Southern New Hampshire University

SCI 310 Final Project Guidelines and Rubric

Overview

In the field of geostatistics, you will be asked to work with a large variety of data. Being flexible in the types of data that you are comfortable working with will be a significant advantage in finding work. For this project, you will be given a large point data set for a real-world scenario. You will work with your instructor to select a set of three different locations (latitude and longitude) that will require three different interpolation techniques. When you have completed your statistical analysis of the data and your interpolation techniques, you will create a visually compelling map series that utilizes correct cartographic principles. Finally, you will provide a summary that describes your analysis and presents your findings.

One of the most powerful aspect of geostatistics is the predictive capabilities that it provides. The Governor‘s office has requested a demonstration of how geostatistics could be utilized in an emergency response situation. They are most interested in how geostatistics can be used to respond more effectively to weather emergencies. After a considerable vetting, your firm has been selected to make the presentation and you have been chosen to manage this project.

Create a map series that demonstrates how geostatistics can be used to predict data values in areas where measurements have not been taken. Include different subjects such as snowfall, rainfall, wind speed, and temperature. Also, include multiple areas to make these demonstrations. Your final product should be professionally done, accurate, and fully cited.

The project is divided into **four milestones**, which will be submitted at various points throughout the course to scaffold learning and ensure quality final submissions. These milestones will be submitted in **Modules Two, Three, Four, and Five.** The final product will be submitted in **Module Seven**.

As you work through each milestone, you will apply the concepts and practices to your own final project.

In this assignment, you will demonstrate your mastery of the following course outcomes:

- Utilize geographic information system tools to manipulate geographic data for geostatistical analysis and map creation
- Apply descriptive statistics to geographic data to determine data correlation and the extent of data reliability in spatial interpolation for use in responsible geoscientific decision making
- Employ suitable interpolation techniques to predict spatial values of unknown, undefined target areas in geological and environmental contexts
- Create cartographic reports depicting geostatistical analysis results pertaining to the reliability of predictions and overall data correlation

Prompt

Develop an in-depth cartographic report that contains a visually powerful map series portraying your analysis, a methodology collection of statistical analyses performed, and a summary of your results.

Specifically, the following **critical elements** must be addressed:

I. **Introduction:** Concisely describe the real-world scenario and locations for which you have data. Which set of three locations will you be using? What is your problem statement?

II. **Data**
   A. **Statistical Models:** Use your data to generate the following statistical models and support your models with screenshots that show the models and accompanying data tables. Make sure to include z-scores, fit, variance, confidence, and so on, where appropriate.
      i. Variograms
      ii. Scatterplots
      iii. Voronoi maps
      iv. Autocorrelation
   B. **Interpretation:** Interpret the data produced by the statistical models you created. Which descriptive statistics techniques can you apply to determine the degree of correlation of your data? Why do these techniques apply?
   C. **Evaluation:** Evaluate your data for potential outliers that could skew or alter your analysis. How would these outliers affect your analysis?

III. **Interpolation**
   A. **Techniques:** Identify and explain potential interpolation techniques that apply to your data correlation. As you identify potential techniques, consider data clusters, data dispersion, local samples, and global estimates, for example.
   B. **Best Fit Process:** Use the interpolation techniques and parameters listed to find a best fit for your spatial data locations. Describe the process you used to find the best fit.
      i. Kriging
      ii. Block kriging
      iii. Cokriging
      iv. Global estimation
      v. Sample estimations
   C. **Best Fit Selection:** Which interpolation techniques give you the best fit for your data? Why is it a good selection for your map creation?

IV. **Map Series**
   A. **Colors:** Contrast your color scale to provide an easy-to-understand visualization. What colors represent positive? Negative? Explain your choices.
   B. **Categories:** Value categories so that they accurately represent your data. Are your data values dispersed? Are there any extreme ranges? Does the majority of your data fit into one category?
   C. **Map Creation:** Create logically intuitive and cartographically accurate maps that display the interpolation results for each interpolation technique used for your study area. Provide additional large-scale maps (i.e., maps that show greater detail of a smaller geographic area) that focus on geographic areas where the interpolation results from each model differed. The intent of these maps is to compare the interpolation estimates from different interpolation techniques. In addition to being logically intuitive and cartographically accurate, exceptional maps will be visually powerful. In total, students should produce 4 to 6 maps for the final cartographic report.

