UEP 232 Introduction to Geographical Information Systems (GIS)
Spring 2019

Location: Data Lab, Tisch Library

Time: Tue, Thu 12-1:15PM

Instructor: Sumeeta Srinivasan, sumeeta.srinivasan@tufts.edu

Lab Hours: Tue, Thu 1:15-2:15PM; and as arranged with individual students

Teaching Assistant: Emma Homstad, emma.homstad@tufts.edu

Lab Hours: TBD

There are no prerequisites. Students will be expected to have competence in computer use and some familiarity with Microsoft Windows environment and file management.

Preferred Pronouns: You can make a note of your preferred name on SIS. If you have any specific pronoun preferences, please let me know. Sumeeta's personal preferred pronouns are “she”, “her”, and “hers”.

1.0 Course Objectives:
The major goals of this course are for the student to learn:

- Spatial data structures, geo-referencing and geo-processing
- Spatial analysis methods for problem solving
- Basic concepts in spatial databases, queries and spatial statistics

By the end of this course students will have achieved the following learning objectives:

- Identify data structures in spatial data (rasters or vectors)
- Describe, design and use basic spatial databases (using keys, joins and queries)
- Implement geocoding and geo-processing techniques in ArcGIS
- Interpret spatial statistics in ArcGIS
- Use appropriate spatial analysis methods for rasters and vectors (queries, union, intersect, spatial join, zonal statistics, interpolation, density and map algebra) in ArcGIS
- Appraise spatial analysis in journal articles
- Design an independent project that incorporates spatial analysis methods

2.0 Course Description:
This course introduces Geographic Information Systems (GIS) and its applications. GIS is a combination of software, data, methods and hardware with capabilities for manipulating, analyzing and displaying spatially referenced data. In its simplest application GIS links spatial location to data to create maps. GIS software tools are very helpful in layering
location data which could be at the most micro level of individuals and buildings that can be aggregated to other spatial units. Data aggregation could be to several scales such as parcels, census units like blocks, block groups, tracts and counties in the US Census or other administrative units in other countries. This layering of different kinds of data can help us ask and answer spatial questions. For example, you could use GIS to ask: Do property related crimes cluster in the wealthiest parts of the city and homicides cluster in the poorest parts of the city? To answer this question in the US you would need to combine data on crime (perhaps at the address level) with Census data on income at the block group level. Other questions that would require combining data with different spatial units are: does the spatial distribution of tweets mentioning an election candidate cluster in locations that are of a minority race or ethnicity? Is proximity to highways correlated with more cases of pediatric asthma measured at the zip code level? Are section 8 voucher recipients (measured at the address level) likely to move to suburbs with good school districts?

The course will meet two times every week. Every week, there will be a lecture or discussion followed by lab time where students will work with GIS software. The lab exercise will segue into an assignment that must be handed in the following week. Additional time may be required beyond the hours of assigned lab time to complete exercises. The lab component will focus on the use of ArcGIS (Version 10.6) software in a Windows environment in the GIS Lab. The course will also require the student to implement an independent project (See section 4.0).

3.0 Grading:
The final course grade will be based on:

Assignments (2 points for week 1 + 4x7) 30%
Midterm exam 20%
Final project (8% paper + 20% poster + 2% abstract + 4% blog + 2% presentation) 36%
Participation (4% attendance, 10% participation in polls, class discussion, feedback to other students) 14%

4.0 Final Project
The purpose of the final project is to provide additional experience in collecting, processing and analyzing spatial data. The project can be relevant to your research interests or to your thesis/dissertation or for a joint project or final paper in another course. Students must start thinking about project ideas early in the semester. The project should use spatial analysis software to examine the spatial implications of a research problem. The student is expected to have scheduled and met the instructor for at least one discussion about their project during the project interview dates specified in Section 7.0 and before their project abstract is due. The student will also maintain a blog on the course Canvas site adding at least one paragraph about their project progress every week during the semester until the abstract is due. Students will provide feedback to at least one blog. The final project will require a paper describing the data, and methods in detail to a GIS specialist and a poster.
targeting a more general audience. Group projects are encouraged but the products of group work will be expected to scale-up to correspond to the number of members in the group (One poster for each member and a longer paper).

5.0 Textbook

Recommended: Bolstad, Paul, 2015, GIS Fundamentals, 4th Edition, XanEdu Inc. 978-0-9717647-3-6 (print) or 978-1-58390-244-8 (ebook)

6.0 Student Responsibilities for Meeting Course Objectives
1. Obtain and read the required and supplemental material. Students will be evaluated on knowledge and skills obtained from lecture, discussion, the required textbook and supplemental reading materials. Students presence in class will account for 4% of their course grade.

2. Be prepared for class discussions and participation in group problem solving. Volunteer to both discuss information, answer questions and brainstorm with your fellow classmates and give them feedback. Participation in such in-class activities will be used by the instructor to evaluate students at the end of the semester for 10% of their course grade.

3. Follow the student honor code and ethical standards. Plagiarism in your paper or cheating during an exam will not be tolerated. The academic code of conduct can be accessed over the web at: https://students.tufts.edu/student-affairs/student-life-policies/academic-integrity-policy

4. Out-of-class assignment must be professionally prepared. This means the course project and exercises will have to be legible and free of spelling errors, and poor grammar. References must be cited properly. No late assignments will be accepted under any circumstances.

