GEO 6166 (Spring 2023)

Advanced Quantitative Methods for Spatial Analysis

Course # 26422 Credit hours: 3.0
Lectures: W (Wednesdays) Periods 7-9 (1:55PM - 4:55 PM)
Location: TUR 3012 - Turlington Hall, Room 3012
Instructor: T.J. Fik, Associate Professor [e-mail: fik@ufl.edu]

OFFICE HOURS:
Tuesdays: 2:00PM – 3:45PM
Wednesdays: 9:45AM – 12:00PM
Thursdays: 1:00PM – 3:00PM or by appointment
Office Location: **3137 Turlington Hall**

Physical Mailing Address: P.O. Box 117315, Dept. of Geography, University of Florida
Gainesville, FL 32611-7315

Pre-requisites
GEO 3162c / GEO 6160 -- Introduction to Quantitative Methods ***or equivalent*** and/or GEO 4167c / GEO 6161 -- Intermediate Quantitative Methods ***or equivalent***. Students must first complete an Intro Quantitative Methods/Statistics course and/or obtain permission from the Instructor to register for this course.

Course Description
This course surveys various and selected topics in Advanced Quantitative Analysis and provides an overview of some classic and widely used techniques for spatial data analysis. The course also provides a series of highly focused discussions on some of the more popular techniques in spatial statistics. Emphasis is on the critical examination and analysis of spatial data, point patterns and generating processes, trend modeling, spatial interpolation, count data regression models, cluster analysis, Principal Components Analysis, hot-spot detection, and process-change statistics in space and time.

Selected Topics include…
Point-Pattern Analysis
Nearest Neighbor Analysis
Advanced Point Count Distributions Models
Kriging as a Spatial Interpolation Methods (Geo-Statistical Modeling)
Count Regression Models: Poisson Regression, Negative Binomial Regression
Maximum Likelihood Estimation and Model Assessment
Multivariate Cluster Analysis
Knox Statistic(s)
Cusum Statistics
Various Detection and Surveillance Statistics (for data involving cases and controls)
Hot-Spot Analysis (K-functions, Kulldorff, Getis, Rogerson's method)
Principal Components Analysis (PCA)
PC regression
Overview of Extreme Probability Distributions (time-permitting)
Note: Course Syllabus for Advanced Quant GEO 6166 (Spring 2023) is subject to change. Any changes or last-minute updates will be brought to your attention via Canvas.

There are Four Course Components (400 possible points):

1. Term Project Proposal (40 points); Posted Due Date: Feb.24th by noon-12:00P. Expectations: 1-3 page overview of proposed Term Project.

2. In-Class Project/Power-point Presentation -- 40-45 minute presentation, allowing 10-15 minutes for questions and comments (worth 120 points).
   Dates for in-class presentations as listed below. Each student must do a "live" in-class presentation. No Zoom.
   Students must choose 1 of the dates listed below for their presentations:

   March 29, April 5, April 12, April 19, or April 26.

   Presentations will take place during the regularly scheduled class periods in TUR 3012 (i.e., between 1:55 and 4:55PM).

3. Final Term Project/Paper/ Write-Up (worth 180 points); Due: Monday, May 1 by noon 12:00PM.

4. Class Attendance and Participation (60 points)

[Note that regular attendance is recommended and attendance will be taken periodically].

Readings: Recommended (Note that No Textbook is assigned for this course)

Readings to Supplement lectures will be uploaded periodically onto Canvas.... and placed in a Readings folder. Some books that may be of interest to you; for those without a strong background in modeling, quantitative methods, or applied spatial analysis.

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).

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 their 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 or programming 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,*** which include the following software:
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. Course material as presented in lecture: **Power-point Lectures/slides and supplemental readings...will be available on Canvas... and will be posted after the lecture (not before).** It is the student's responsibility to access and review 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- etc.

Grade Values for Conversion

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade	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 or Advanced Quantitative Analysis
The term project must demonstrate a working knowledge of advanced quantitative methods for applied data analysis in an application involving cross-section, spatial, temporal, and/or spatio-temporal data to address a specific research question. 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. Research topics/projects 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 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 (when and where applicable).