V. **Results**
   A. **Evaluation:** Evaluate your results. Now that you have analyzed the data and created the models and maps, what do the data, models, and maps mean? What conclusions can you draw from the maps?
   B. **Predictions:** Discuss the reliability of your predictions. Was the interpolation technique that you selected the best fit for your data? How do you know? Use the statistical models that you created to support your answer.
   C. **Decision Making:** How can you use the data, maps, and models to make responsible geoscientific decisions? What kind(s) of decisions would be appropriate given the scenario?
   D. **Challenges:** What challenges or difficulties did you face in completing the project? How do the maps you created show evidence of these challenges? What would you do differently next time?

Milestones

Milestone One: *Identifying and Investigating the Data*
In **Module Two**, you will identify and investigate the data for the final project. For the final project, you will be asked to use geostatistical techniques to analyze a meteorological problem. To do so, you must first develop a question that can be answered with these methods. First, determine what meteorological question you would like to answer. Next, select a state from which to obtain data. Within that state, select three locations to serve as your observation locations. **This milestone is graded with the Milestone One Rubric.**

Milestone Two: *Geostatistical Models*
In **Module Three**, you will use the Geostatistical Analyst Tutorial to complete Exercise 1: Creating a surface using default parameters and Exercise 2: Exploring your data. When finished, write a brief report explaining what you did and what the results of the analysis show. Include exports or screenshots of all models, graphics, and data you produce during each exercise in the reports. **This milestone is graded with the Milestone Two Rubric.**

Milestone Three: *Kriging*
In **Module Four**, you will use the Geostatistical Analyst Tutorial to complete Exercise 3: Mapping ozone concentration, Exercise 4: Comparing models, and Exercise 5: Mapping the probability of ozone exceeding a critical threshold. When finished, write a brief report explaining what you did and what the results of the analysis show. Include exports or screenshots of all models, graphics, and data you produce during each exercise in the reports. **This milestone is graded with the Milestone Three Rubric.**

Milestone Four: *Mapping Data*
In **Module Five**, you will create a visually appealing map to convey that data to consumers. Include all of the major elements of maps: legend, scale, appropriate symbols and colors, labels, north arrow, and title. When completed, export the map as a PDF file. **This milestone is graded with the Milestone Four Rubric.**

Final Submission: *Cartographic Report*
In **Module Seven**, you will develop an in-depth cartographic report that contains a visually powerful map series portraying your analysis, a methodology collection of statistical analysis performed, and a summary of your results from the data. It should be a complete, polished artifact containing **all** of the critical

elements of the final product. It should reflect the incorporation of feedback gained throughout the course. **This submission will be graded with the Final Project Rubric.**

Deliverables

Milestone	Deliverable	Module Due	Grading
One	Identifying and Investigating the Data	2	Graded separately; Milestone One Rubric
Two	Geostatistical Models	3	Graded separately; Milestone Two Rubric
Three	Kriging	4	Graded separately; Milestone Three Rubric
Four	Mapping Data	5	Graded separately; Milestone Four Rubric
	Final Submission: Cartographic Report	7	Graded separately; Final Project Rubric

Final Project Rubric

Guidelines for Submission: Your cartographic report should be 3 to 5 pages in length (excluding maps). Use APA style to cite any necessary sources.

Critical Elements	Exemplary (100%)	Proficient (85%)	Needs Improvement (55%)	Not Evident (0%)	Value
Introduction	Meets "Proficient" criteria and description clearly connects scenario and locations	Concisely describes scenario and locations	Describes scenario and locations but description is wordy or vague	Does not describe scenario and locations	4
Data: Statistical Models [SCI-310-02]	Meets "Proficient" criteria and support through screenshots is exceptionally clear and detailed	Generates statistical models and supports models with screenshots showing models and accompanying data tables	Generates statistical models but does not support models with screenshots showing models and accompanying data tables	Does not generate statistical models	5.75
Data: Interpretation [SCI-310-02]	Meets "Proficient" criteria and data interpretation and explanation are exceptionally clear and detailed	Accurately interprets data produced by models to determine degree of data correlation and explains descriptive statistics techniques used	Interprets data produced by models to determine degree of data correlation and explains descriptive statistics techniques used but with gaps in accuracy or detail	Does not interpret data produced by models to determine degree of data correlation	5.75
Data: Evaluation [SCI-310-02]	Meets "Proficient" criteria and data evaluation and explanation are exceptionally clear and detailed	Accurately evaluates data and explains how outliers could affect analysis	Evaluates data and explains how outliers could affect analysis but with gaps in accuracy or detail	Does not evaluate data	5.75

