GEO 6166 (Spring 2018)
Advanced Quantitative Methods for Spatial Analysis
Section: # 091D; Credit hours: 3.0
Lectures: R (Thursdays) → Periods 3-5 (9:35AM – 12:35PM)
Location: TUR 3012 (Turlington Hall, Room 3012)
Instructor: T.J. Fik, Associate Professor [e-mail: fik@ufl.edu]

OFFICE HOURS:
Tuesdays: 1:30PM – 4:15PM
Thursday: 1:30PM – 3:00PM; 4:00PM – 4:30PM, or by appointment
Office Location: 3137 Turlington Hall
Physical Mailing Address: PO Box 117315, Dept. of Geography, University of Florida
Gainesville, FL 32611-7315

Pre-requisites
The following courses are pre-requisites: GEO 3162c/GEO 6160 -- Introduction to
Quantitative Methods for Geographers (or equivalent) and GEO 4167c/GEO 6167 --
Intermediate Quantitative Methods (or equivalent). Students must first complete the
Intro/Intermediate Quantitative Methods sequence (or its equivalent) and/or must have
permission from the Instructor to register for this course or to take this course concurrently
with GEO 4167c_GEO 6161.

Course Description
This course surveys various and selected topics in <u>Advanced Quantitative Analysis</u> and
provides an overview of widely used techniques for spatial data analysis. It also provides a
series of highly focused discussions on a few of the more popular techniques in spatial
statistics. Emphasis is on the critical examination and analysis of spatial data, point patterns,
trend modeling and spatial interpolation, count data modeling, cluster and hot-spot detection,
and process change statistics in space and time.

Selected Topics include…
Point-Pattern Analysis & Spatial Modeling of Point Distributions
Kriging Methods and Semi-variogram modeling
Spatial Autocorrelation & Measures of Spatial Dependence (Global & Local)
Advanced Econometrics (Count Regression, Poisson and Negative Binomial Regression)
Maximum Likelihood Estimation and Model Assessment
Inverse Weighting, Kernel Density Methods, and Spatial Interpolation Methods
Geographically Weighted Regression (GWR) -- Overview
Cusum and Process-change Statistics
Applied Time-Space Clustering Statistics
Hot-Spot Analysis (K-functions, Kulldorff, Getis G, Rogerson, etc.)

Course Components (out of 400 possible points):
1. Term Project Proposal **(50 points)**
2. Final Term Project/Paper **(200 points)**
3. In-Class Presentation of Final Term Project (time permitting), Powerpoint (**100 points)**
4. Class Attendance and Participation (**50 points**)
   [Note that regular attendance is recommended and attendance will be taken periodically].

Proper classroom etiquette is expected and mandatory.
Note: Talking during lecture, the use of cell/smart phones, texting, surfing the web, or engaging in any form of social networking or "personal" computing during the regularly scheduled class period is strictly prohibited… and will not be tolerated.

Readings: Recommended and Highly Recommended*

General—Spatial Analysis
*Quantitative Geography: Perspectives on Spatial Data Analysis, A. Stewart Fotheringham, Chris Brunsdon, and Martin Charlton; Sage: Thousand Oaks, CA (2000).

Advanced Point-Pattern Analysis
Statistical Analysis and Modeling of Spatial Point Patterns, by Janinine Illian, Antti Penttinen, Helga Stoyan, and Dietrich Stoyan, Wiley: West Sussex: England (2008).

Cluster Detection & Spatial Modeling
*Statistical Methods for Spatial Data Analysis, by O. Schabenberger and C.A. Gotway, Chapman & Hall/CRC: Boca Raton, Florida (2005).

Spatial Epidemiology
Applied Spatial Statistics for Public Health Data, by L. Waller and C. Gotway, Wiley: New York (2004).

Process Change & Cusum Statistics
Statistical Detection and Surveillance of Geographic Clusters, by Peter Rogerson and Ikuho Yamada, Chapman & Hall/CRC Press: Boca Raton, Florida (2009).

Spatial Econometrics
Spatial and Spatial-Temporal Econometrics, by James P. LeSage and R. Kelley Pace, Elsevier, Emerald Publishing Group (UK): London (2004).

A note on computer software
Students may choose from a variety of available software to assist them in the completion of their final term project (based on what is best suited for your research interests and/or your project needs). Note that this is a course that surveys various techniques and methods… and is not a course in how to use specific software packages. **Students are expected to learn software on their own time**, and it is recommended that students take advantage of learning **Spatial Analyst** for **ArcView GIS** (requires GIS background, available in Geography Labs), including *GWR – Geographically Weighted Regression (version 3x) or any of the **Free** downloadable programs or options:*

Crime-Stat (for Point-Pattern Analysis and Nearest-Neighbor Statistics)
GeoDa (for Spatial Auto-Regressive/SAR model estimation, etc.)
SatScan (for Point-Pattern Analysis, Pattern Recognition, Spatial Stats, etc.)
--Programming in the language R

Note: This course is still a "work in progress" and topics, lectures or content may change without advanced notice. Student input and recommendations are greatly appreciated.

<u>Course material as presented in lecture</u>

Powerpoints/Lectures, Supplemental readings, etc,. will be available on Canvas. It is the student's responsibility to access those files. Once the semester is over, those files will be removed from the Canvas website.

