

UGRD_SOE_2620_DSA303_LIU SHEW FAN



Singapore Management University

COURSE INFORMATION

Course Code & Title

DSA303 - Spatial Data Analysis

Effective Start Date

11/01/2027

Offering Unit / Department / School

SOE

Course Career

Undergraduate

Course Units

CU:

1

Grading Basis

GRD - Graded

Course Description

This course introduces statistical concepts and basic tools involved in modelling and analyzing spatial data: Data that are correlated in 'space', arising in regional and urban economics, epidemiology and public health, environmental science, ecology, biology, geology and other disciplines. An outline is given to the three types of spatial data: geostatistical data, lattice data and point patterns. Emphasis is on the analysis of lattice data due to its close ties with regional science and economics. Exploratory spatial data analysis methods, including various plots and tests for spatial autocorrelation, are introduced. Some standard spatial linear regression models and spatial panel data models are also discussed. Quasi-maximum likelihood and GMM methods are used for model estimation and inferences. Real data analyses using R are presented throughout the course.

Course Learning Outcomes

We will cover the following topics:

1. Spatial Data in R: Vector and Raster
2. Handling geometry operations and coordinate reference systems
3. Making maps, a.k.a. the ancient art of cartography
4. Spatial descriptive measures and point pattern analysis
5. Areal data analysis and spatial models
6. Engaging in geostatistical analysis

SMU Graduate Learning Outcomes

Critical thinking & problem solving, Disciplinary knowledge, Multidisciplinary knowledge, Communication, Intercultural understanding and sensitivity, Self-directed learning

Competencies

Econometric Analysis, Data Analytics, Data and Statistical Analysis, Critical Thinking, Conceptual Thinking

Course Area(s)

AREA - Analytics Major, AREA - Business Options, AREA - Business-Oriented Electives, AREA - Data Science and Analytics Electives, AREA - Econ Major Rel/Econ Options, AREA - Economics Electives, AREA - Grad Req - Dig Tech/Data Ana (Intake 2024 onwards), AREA - IS Related Courses, AREA - Social Sciences/PLE Major-related, ENRL - SS Enrolment: 6 ISEP; 1 SUSEP, RQCP - STAT201

Simple Requirements

STAT201 - Pre-req

Type

Prerequisite

Complete ANY of the following Courses:

- STAT201 - Probability Theory and Applications

CLASS SECTION INFORMATION

Instructor(s)

LIU SHEW FAN LIU (sfliu@smu.edu.sg)

Instruction Mode

In Person

Consultations

Teaching Assistants

Friday 9am (or by
appointment)

and

Office Location

SOE/SOSS 5044

Assessment Components (New)

Category*	Weightage*	Assessment/Submission Period*				
Proctored Assessments	30	Week 15				
Description	Individual Group?*	or	With Component?*	Writing	With Component?*	Oral
Final Examination	Individual		Yes		No	

Category*	Weightage*	Assessment/Submission Period*				
Projects/Assignments	40	Week 13				
Description	Individual Group?*	or	With Component?*	Writing	With Component?*	Oral
SMU-X project	Group		Yes		Yes	

Category*	Weightage*		Assessment/Submission Period*			
Projects/Assignments	20		Week 7			
Description	Individual Group?*	or	With Component?*	Writing	With Component?*	Oral
Assignment	Individual		Yes		No	

Category*	Weightage*		Assessment/Submission Period*			
Class Participation and Activities	10		Week 15			
Description	Individual Group?*	or	With Component?*	Writing	With Component?*	Oral
Regular attendance and active participation	Individual		No		Yes	

Instructional Methods and Expectations

ASSESSMENT METHODS

Class Participation	: 10%
Assignments	: 20%
Group project	: 40%
Final Examination	: 30%

ASSESSMENT DETAILS

- **Class Participation:** Regular attendance and active participation are essential for the successful execution of the group project. Any absence must be supported by a valid excuse (e.g., medical certificates).
- **Assignments:** There will be two assignments of equal weight, designed to provide essential practice for the group project. These will be scheduled after the completion of learning objectives 4 and 5.

Project Timeline

- **Week 1:** The main project details and requirements will be introduced.
- **Week 2:** Groups will be formed and tasks allocated. Students will meet with the industry partner to discuss project specifics.
- **Research Phase (Weeks 1-4)**
 - Students will work on formulating research hypotheses under instructor supervision.
 - Additional data will be collected from public sources, with necessary data cleaning conducted during this period.
- **Data Analysis (Weeks 5 onwards).** Students may begin preliminary data analysis as early as week 5.
- **Week 13:** Final presentation to the industry partner.

Final Exam (3 hours):

- **Part A:** MCQ (closed book)
- **Part B:** coding (open book)

Weekly Lesson Plan

WEEKLY LESSON PLAN

The table provides a tentative course schedule which is subject to change.

Week	Topic
1	Handling spatial data in R: vector data handling using simple features
2	Handling geometry operations and coordinate reference systems
3	Making maps with R
4	Spatial descriptive summary measures
5	Engaging in point pattern analysis 1
6	Engaging in point pattern analysis 2
7	Engaging in areal data analysis 1 Project proposals
8	Recess Week
9	Engaging in areal data analysis 2
10	Modelling spatial relationships 1
11	Modelling spatial relationships 2
12	Engaging in geostatistical analysis 1
13	Engaging in geostatistical analysis 2 Group presentations

Recommended Textbooks and Readings

RECOMMENDED TEXTS

No single textbook covers all the listed topics above. The lecture notes provided will cover all examinable material. Additional readings are listed in each lecture note from the following texts.

For Theory:

- Tonny Oyana (2021), **Spatial Analysis with R**, 2nd edition, CRC Press.

- Guiseppe Arbia (2014) ***A Primer for Spatial Econometrics***, 1st edition, Palgrave Macmillan.

For coding:

- Robin Lovelace, Jakub Nowosad, Jannes Muenchow, **geocompx**.
<https://geocompx.org/>
- Paula Moraga (2023), ***Spatial Statistics for Data Science: Theory and Practice with R***, 1st edition, CRC Press. Click [here](#) for the updated online version.

Other Information

N/A

UNIVERSITY POLICIES

Academic Integrity

All acts of academic dishonesty (including, but not limited to, plagiarism, cheating, fabrication, facilitation of acts of academic dishonesty by others, unauthorized possession of exam questions, or tampering with the academic work of other students) are serious offences.

All work (whether oral or written) submitted for purposes of assessment must be the student's own work. Penalties for violation of the policy range from zero marks for the component assessment to expulsion, depending on the nature of the offense.

When in doubt, students should consult the instructors of the course. Details on the SMU Code of Academic Integrity may be accessed at <https://smu.sharepoint.com/sites/oasis/SitePages/DOS-WKLSWC/UCSC.aspx>

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Accessibility

SMU strives to make learning experiences accessible for all. If you anticipate or experience physical or academic barriers due to disability, please let me know immediately. You are also welcome to contact the university's student accessibility support team if you have questions or concerns about academic provisions: accessibility@smu.edu.sg.

Please be aware that the accessible tables in our seminar room should remain available for students who require them.

Digital Readiness for Teaching and Learning (DRTL)

As part of emergency preparedness, instructors may conduct lessons online via the Zoom platform during the term, to prepare students for online learning. During an actual emergency, students will be notified to access the Zoom platform for their online lessons. The class schedule will mirror the current face-to-face class timetable unless otherwise stated.