5. If you need to communicate with the instructor, you may do so via e-mail, or by making a personal appointment in class or during lab hours. It may take at least one workday for the instructor to return an e-mail message. Please plan accordingly. If you need more then 5-10 minutes of the instructor's time, it may be best to schedule an appointment.

6. Please come by lab hours not only when you have questions or concerns about the material in class but also when you just need someone to brainstorm or have a conversation.

7. Be prepared to spend many hours in the lab learning to work with the software and data.

8. Available Academic Supports: Tufts University has assistance available for students in need of academic help. The Academic Resource Center
https://students.tufts.edu/academic-advice-and-support/academic-resource-center
provides writing support and advice on avoiding plagiarism, among other supports, to ensure students’ successful undergraduate careers.

9. **Students with Disabilities:** Tufts University values the diversity of students, staff, and faculty; recognizing the important contribution each student makes to our unique community. Tufts is committed to providing equal access and support to all qualified students through the provision of reasonable accommodations so that each student may fully participate in the Tufts experience. If you have a disability that requires reasonable accommodations, please contact the Student Accessibility Services office at Accessibility@tufts.edu or 617-627-4539 to make an appointment with an SAS representative to determine appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.
## 7.0 Course Outline and Readings

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<tr>
<th>Week</th>
<th>Lecture</th>
<th>Laboratory Assignment</th>
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<tr>
<td><strong>Week 1</strong>&lt;br&gt;Jan 17</td>
<td><strong>Course overview</strong>&lt;br&gt;Introduction to GIS, applications and history of GIS&lt;br&gt;Read: Campbell and Shin, Ch 1 or Bolstad Ch 1</td>
<td><strong>Lab 0:</strong> Why am I here?&lt;br&gt;&lt;i&gt;Return survey distributed in class&lt;/i&gt;</td>
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<td><strong>Week 2</strong>&lt;br&gt;Jan 22, 24</td>
<td><strong>Spatial data models</strong>&lt;br&gt;Read: Campbell and Shin, Ch 4 or Bolstad Ch 2</td>
<td><strong>Lab 1a:</strong> ArcGIS Basics tutorial&lt;br&gt;<strong>Lab 1b:</strong> Creating legends tutorial&lt;br&gt;<strong>Assignment 1 due before class</strong>&lt;br&gt;<strong>Journal note 1 due</strong></td>
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<td><strong>Week 3</strong>&lt;br&gt;Jan 29, 31</td>
<td><strong>Coordinate Systems and Projections</strong>&lt;br&gt;Read: <a href="http://giscommons.org/earth-and-map-preprocessing/">http://giscommons.org/earth-and-map-preprocessing/</a> and Campbell and Shin, Ch 2 or Bolstad Ch 3</td>
<td><strong>Lab 2:</strong> Coordinate systems in ArcGIS&lt;br&gt;Trouble shooting Coordinate Systems tutorial&lt;br&gt;<strong>Assignment 2 due before class</strong></td>
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<td><strong>Week 5</strong>&lt;br&gt;Feb 12, 14</td>
<td><strong>Databases</strong>&lt;br&gt;Read: Campbell and Shin, Ch 5-6 or Bolstad: Ch 8</td>
<td><strong>Lab 4a:</strong> Analysis with databases, queries &amp; joins Census Tutorial&lt;br&gt;<strong>Lab 4b:</strong> Spatial and attribute queries tutorial&lt;br&gt;<strong>Assignment 4 due before class</strong></td>
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<td><strong>Week 6</strong>&lt;br&gt;Feb 19, 21</td>
<td><strong>Cartography and Visualization</strong>&lt;br&gt;Read: Campbell and Shin, Ch 9; <a href="http://giscommons.org/output/">http://giscommons.org/output/</a>&lt;br&gt;Journal note 2 due</td>
<td>No class. Mondays schedule on Thursday</td>
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<td><strong>Week 7</strong>&lt;br&gt;Feb 26, 28</td>
<td><strong>Spatial Analysis: Vectors</strong>&lt;br&gt;Read: Campbell and Shin, Ch 7 or Bolstad: Ch 9</td>
<td><strong>Lab 5:</strong> Vector analysis&lt;br&gt;Groton Farm Tutorial&lt;br&gt;<strong>Assignment 5 due before class</strong></td>
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| Week 8  
Mar 5, 7 | **Spatial Analysis: Rasters**  
Read: Campbell and Shin, Ch 8 or Bolstad: Ch 10 | Lab 6: Raster analysis  
China Windfarm Tutorial  
Assignment 6 due **before class** |
| Week 9  
Mar 12, 14 | **Spatial Analysis: Statistics**  
Read: Bolstad: Ch 12 | Lab 7: Spatial Statistics  
Assignment 7 due **before class**  
**Journal note 4 due** |
| Week 10  
Mar 26, 28 | **Spatial error and uncertainty**  
Read: Bolstad: Ch 13, 14  
(**In class midterm review** | Midterm exam (Take home 24-hour exam) |
| Week 11  
Apr 2, 4 | **GIS Project intro (project interviews begin)**  
Project exercise (in class) | Assignment 8 due **before class** |
| Week 12  
Apr 9, 11 | **GIS Project interviews end**  
**Abstract due Apr 9th** | **GIS Project help** |
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**Apr 16, 18** | **GIS Project**  
**Discuss Abstract in class** | **GIS Project help** |
|  
**Apr 23, 25** | **GIS Project (in class presentation of map)** | **GIS Project (in class presentation of map)** |

**Instructor lab hours for April 30-May 7 TBD. GIS Poster is due May 7th and Paper due May 10th**