Students with Disabilities
Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

Student Performance Evaluation and Grades
A student's overall performance in the course will be determined by the total points earned **out of a possible 400 points**, and based on the overall percentage:

91.0-100%	=	A
90.0-90.9%	=	A-
87.0-89.9%	=	B+
80.0-86.9%	=	B
78.0-79.9%	=	B-
75.0-77.9%	=	C+
65.0-74.9%	=	C
60.0-64.9%	=	C-
57.0-59.9%	=	D+
50.0-56.9%	=	D
45.0-49.9%	=	D-
00.0-44.9%	=	E

Grade Values for Conversion															
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	.67	0	0	0	0	0

Term Project: Applied Spatial Analysis

The term project must demonstrate a working knowledge of advanced statistical methods for spatial data analysis in an application involving cross-section, spatial, temporal, and/or spatio-temporal data to address a specific research questions. Students are expected to test a series of designated hypotheses which fall under a more general research objective and/or problem statement. The project must incorporate techniques or methods discussed in the course, extensions thereof, or other "advanced" methods (with permission from Instructor). Research topics must be pre-approved by the instructor (hence, the purpose of submitting a term project proposal for review). Students are responsible for (a) acquiring, collecting, cleaning, and managing their own data and databases; (b) model construction, development, and assessment, as well as carrying out all related computational and diagnostic procedures; and (c) the production of a final write-up (which is to include a brief literature review, overview of the research problem, and a summary and conclusion section). The final write-up must be submitted along with all supporting materials…including a copy of the data (in spreadsheet or database form), relevant output and summary tables, and technical appendices which demonstrate the mechanics or mathematics of the techniques used in the analysis. Students are responsible for analyzing their own data and results, and are required to write and submit a final paper that is not to exceed 25 pages in length (excluding tables, charts, generated output, maps, and/or technical appendices). Students are also responsible for creating a Powerpoint presentation of their projects (which will be presented to the class at the semester's end, time permitting). NOTE: Students must be prepared to present their findings to the class in a short 20-25 minute power-point presentation (Time/Date: To Be Determined). A copy of the Powerpoint slides must be submitted along with the write-up/term paper.

Term Project Due Date (Submission of Final Term Paper & Powerpoint): Thursday, April 19th, **2018 (by the end of the regularly scheduled class period for this course)**. No Late Projects will be accepted. All Projects and related materials must be submitted by the posted due date above.

Term Project Guidelines

The term project/paper/report is worth a total of 200 points – 50% of your grade for this class. Your term project/paper/report and .ppt/.pptx presentation is worth a total of 300 points – 75% of your final grade. Hence, great care should be taken to produce a paper/project and a Powerpoint presentation that clearly demonstrate a working knowledge of the methods used in your analysis.

Each student is required to submit a term paper that provides an overview of the model and methods used in their analysis, and a detailed discussion of the findings and results. All relevant graphs, plots, charts, graphics, maps, and statistical summary tables should be submitted along with a summary and write-up in a paper that is not to exceed 25 total pages in length. Note that your accompanying Powerpoint presentation should be (a) limited to no more than 30 slides maximum, and (b) submitted as a .ppt or .pptx file on CD or flash drive no later than **Thursday, April 19th, 2018 (to be collected at the end of the class period).** Attach related computer-generated output and any other relevant computer output (e.g., R-programming code, listing of software) as an appendix.

Note: The pages of the Appendix do not count as pages of text. Also, the paper must be typed, double-spaced, using standard 12pt font (Times Roman, Helvetica) with standard 1" margins. Paper should include a brief literature review, problem statement, findings, etc, etc (see next page); and submitted as a Word file in .doc/docx. format.

Prior to starting work on a term project, students must submit a 1-Page proposal/abstract (hard copy)-- basically, a synopsis of their project with student's name, tentative title, and a maximum 2-paragraph overview.

NOTE: The 1-Page, Term-Project Proposal must be submitted to the instructor for review (Due date/time: TBA). Proposals are accepted as Hard Copy Only. Once, the proposal is officially accepted, students may proceed to work on their term projects.

Specific Term-project guidelines -- The term paper/project should have **a cover/title page clearly showing the student's name and the title of the work**. Note: the cover page does not count as a page of text. The write-up should include the following items:

Title/Cover Page	***section 0***

Overview of Project or Topic & Introduction
Statement of the Problem, Objective(s)
Literature Review and Background Information   ***section I***

Re-statement of **Objective(s) and Hypotheses** (clearly defined)
Description of variables, model, and/or method(s), with
   theoretical justification of the model/methods to be utilized
Description of the data that will used in the analysis
Summary table(s) Highlighting the Pertinent Results
Discussion and Interpretation of Results   ***section II***

Summary of Results/Relevant Findings/Conclusions
Implications and Directions for Future Research   ***section III***

Statistical or Mathematical Appendix/Appendices
   w/Computer-generated Output/supporting material
Literature cited page(s) or Bibliography   ***section IV***

Term Projects must be submitted on either CD, flash drive, or as Hard Copy.
Note that "e-mail or dropbox submissions" WILL <u>NOT</u> BE ACCEPTED for any reason.
Note also that the cover/title page, statistical appendix, and bibliography do not count as official pages of text. In addition (if submitting your project in hardcopy form), the write-up must be page-numbered and the paper should be securely stapled and bound together. If submitting as hard copy, note that it is not the instructor's responsibility to bind or staple together the pages of your project/paper. Failure to submit the project in a securely bond manner will result in the loss of 50 points. Final copies of the Term Paper/Project are to be submitted to the Instructor no later than the specified "due date" and "time" as specified in this syllabus. No late projects will be accepted for any reason. NO EXCEPTIONS.

Failure to turn in a term project by the due date and time will result in a final grade of E for the course (there are no exceptions). In short, NO INCOMPLETES will be given out this term.

GOOD LUCK and GOOD JOURNEY!