

## Graduate Course

CSS 739 001, GGS 590 005.

## Urban Analytics



## Provisional Syllabus

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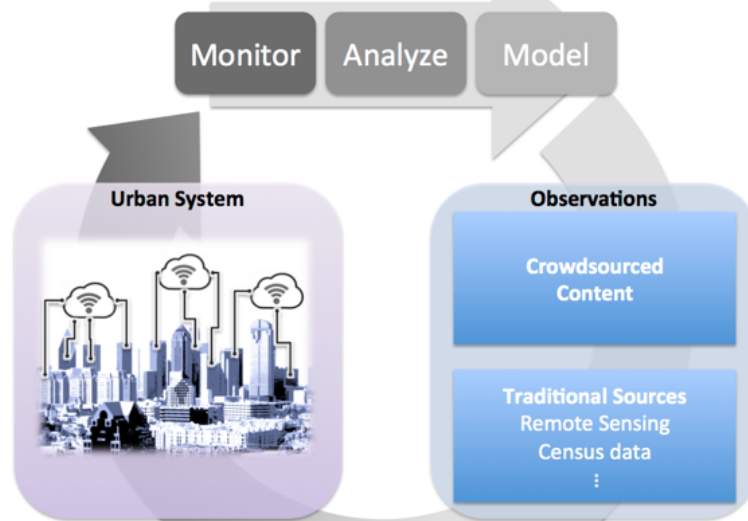
Office hours: Room 381, Research Hall, Friday 2:00-3:00, 4:30-5:00 or  
by appointment<sup>1</sup>.

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<sup>1</sup> Please note between 3pm and 4.30 pm each Friday the CSS Program offers a Seminar Series. All are welcome to attend.

## Overview

This course is a graduate-level introduction to **Urban Analytics** that focuses on the use of data to study cities. The emphasis of the class is to provide students with a understanding of what methods, tools and theory can be used to monitor, analyze and model cities. A high level overview is given in Figure 1.



**Figure 1:** Urban Analytics Concept

As an introduction to urban informatics, the course has the following *objectives*:

1. to understand the *motivation* for the use of data to study cities, including some historical aspects;
2. to learn about the variety of Urban Analytics *research programs* across the several disciplines (urban planning, regional science, public policy, geography, computational social science etc.), through a survey of the literature and case studies.
3. to understand the *distinct contribution* that Urban Analytics can make by providing specific insights about cities at multiple scales.
4. to provide the *foundations* for more advanced work in the area of Urban Analytics.

While this class has no prerequisites, and no particular computer science, programming, or advanced mathematics skills are necessary for this course, since it is specifically designed as an introductory survey. However, some basic understanding of GIS and quantitative methods is desirable. The main requirements to take this course and perform well are:

- Interest in some aspect of cities where urban analytics have been applied (e.g., the environment, transportation, urban planning, urban growth, regeneration).
- Curiosity about the how urban analytics can be applied to a wide range of problems facing cities at large.
- Basic skills in critical thinking and analytical reasoning (learning concepts, fundamental principles, and how to apply them to Urban Issues).
- Motivation to learn from case studies, research projects, and demonstrations.
- Willingness to carry out quantitative research.

### **Course Organization and Grading**

Students will get the most out of the class by keeping up with all assigned readings in advance of classroom discussions, and by *participating* in class discussion.

**Short Writing Assignments (30% of grade):** will be used for assessing the student's grasp of weekly readings and lecture topics. These will count 30% of the grade. Topics will be posted on the class website for that week. More details on the SWAs are on the class web site. These will start in week 2.

The SWA will be due by 9 AM on the day of the class. Email me ([acrooks2@gmu.edu](mailto:acrooks2@gmu.edu)) the short writing assignment and I will post them on the class website under the appropriate week (students are expected to review each others SWA before the class meeting time). **Late short writing assignments will not be accepted.**

**Presentations (25% of grade):** Students will each be required to give 2 in-depth review of a key scholars in the field of urban analytics over the course of the semester. Presentation guidelines will be posted on the course website. Or demo a specific urban analytics tool (software). Please note **presentations are due to me at 9am of the day of the class.** *Note this and in class participation make up to 25% of your of your grade. Please discuss the presentation with me the week beforehand.* In addition students who are presenting the work of the scholar are required to provide one key paper by them at least one week before the class.