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 summary Power-point presentation of their project; to be presented to the class during the last five weeks of the semester's end: **40-45 minute maximum Power-point presentation**. A digital copy of the Power-point slides must be submitted along with the write-up/term paper by May 1 (including any changes, edits or post-presentation additions). Note that I will not consider team projects this semester. All students must turn in their own term projects.

Three viable options for the term project that I will consider are listed below:

1. Complete an extension of the work/project/paper from last semester (from GEO 6160 or GEO 4167C) if your research on that topic is ongoing or has taken a new and exciting twist or turn. This will require extensive improvement or augmentation of that project. Since this is a graduate-level course, I expect graduate-level work.

2. Complete a new research project/paper on a subject of your choosing... may or may not be part of your ongoing Master's thesis or Doctoral dissertation research.

3. Create a "Quant Course Lecture" on a given technique/method/topic as if you are the Instructor for this course. The work is to be presented as if a chapter from an Advanced Quantitative Methods textbook, accompanied by a Power-point lecture/summary of that chapter.

Term Project Due Date (Submission of Final Term Paper, Power-point summary)... by or before Monday, May 1 by noon (12:00PM). **No Late Term Projects will be accepted.** All Term Projects and related materials must be submitted by the posted due date above. **Absolutely No Incompletes will be given out** in this course (or during the Spring 2023 term).

Term Project Guidelines

Term project/paper and Power-point presentations are worth a total of 300 points (180 and 120 points, respectively) – that's 75% of your grade for this class. Hence, great care should be taken to produce a paper/project and a Power-point presentation that clearly demonstrate a working knowledge of the methods used in your analysis. Expectations are as follows: Students are to prepare a professional write-up and Power-point presentation 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 Power-point presentation should be (a) limited to no more than 35 slides maximum, and (b) submitted as a .pptx file no later than the due date.
Again, the Due Date (and Time) for submission of both the paper and Power-point proposal is **by or before Monday, May 1, 2023 by noon (12:00PM).**

Attach related computer-generated output and any other relevant computer output (e.g., R-programming code, listing of software, extra tables or charts for model diagnostics, etc.) 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. Term Papers should include a literature review, problem statement, findings, etc (see next page); and submitted as a Word file in docx. format. Prior to starting work on a term project, students must submit a 1-3 Page proposal/abstract/overview of their proposed project (which must be approved by the Instructor) -- basically, a synopsis of their project with student's name, tentative title, and a description of their proposed research. NOTE: A 1-3 Page, Term-Project Proposal must be submitted to the instructor for review and feedback. Due date/time is Feb. 24th by noon (12:00PM). Proposals must be upload to Canvas website for evaluation and feedback from Instructor. 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***

Note: Term Projects must be uploaded to the Canvas website for this course by the due date and time. Note: e-mail, Zip-file, or Drop-box submissions WILL NOT 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, the write-up must be page-numbered. Final copies of the

Term Paper/Project are to be submitted to the Instructor no later than the specified "due date" and "time" as indicated in this course syllabus. No late projects will be accepted for any reason.

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.

A Note on Courtesy-- Please refrain from engaging in the following activities while the class is in session: texting, tweeting, cell-phone conversations, checking voice-mails, social networking, on-line surfing, website browsing, checking your e-mail, sending Instagrams, Facebooking, Pinterest posts, Tik-Toking, e-shopping, etc. Do the social media thing on your own time please. I DO NOT tolerate students starring into their laptops and surfing the web while I am lecturing. This is distracting to me and others in the classroom. In addition, talking or conversing with other students while the instructor is speaking and presenting lecture material is rude and unacceptable. To reiterate, proper classroom etiquette is expected. 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. Please refrain from these types of activities during "my time". Thank you for showing interest in my Quant course offerings. I look forward to a fun and productive semester.

Good Luck and Good Journey.

And as always.. Go Gators!