Catalog description:

Selected geographic problems. Faculty research specializations in which seminars may be offered include biogeography, climate variability, counterurbanization, field and laboratory methods in remote sensing, geographic information systems (GIS), mathematical methods, quaternary field studies, reconstructing historical environments, remote sensing theory and applications, soils, theories of development, urban trends, and regional analysis.

Course objective:

Spatial analysis, especially spatial statistical analysis, is traditionally based on the planar space assumption, that is, a phenomenon of interest is assumed to occur over a Euclidean planar space in which events can be located anywhere and distance is measured as the straight-line (i.e., Euclidean) distance. However, the assumption is barely satisfied in reality when the phenomenon of interest is concerned with human behaviors because our everyday movements are strongly restricted by transportation networks. Whereas several researchers have been started to tackle this problem and proposed network-based analytical techniques since the 1980’s, their application so far is fairly limited.

The objective of this course is to introduce a variety of network-based spatial analytical methods including both statistical and optimizational ones. Topics to be covered can roughly be categorized into the following three types:

1. Graph theory,
2. Analysis of networks, and
3. Analysis on a network, which is the major focus of the course.
Course materials:
- Textbooks
  - No particular book is assigned as a required textbook for this course. Reading assignments will consist of chapters from various books, journal articles, materials posted on websites, and so on.
  - Students are also encouraged to suggest reading materials related to the course topics.
  - See a separate handout for more information about reading materials.
- Online materials.
  - This course has an online component using the WebCT (web course tools) system (https://webct.utah.edu/webct/logonDisplay.dowebct), which provides access to course announcements, emails, and other information related to the course. It is your own responsibility to check the site periodically to obtain necessary information in a timely manner.
  - See http://webct.utah.edu/ for more information about the WebCT system. You must logon to WebCT using your university Network ID (uNID).

Evaluation:
Evaluation of this course will be based on the following components.

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Guest lecture</td>
<td>40%</td>
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<tr>
<td>Final project and presentation</td>
<td>50%</td>
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<tr>
<td>Class participation</td>
<td>10%</td>
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</table>

- Guest lecture (40%)
  - Each student will be required to select a topic of interest and give a presentation as if he/she was a guest lecturer. The topic should be related to the broad concepts of the course (that is, network and spatial analysis), but it is fairly open.
  - The presenter should
    - Provide copies of reading materials (up to three) one week in advance of his/her scheduled presentation date,
    - Prepare a PowerPoint presentation, and
    - Give a one-hour (length may vary) presentation in class.
- Final project and presentation (50%)
  - Students will be required to write a paper based upon materials covered in class this semester.
  - Evaluation of the final project will be based on (1) a one-page proposal of the project, (2) a final paper, and (3) an in-class presentation.
  - The one-page proposal of research topics is due on February 28th and should be approved by the instructor. The final paper is due on April 25th and the in-class presentation is scheduled at the last class meeting (i.e., April 25th).
  - For more information about the final project, see pages 5 and 6.
• Class participation (10%)
  o Perfect attendance is strongly recommended. Students are also expected to participate in
    and/or lead in-class discussions.
• Grading scheme
  o Final letter grades will be assigned according to the scheme provided below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>95~</td>
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<tr>
<td>A-</td>
<td>90~94</td>
</tr>
<tr>
<td>B+</td>
<td>85~89</td>
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<tr>
<td>B</td>
<td>80~84</td>
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<tr>
<td>B-</td>
<td>75~79</td>
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<tr>
<td>C+</td>
<td>70~74</td>
</tr>
<tr>
<td>C</td>
<td>65~69</td>
</tr>
<tr>
<td>C-</td>
<td>60~64</td>
</tr>
<tr>
<td>D</td>
<td>50~59</td>
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<tr>
<td>E</td>
<td>≤49</td>
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</table>

Class policies:
• Evaluation related policies
  o Individual extra credit will not be assigned.
  o There will be no “make-up” exams or assignments.
  o An “incomplete” will be given only in extreme cases when conditions beyond the
    student’s control require an extended period of absence.
  o Any assignment presented to the instructor after its due date will be worth only half of the
    earned points.
  o Materials to be turned into the instructor must be typed. No hand-written assignments are
    accepted.
• Attendance
  Perfect attendance is strongly recommended. The amount of material covered in a class meeting
  is significant and the content of the course is progressive, meaning you must know the material
  from previous class meetings in order to understand subsequent material. If students miss two
  consecutive classes, they should notify the instructor and provide an explanation. Otherwise,
  students may be contacted by the University and be required to document that they have not
  unofficially withdrawn from the class.
• Student Responsibilities
  Each student in this course is expected to act and behave according to the rules and regulations
  identified in the Student Handbook of the University of Utah
  (http://www.acs.utah.edu/sched/handbook/toct.htm). All students are expected to: (1) attend every
  class, (2) take lecture notes, (3) review the assigned readings before every class, (4) complete
  assignments and examinations on time, (5) participate in class discussions, and (6) conduct
  themselves as adults in the classroom.
  Students are encouraged to help each other in their work. However, final products turned into the
  instructor must display evidence of individual initiative and creativity. It is assumed that students
  taking this course will live up to the highest levels of academic honesty.
• Academic Misconduct
  o Academic misconduct will not be tolerated. Penalties may include failure of an
    assignment, the entire course, and/or the filing of formal charges with appropriate
    university authorities. Academic misconduct includes, but is not limited to, cheating,
    misrepresenting one’s work, and plagiarism.
Cheating involves the unauthorized possession or use of information in an academic exercise, including unauthorized communication with another person during an exercise such as an examination.