**A research project** (paper and presentation) is due as the final exam and will count as the remaining 45% of the grade. The research paper will focus on either the use of data to explore an urban issue or the development of a computational model in an area of student interest related to cities. Specific guidelines and tips for preparing the research paper will be made available separately. The paper will be presented either during the final week of classes or during our *final exam* time.

Late papers will lose one quarter of a letter grade per 24 hours.

**Grading:** Student's grades will be based on the following:

- 25%: Article presentations.

- 30%: Short writing assignments, and class participation.
- 45%: Research project (10% for initial abstract and presentation, 10% for final presentation, 80% for final paper).

### **Grading Scale** (points = percentage)

95-100 = A+

88-94 = A

82-87 = A-

76-81 = B+

70-75 = B

64-69 = B-

58-63 = C

<58 = F

### **Academic Honesty and Collaboration**

The integrity of the University community is affected by the individual choices made by each of us. GMU has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct.

Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using MLA or APA format. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

As in many classes, a number of projects in this class are designed to be completed within your study group. With collaborative work, names of all the participants should appear on the work. Collaborative projects may be divided up so that individual group members complete portions of the whole, provided that group members take sufficient steps to ensure that the pieces conceptually fit together in the end product.

Other projects are designed to be undertaken independently. In the latter case, you may discuss your ideas with others and conference with peers on drafts of the work; however, it is not appropriate to give your paper to someone else to revise. You are responsible for making certain that there is no question that the work you hand in is your own. If only your name appears on an assignment, your professor has the right

to expect that you have done the work yourself, fully and independently.

The re-use of computer models is not acceptable. If one does use code from another model, please ensure the code that is used is accredited to the original model (just as you would do to a reference in a paper).

### **Disability Statement**

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 2500; 993-2474; <http://ods.gmu.edu>) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

### **Student Support Resources**

George Mason University has a number of academic support and other resources to facilitate student success (e.g., Counseling and Psychological Services, Learning Services, University Career Services, the Writing Center, etc.). See [http://www.gmu.edu/](http://www.gmu.edu) for more details.

### **Reading Assignments**

There is not one textbook that covers all the material in the class. As such we will draw on book chapters, journal articles and working papers to understand urban analytics. All readings are assigned as preparatory material to the weekly meeting. The reading material for this course consists mostly of required readings and optional recommended readings listed below and detailed for each meeting. The optional readings may or may not be discussed in class, depending on the time available, but is nonetheless included in the interest of depth and completeness.

Note that many of these will be made available on the class website under the appropriate week. Also more will be added during the course of the semester.

### **Class Website**

The class website contains all the supplementary material needed for the course. Material for each class including models is given in the assigned week.

Please note that course handouts (lecture slides) will not be available until the day of the class, however core reading material and references will be provided beforehand. I do not expect you to read all the additional references; I provide them purely for a reference resource for topics covered in class.

**You should check this website regularly for updates.**

### **Office Hours and Contact Information**

I hold office hours (Room 381, Research Hall) every Friday either between 2 to 3pm or 4.30 to 5pm (note between 3 and 4.30 is the CSS Friday Seminar series which you are welcome to attend). I am also available via appointment. Please note if you email me ([acrooks2@gmu.edu](mailto:acrooks2@gmu.edu)), I will respond but it might take up to 24 hours and I will not respond to emails over the weekend. **Please note it is George Mason University policy to use GMU assigned emails. If you email me by any other email address I will not respond.**

## **Tentative Course Schedule and Outline:**

### **Week 1: Introduction to Urban Analytics**

- **Discuss:** Course organization and administration. Questioning the city through urban analytics. Is urban analytics a new approach or a progression / updating of established methods. Is it “atheoretical”?
- **Case Studies:** NYC Data Store
- **Reading:** Batty et al. (2012); Bettencourt and West (2010).