Interpolation: Techniques [SCI-310-03]	Meets "Proficient" criteria and explanation demonstrates nuanced understanding of relationship between interpolation techniques and data correlation	Accurately identifies and explains potential interpolation techniques that apply to data correlation	Identifies and explains potential interpolation techniques that apply to data correlation but with gaps in accuracy or detail	Does not identify and explain potential interpolation techniques that apply to data correlation	7.66
Interpolation: Best Fit Process [SCI-310-03]	Meets "Proficient" criteria and description of process is exceptionally detailed and logical	Clearly describes process using interpolation techniques to find best fit for spatial data locations	Describes process using interpolation techniques to find best fit for spatial data locations but description lacks clarity or detail	Does not describe process using interpolation techniques to find best fit for spatial data locations	7.67
Interpolation: Best Fit Selection [SCI-310-03]	Meets "Proficient" criteria and explanation is exceptionally detailed and logical	Clearly explains which interpolation techniques provide best fit for data	Explains which interpolation techniques provide best fit for data but explanation lacks clarity or detail	Does not explain which interpolation techniques provide best fit for data	7.67
Map Series: Colors [SCI-310-01]	Meets "Proficient" criteria and visualization can be understood at a glance	Logically contrasts color scale to provide easy-to-understand visualization and explains color choices	Contrasts color scale and explains color choices but color scale has gaps in logic or is not easily understood	Does not contrast color scale	7.67
Map Series: Categories [SCI-310-01]	Meets "Proficient" criteria and categories can be understood at a glance	Values categories to accurately represent data	Values categories to represent data but with gaps in accuracy	Does not value categories to represent data	7.67
Map Series: Map Creation [SCI-310-01]	Meets "Proficient" criteria and maps are visually powerful and able to be understood at a glance	Creates four to six logically intuitive and cartographically accurate maps for specified locations	Creates four to six maps but with gaps in logic or accuracy or without a focus on specified locations	Does not create four to six maps	7.66
Results: Evaluation [SCI-310-04]	Meets "Proficient" criteria and evaluation demonstrates keen insight into data, models, and maps	Comprehensively evaluates results of data, models, and maps	Evaluates results of data, models, and maps but evaluation is cursory or inaccurate	Does not evaluate results of data, models, and maps	7.67
Results: Predictions [SCI-310-04]	Meets "Proficient" criteria and discussion is exceptionally logical and detailed	Comprehensively discusses reliability of interpolation technique using statistical models for support	Discusses reliability of interpolation technique but discussion is cursory or inaccurate or lacks support from statistical models	Does not discuss reliability of interpolation technique	7.67
Results: Decision Making [SCI-310-02]	Meets "Proficient" criteria and explanation demonstrates keen insight into relationship between data, maps, and models and responsible geoscientific decisions	Clearly explains use of data, maps, and models for making responsible geoscientific decisions	Explains use of data, maps, and models for making responsible geoscientific decisions but explanation lacks clarity or detail	Does not explain use of data, maps, and models for making responsible geoscientific decisions	5.75

Results: Challenges [SCI-310-04]	Meets "Proficient" criteria and connection between challenges and evidence from maps is exceptionally clear	Clearly describes challenges in completing project and supports description with evidence from maps	Describes challenges in completing project but description lacks clarity, detail, or support from maps	Does not describe challenges in completing project	7.66
Articulation of Response	Submission is free of errors related to citations, grammar, spelling, syntax, and organization and is presented in a professional and easy-to-read format	Submission has no major errors related to citations, grammar, spelling, syntax, or organization	Submission has major errors related to citations, grammar, spelling, syntax, or organization that negatively impact readability and articulation of main ideas	Submission has critical errors related to citations, grammar, spelling, syntax, or organization that prevent understanding of ideas	4
				Total	**100%**