GIS 4424C/6456C: Applications in GIS for Zoonoses and Disease Ecology

Instructor: Dr. Jason K. Blackburn

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Office: Geography 3133
Office hours: Via Zoom in Canvas: M 10-11, T 2-230, TR 10-1030, By appointment W,F

Please initiate email for the class through Canvas.

This is an online class with asynchronous course delivery. We will only meet live during pre-arranged office hours or scheduled one-on-one meetings.

Background

This is a 3 credit-hour course focused on the application of exploratory spatial data analysis, local spatial statistics, and ecological modeling to disease ecology with an emphasis on zoonoses - those diseases that affect both animals and humans. Throughout this course we will explore the use of geographic information systems, spatial statistics, and ecological models (e.g. logistic regression and ecological niche models) to in examining disease distributions, frequency, and environmental conditions. These explorations are completed using software available in the computer lab or UF Apps (many apps are open source and can be downloaded). We will complete lab assignments using GIS software or code. We will focus on zoonotic systems. Students will have an opportunity to learn and apply several popular GIS and spatial statistical techniques to disease and climate data sets. These will include the use of Anselin's local Moran's *I*, Getis and Ord's G statistics, and the spatial scan statistic to explore spatial and spatio-temporal patterns of spatial data. Students will also explore ecological niche theory and its application to disease modeling, such as genetic algorithms and logistic regression. The course is setup to allow students the opportunity work with data sets of their choice for a final project, and graduate students are encouraged to use thesis/dissertation related data. The goal of the course is to introduce students to the many and varied opportunities for GIS and spatial analysis, with an emphasis of ecological processes and environmental relationships between diseases and their hosts (and vectors). Students from across campus are encouraged to enroll to foster cross training that will bridge the skills of geographers, epidemiologists, modelers, and public health.

In this course, students will be expected to (course objectives):

1) Define diseases and relate spatial processes to disease outbreak dynamics
2) Map disease and map statistical outputs (graphically and with maps)
3) Perform basic R functions for statistics and graphing in epidemiology

4) Map and manage environmental data (e.g. climatic data)
5) Employ global measures of spatial autocorrelation
6) Employ local measures of local spatial autocorrelation
7) Understand the basic theory and application of ecological niche modeling
8) Compose GIS related methodology and results sections for manuscripts using laboratory write-ups a practice
9) Publicly present GIS-related data and analyses to scientific audiences, particularly non-GIS or non-epidemiology audiences
10) Evaluate and train a group on the basics of spatial statistical techniques not taught by the instructor

Prerequisite

Students should have had an undergraduate course equivalent to GIS 3043 or GIS 3xxx (GIS Models for Public Health) and Geography 6161C or equivalent.

Student Evaluation

This course will use a variety of methods to evaluate student performance. For all graded work in the course, *rubrics are provided ahead of grading through the online system (currently Canvas)*.

(12) Laboratory practical GIS exercises with short lab write-ups (25 pts each x 12 = **300 points**)

(15) Quizzes on course content knowledge (10 pts each x 15 = **150 pts**)

(1) First draft of written paper on a GIS project of the student's choice (with instructor approval) (**40 pts**)

(1) Peer review of classmate's paper following a specific (provided) rubric (**30 pts**)

(1) Revision of GIS project paper based on peer review (**30 pts**)

(1) Presentation on the final paper (15 minutes with PowerPoint) (**75 pts**)

(1) Review of a technique not taught by the instructor. Each graduate student will provide an overview presentation (10-15 minutes) on a technique and appropriate readings describing the test (1x reading) and at least 1x paper applying the technique. (**100 pts**) **Undergraduates do not have this course requirement or these points*

Student participation in class accounting for participation in discussions, attendance, and collegiality and timeliness of peer review efforts. There is a rubric provided for participation grading. (**100 pts**)

Total points in class = 825 for grads, 725 for undergrads

Grading Policy

This course will employ the A – E grading scale, with 95≥A, 89-94 A-, 86-88 B+, 83-85 B, 79-82 B-1, 76-78 C+, 73-75 C, 72-69 C-, 68-66 D+, 63-65 D, 59-62 D-, <59 E,. http://www.isis.ufl.edu/minusgrades.html

Text

This course has a reading list updated regularly and PDF of all readings are provided ahead of time by the instructor.