### **Week 2: Cities as Systems**

- **Discuss:** Cities as Systems, Urban theory, how data can help with urban theory
- **Case Studies:** von Thunen model.
- **Reading:** Quercia et al. (2013) Chapter 3 of Briassoulis (2000)

### **Week 3: Sensing the City – Part 1**

- **Discuss:** The different ways in which we can measure the characteristics of the city (Social and Physical landscapes), Real time data, sensor networks, mobile data and tracking, data curation and infrastructure.
- **Readings:** Goodchild (2007); Crooks et al. (2015)
- **Demos:** Real time data, metro and tube analysis
- **Assignment:** SWA.

### **Week 4: Sensing the City – Part 2**

- **Discuss:** Continuation of Part 1, focus more on Data curation and Infrastructure, Databases, Analysis, Standards as we move from ordered to unstructured data.
- **Readings:** de Montjoye *et al.* (2013); Elwood and Leszczynski (2011); ISO 37120:2014
- **Demos:** Privacy, Record linkages and data fusion
- **Assignment:** 500 word description of semester project

### **Week 5: Term Project Idea Presentations**

- **Discuss:** Term projects

### **Week 6: Crowdsourcing Geospatial Content from Multiple Web Sources**

- **Discuss:** How show how geospatial web content can be harvested from a

- verity of social media platforms
- **Readings:** Lamprianidis et al., (2014); Lamprianidis and Pfoser (2011) Efentakis et al. (2013)
- **Demos:** Geotweets Application (Flickr, Instagram and Twitter)
- **Assignment:** SWA

### **Week 7: Visualizing the City**

- **Discuss:** Introduce visualization as a conceptual / practical framework to study cities. City Dashboards, interactive vs. static visualisations.
- **Read:** Wood et al. (2007); Anselin (2012); Harrower and Brewer (2003).
- **Demos:** City Dashboards, colorbrewer, Exploratory Spatial Data Analysis (ESDA), CartoDB, MapBox
- **Assignment:** SWA

### **Week 8: No Class Spring break:**

### **Week 9: Crowdsourcing a Collective Sense of Place**

- **Discuss:** How place is generally defined as a location that has been assigned meaning through human experience. In this class we will explore how through crowdsourcing we can computationally analyze and quantify the shared meaning of place.
- **Read:** Williams and Stewart (1998) Blei et al. (2003) Wang et al. (2007) Hidalgo and Hernandez (2001)
- **Demos:** Walk through of SensePlace
- **Assignment:** SWA

### **Week 10: Cities: Contexts and Flows**

- **Discuss:** How cities can be described from attributes to composite indicators (e.g. geodemographics), k means clustering, segregation indexes etc. Then turn to networks and flows within cities, social vs. physical flows.
- **Readings:** Vickers and Rees (2007); Spielman and Singleton (2015); Okabe et al. (2006); Hu et al. (2014).
- **Demos:** SANET
- **Assignment:** SWA

### **Week 11: No Class, Dr. Crooks out of town**

- **Assignment:** Work on class project

### **Week 12: Explaining the City**

- **Discuss:** Exploratory methods for analyzing data from simple linear regression to geographical weighted regression (GWR).
- **Readings:** Brunson et al. (1996); Fotheringham (1997); Rey et al. (2015).
- **Demos:** GWR, PySAL.
- **Assignment:** SWA

### **Week 13: Generative Urban Systems**

- **Discuss:** how cities can be conceptualized from the bottom up, touching lightly on complexity science through agent based models and cellular automata.
- **Readings:** Heppenstall et al. (2016); Crooks and Heppenstall (2012); Crooks and Castle (2012).
- **Demos:** Work from CSS Program at GMU, University College London and elsewhere.
- **Assignment:** SWA

### **Week 14: Summary of Urban Analytics**

- **Discuss:** Optimal cities and smart cities, planning and sustainability. Challenges and opportunities of using new and emerging data to study current and future cities.
- **Readings:** Batty et al. (2012 ); Jenkins et al. (2016); Waddell (2002).
- **Demos:** UrbanSim
- **Assignment:** Work on Project.

### **Week 15 & 16: In class presentation of projects.**

**Note:** Recording of any kind (audio, video), reuse of course materials, and further dissemination of the course content is not permitted unless prior written consent of the professor and George Mason University has been given or if recording is part of an approved accommodation plan.