

Spatial Data Science: Advance Your Analytics

OEM: ESRI

COURSE DESCRIPTION

Discover hidden patterns, predict with confidence. Take your analytics projects to the next level by incorporating the power of location and place-based context. This course introduces spatial statistical techniques and methods used to uncover patterns and relationships in data, unlocking insights that help organizations solve complex problems. You'll explore a variety of scenarios and build skills with powerful ArcGIS tools used by analysts, researchers, and data scientists around the world.

AUDIENCE PROFILE

- This section doesn't contain any content.

PREREQUISITES

- This course assumes familiarity with ArcGIS Pro. Completion of one of the following courses, or equivalent knowledge, is recommended.
- ArcGIS Pro: Essential Workflows
- Migrating from ArcMap to ArcGIS Pro
- Spatial Analysis Essentials for ArcGIS

COURSE OBJECTIVES

By the end of this course, participants will be able to:

- Apply data engineering tools to prepare spatial data for analysis and statistical modeling, ensuring project results are built on a reliable and documented foundation.
- Gain experience with exploratory spatial statistical methods and space-time analysis techniques to detect trends, clusters, hot spots, and anomalies.
- Create and assess prediction models using geostatistical techniques and regression analysis.

COURSE OUTLINE

Module 1: Course introduction

- Course introduction
- Course goals

- Installing the course data
- Training Services account credentials
- Icons used in this workbook

Module 2: Building a foundation for spatial data science

- Lesson introduction
- Spatial analytics and data science
- Confidence in conducting spatial data science
- Spatial analytics and data science case studies
- Types of spatial statistics
- Interpreting inferential statistics
- Geospatial AI
- Lesson review
- Answers to lesson 1 questions

Module 3: Data engineering

- Lesson introduction
- Data Engineering view in ArcGIS Pro

Exercise 2A: Identify when to use the Data Engineering view

- Start ArcGIS Pro
- Explore the data
- How to evaluate data
- Evaluating data for data preparation
- Creating charts in the Data Engineering view
- Interpreting data using charts

Exercise 2B: Prepare data using the Data Engineering view

- Add data to ArcGIS Pro
- Evaluate the data for cleaning
- Prepare the data for visualization
- Create charts to visualize data
- Lesson review
- Answers to lesson 2 questions

Module 4: Clustering

- Lesson introduction
- Heat map versus hot spots
- Clusters and outliers
- Descriptive versus inferential statistics
- Analyzing spatial patterns

Exercise 3: Use spatial statistics to analyze spatial patterns

- Open an ArcGIS Pro project
- Locate directional trends in data
- Run the Average Nearest Neighbor tool
- Run the Spatial Autocorrelation tool
- Perform optimized hot spot analysis
- Perform optimized outlier analysis
- Lesson review
- Answers to lesson 3 questions

Module 5: Space-time analysis

- Lesson introduction
- Incorporating time into your analysis
- Space-time analysis
- Emerging hot spot analysis
- Conducting a space-time analysis

Exercise 4: Explore space-time pattern mining tools

- Create a space-time cube
- Run an emerging hot spot analysis
- Run a local outlier analysis
- Create a space-time cube layer
- Visualize the emerging hot spot analysis result in 3D
- Visualize the local outlier analysis result in 3D
- Forecast future values
- Review forecasting result
- Lesson review
- Answers to lesson 4 questions

Module 6: Regression analysis

- Lesson introduction
- What is regression?
- Regression equation
- Analysis using linear regression
- Checkpoint
- Exploratory regression

Exercise 5: Find a properly specified regression model

- Open an ArcGIS Pro project
- Perform exploratory data analysis
- Use the Generalized Linear Regression tool
- Evaluate the spatial output from the GLR tool
- Create a scatter plot matrix
- Run the GLR tool on multiple dependent variables

- Reviewing OLS model outputs
- Lesson review
- Answers to lesson 5 questions

Module 7: Multiscale geographically weighted regression

- Lesson introduction
- How relationships change over space
- Multiscale geographically weighted regression characteristics
- When to use MGWR
- MGWR in action

Exercise 6: Perform MGWR

- Run GWR using a properly specified model
- Map coefficients to see variation over space
- Predict using GWR
- Lesson review
- Answers to lesson 6 questions

Module 8: Presence-only prediction

- Lesson introduction
- What is presence-only prediction?
- Presence-only prediction workflow
- Accuracy of data inputs for prediction

Exercise 7A: Train a presence-only prediction model

- Open an ArcGIS Pro project
- Explore the input data
- Train a presence-only prediction model
- Explore model outputs
- Interpreting presence-only prediction outputs

Exercise 7B: Make a prediction using a presence-only prediction model

- Review model output diagnostics
- Predict future habitat locations
- Lesson review
- Answers to lesson 7 questions

Module 9: Geostatistical interpolation

- Lesson introduction
- What is interpolation?
- Differentiate between regression and interpolation
- Geostatistical interpolation

- Geostatistical interpolation workflow
- Examine the Geostatistical Analyst Interpolation toolset
- Approaches to geostatistical interpolation

Exercise 8: Perform exploratory interpolation

- Open an ArcGIS Pro project
 - Explore the data distribution
 - Perform exploratory interpolation analysis
 - Evaluate the results
 - Examine a predicted surface
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- The Geostatistical Wizard
 - Lesson review
 - Answers to lesson 8 questions

Module 10: Appendices

- Appendix A: Data license agreement
- Appendix B: Answers to lesson review questions
- Appendix C: Additional resources
- Appendix D: Lesson stories

DELIVERY NOTE

- Esri will provide the following software to use during class:
- ArcGIS Pro 3.6
- ArcGIS Geostatistical Analyst
- ArcGIS Spatial Analyst