Misrepresenting one’s work includes, but is not limited to, representing material prepared by another as one’s own work or submitting the same work in more than one course without prior permission of all instructors.

Plagiarism means the intentional unacknowledged use or incorporation of any other person’s work in one’s own work offered for academic consideration or public presentation.

Liability Warning
Students are responsible for all activities on their computer accounts. Keep your user name and password confidential.

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

Tentative course schedule:
The tentative schedule of the course is listed in the following table. Please note that this schedule as well as procedures explained above is subject to change in the event of extenuating circumstances.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Note</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1/10</td>
<td>Introduction and course overview</td>
<td></td>
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<tr>
<td>2</td>
<td>1/17</td>
<td>Graph theory: basics</td>
<td></td>
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<tr>
<td>3</td>
<td>1/24</td>
<td>Graph theory: connectivity and more</td>
<td></td>
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<tr>
<td>4</td>
<td>1/31</td>
<td>Algorithms: efficiency and complexity</td>
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<tr>
<td>5</td>
<td>2/7</td>
<td>Shortest path algorithms</td>
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<td></td>
<td></td>
<td>Traveling salesman problem</td>
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<tr>
<td>6</td>
<td>2/14</td>
<td>Network flows</td>
<td></td>
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<tr>
<td>7</td>
<td>2/21</td>
<td>Introduction to spatial analysis on a network K-function analysis and its network variant SANET</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2/28</td>
<td>Discussion on students’ final project topics</td>
<td>Project proposal due</td>
</tr>
<tr>
<td>9</td>
<td>3/7</td>
<td>Vironoi diagram and its network variant</td>
<td>Student guest lecture 1</td>
</tr>
<tr>
<td>10</td>
<td>3/14</td>
<td>Network-based market area analysis</td>
<td>Student guest lecture 2</td>
</tr>
<tr>
<td>11</td>
<td>3/21</td>
<td>Spring break (No class)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3/28</td>
<td>Network autocorrelation vs. spatial autocorrelation</td>
<td>Student guest lecture 3</td>
</tr>
<tr>
<td>13</td>
<td>4/4</td>
<td>Local-scale analysis of network autocorrelation</td>
<td>Student guest lecture 4</td>
</tr>
<tr>
<td>14</td>
<td>4/11</td>
<td>TBA</td>
<td></td>
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<tr>
<td>15</td>
<td>4/18</td>
<td>AAG Annual Meeting (Instructor away, no class)</td>
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<tr>
<td>16</td>
<td>4/25</td>
<td>Final project presentation</td>
<td>Final project due</td>
</tr>
</tbody>
</table>
Guidelines for the term paper:

- Students will be required to write a paper based upon materials covered in class this semester. The following is a partial list of general directions that one might take in the paper:
  1. Focusing on software and computational aspects,
  2. Focusing on theory and methodology (for example, proposing new ones and improving existing ones),
  3. Applying methods to data of interest, and
  4. Reviewing literature of topics of interest.

  - Please note that most papers are expected to fall into the first three categories. The last category should be considered to be a backup option.

- Students may use the same data and/or articles that they have used/will use in their other projects. However, the final product to be submitted to the instructor should be independent of any other projects.

  - Students are welcome to work on their dissertation/thesis topic and include their final project for this course into their dissertation/thesis, but not the other way around.

- No group work will be accepted. The final paper must be typed (double space, 10-12 fonts); no hand-written ones are accepted. The length of the paper should be around 15 pages, excluding maps, diagrams, program codes, and things alike.

- Evaluation of the final project will be based on (1) a one-page proposal of the project, (2) a final paper, and (3) an in-class presentation. The one-page proposal of research topics is due on February 28th and should be approved by the instructor. The final paper is due on April 25th and the in-class presentation is scheduled at the last class meeting (i.e., April 25th).

- A final paper should be self-contained and include
  1. Your reasons for embarking on the project,
  2. Literature review of the topic selected

    - A minimum of 5 references (journal articles, book chapters, etc.) is required.
  3. Summary of the data you used (if any)
  4. Description of the methodology/theory you focused on and/or used to analyze the data
  5. Methodology/theory you propose and/or results of the data analysis
  6. Discussion about your findings, remaining problems, etc.

- The research paper should take the form of a scientific paper with a title page and sections listed below:
  1. A 10-15 line abstract
  2. An introduction, which presents the objective of your project and may include literature review
  3. The main body of the text, possibly consisting of several sections, which presents literature review, methodology, data, results, and discussions
  4. A conclusion
  5. A bibliography that lists all the references quoted in the text (no extra references; a minimum of 5). The references should cover both methodological and substantive aspects of the project.
Consult major journals (for example, Geographical Analysis, Annals of the Association of American Geographers, Journal of Geographical Systems, Statistics in Medicine, …) for the format, style, and contents of each section.

- The above structure may not be applied if you choose to write a paper in category (4). In that case, a final paper should consist of
  - Summaries of individual articles/book chapters
    - A minimum of 15 references is required.
  - Discussion about what you have learned through the entire review process
    - You should synthesize knowledge that you obtained from individual references.