Study program: Geoinformation Technologies

Qualification: PhD

General Information	
University	Yerevan State University (YSU)
Course title	Spatial Statistics
Course/Module code	Geoinformation Technologies
Course type	Mandatory
Year of Study	1st year, 2nd semester
Term/Semester	Spring (Semester)
Credits awarded	3(ECTS)
Degree	PhD
Enrollment status	Full-Time
Prerequisites and co-requisites (if applicable):	- Proficient knowledge of linear algebra theory and statistics - Advanced knowledge of GIS and geovisualization - Basic knowledge of spatial analysis - Proficient knowledge in programming

Lecturer's details	
Name, surname	Dr. Artak Piloyan
Academic title	Assistant professor
Contact details	Email: artakpiloyan@ysu.am
Office hours and consultation schedule	11:00-14:00 Monday, Wednesday

Course Structure	
Type (compulsory/ optional):	
Course Goal	This course is intended as an introduction to spatial statistics and aims to provide students with the background necessary to investigate geographically represented data. There are numerous research questions involving spatial data, but in this course, focus will be placed on methods that are relevant in the fields of public health, environmental science, and social science. Lectures will cover the three

	main areas of spatial statistics: geostatistical data, lattice (areal) data, and point patterns.
Learning Outcomes	On the completion of this course, students should be able to: - Define and characterize the concepts of spatial statistics - Distinguish different types of spatial data (geostatistical, areal, point process) and understand how spatial autocorrelation plays a role in statistical modeling - Expand workforce relevant skills in R, pertaining to the analysis of spatial data - Investigate spatial autocorrelation in example datasets provided as exercises. Determine which spatial methods to use in their own research and implement them using statistical software and GIS. - Apply the concepts of spatial statistics to real data sets - Discuss new methods in the spatial statistics literature based on an understanding of the basic spatial statistics approaches, principles and main assumptions - Identify the need to utilize spatially informed analytic techniques
Course contents:	1. Statistical Foundation 2. Neighborhoods, Spatial Co-Location 3. Correlation, Regression 4. Inequality and Convergence 5. Principal component analysis, Factor Analysis 6. Spatial Clustering 7. Interpolation 8. Gravity and Spatial Interaction Modeling 9. Spatial Regressions 10. Hot Spots and Density Calculations 11. Maximum Likelihood 12. Course Summary
Assessment methods and criteria	This course is evaluated as follows: 60% Assignments

	15% Final Exam 25% In-class Exercises and Quizzes
Recommended textbooks and links (in order of relevance):	1. Textbooks: Some popular ones include: • "Applied Spatial Data Analysis with R" by Bivand, Pebesma, and Gómez-Rubio. • "Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools" by de Smith, Goodchild, and Longley. • "Spatial Statistics and Geostatistics: Theory and Applications for Geographic Information Science and Technology" by Webster and Oliver. 2. Online Courses: • Coursera: "Spatial Data Science and Applications" by University of California, Davis. • edX: "Spatial Data Analysis and Visualization" by University of California, Santa Barbara. • Esri Training: Esri offers various courses on spatial statistics and geospatial analysis using their software. 3. Websites and Resources: • Spatial Data Science with R (https://keen-swartz-3146c4.netlify.app/): Provides interactive tutorials and code examples for spatial analysis using R. • GeoDa Center (https://geodacenter.github.io/): Offers a collection of software tools, guides, and resources for spatial analysis. • The Spatial Statistics Resources Page (https://www.spatial-statistics.com/): Features a curated list of spatial statistics software, tutorials, and research papers. 4. Academic Journals and Research Papers: Students welcome to explore academic journals such as the "Journal of Geographical Systems" and "Spatial Statistics" to read research papers related to spatial statistics. This can help to gain a deeper understanding of advanced topics and applications.

	5. Practical Exercises and Projects: Design hands-on exercises and projects that allow students to apply spatial statistics techniques using software tools like R, Python (using libraries such as GeoPandas and PySAL), or GIS software like ArcGIS or QGIS. This can help reinforce their learning and develop practical skills.