul Cote, *Raster GIS Fundamentals*, Harvard GSD, 2008
- ESRI Spatial Analyst Overview

Case Study :

- Carr, M. H., and P. Zwick. "Using GIS suitability analysis to identify potential future land use conflicts in North Central Florida." *Journal of Conservation Planning* 1, no. 1 (2005): 89-105

Problem Set 2 Due: October 23rd

Exercise 3 Assigned: Raster Data and Decision Making: Due: Midnight October 30th

GIS WORKSHOP (11.520) STARTS October 27