OPTION TEXTS

Brunsdon, Oyana (2020), *Spatial Analysis with R: Statistics, Visualization, and Computational Methods*. CRC Press. Available as Ebook/Kindle.

As an optional reference text, look at Stevenson et al. (2008). *Spatial Analysis in Epidemiology.* Oxford Press. 208 pages.

Class attendance, make-up exams, and late work

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

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.

For more information visit: http://www.dso.ufl.edu/drc/

UF grading policies

Please see the UF Registrar's grading policies for current guidelines not discussed in class.

http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html

Honor Code

Students are expected to abide by the UF honor code and ethical conduct, listed on the following website: http://www.dso.ufl.edu/stg/

Other Concerns

Please be aware that the University Counseling Center (392-1575), the Student Health Care Center (392-1161) and Student Mental Health (392-1171) can assist students as they work through personal, academic and social issues. Please take care of your health and watch for swine flu symptoms. Provide advance notice and obtain documentation for excused absences where possible.

Recording of live meetings via Zoom

Our group office hours sessions, or any meetings where I answer questions, may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voice recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording, and unauthorized sharing of recorded materials by students or any other party is prohibited.

Policy on Chat GPT and use of writing bots

While AI tools like Chat GPT can be efficient, students should be critical of it as in any other source of information. It may interpret technical information poorly, may get facts wrong, and does not appropriately credit sources. Be very careful in its application and credit and paraphrase it as you would any other sources. Good writing integrates multiple sources and aims for engaging readers with the content which Chat GPT can fail to do. Direct copy-paste of text or minimal revision of artificially generated is a form of plagiarism, as would be from any other text or document, so please always thoroughly revise, edit, fact-check, and improve any writing generated with AI tools. It is expected that students will produce their own writing for assignments in this course. Any use of AI must be disclosed in any writing. If deemed a copy/paste, credit will not be assigned. It is fine to not to use it at all.

Please read this to learn more about https://medium.com/@kjc_44470/why-chat-gpt-is-not-a_threat-to-writers-and-creatives-how-to-use-it-as-a-tool-4a59b3934b5a

Week	Monday	Topic	Quiz	Lab Assigned	Lab Due	Other
1	21-Aug	Introductions, GIS, Descriptive Spatial Stats	**1&2**			
2	28-Aug	Mapping concentrations: Kernel Density Estimation	**3**	**1**		
3	4-Sep	Epidemiological concepts and mapping epi data	**4**	**2**	**1**	
4	11-Sep	Global spatial statistics & clustering - Ripley's K and ANNI	**5**	**3**	**2**	
5	18-Sep	Local spatial autocorrelation: Getis-Ord Gi*	**6**	**4**	**3**	
6	25-Sep	LISA: Local Moran's I and rate smoothing	**7**	**5**	**4**	
7	2-Oct	SaTScan: Space-Only point pattern analysis	**8**	**6**	**5**	
8	9-Oct	SaTScan: Spatio-temporal PPA	**9**	**7**	**6**	**Grads: Technique review assigned**
9	16-Oct	Spatial Regression: Lag Model	**10**	**8**	**7**	
10	23-Oct	Spatial Regression: Error Model	**11**			**Final project start**
11	30-Nov	Raster data preparation and logistic regression	**12**	**9**	**8**	
12	6-Nov	Ecological Niche Modeling approaches GLM - Genetic Algorithms	**13**	**10**	**9**	**Grads: Technique review due**
13	13-Nov	Presence Only Modeling - Predicting with MaxEnt models	**14**	**11**	**10**	
14	20-Nov	Geo-AI: from GLMs to Random Forests - predicting disease			**11**	
15	27-Nov	Boosted Regression Trees - State-of-the-Art ENMs	**15**	**12**		**Draft 1 due**
16	4-Dec	Putting it all together - making a How-To ESDA guidebook from class			**12**	**Review Due/presentation due**
Finals Week	11-Dec	FINALS WEEKS - FINISH FINAL DRAFT OF PAPER				**Final Draft due**