

## ST5226: Spatial Statistics (Module Outline)

1. **Lecturers:** Chan Hock Peng (Weeks 1-6) *email:* stachp@nus.edu.sg *office:* S16-6-102.  
David Nott (Weeks 7-13) *email:* standj@nus.edu.sg *office:* S16-7-109.

2. **Module description:** At present, almost all data that is collected is stamped with a location. This spatial information can help us in our understanding of the patterns in the data. The course is designed to introduce students to methods for handling and analysing such data. Topics covered include basic concepts of spatial data, prediction (kriging) for stationary data, and modeling the three main types of spatial data – geostatistical, areal and point pattern. R will be extensively used to demonstrate and implement the techniques.

3. **Recommended texts:**

(a) [Main] Applied Spatial Data Analysis with R (2<sup>nd</sup> edn) by *Bivand, Pebesma and Gomez-Rubio*, Springer.

(b) [Supplementary] Applied Spatial Statistics for Public Health Data by *Waller and Gotway*, Wiley.

Both texts can be downloaded from NUS Library.

4. **Topics covered**

**Weeks 1-6:**

(a) Classes for Spatial Data in R (Chapter 2 of Bivand)

(b) Visualising Spatial Data (Chapter 3 of Bivand)

(c) Spatial Data Import and Export (Chapter 4 of Bivand)

(d) Further Methods for Handling Spatial Data (Chapter 5 of Bivand)

(e) Spatial Point Pattern Analysis (Chapter 7 of Bivand and Chapter 5.2 of Waller)

Topics 4(a)-(d) are covered in Weeks 1-4. Topic 4(e) is covered in Weeks 5-6.

**Weeks 7-13:**

- (f) Introduction to geostatistical data. Variogram and semi-variogram models and their estimation. (Chapter 8 of Waller and Chapter 8 of Bivand)
- (g) Spatial prediction for geostatistical data. (Chapter 8 of Waller and Chapter 8 of Bivand)
- (h) Introduction to areal data. Neighbourhood structures and weights, exploratory data analysis. (Chapter 9 of Bivand)
- (i) Regression with spatially correlated data. Simultaneous and conditional autoregressive models. (Chapter 9 of Waller)
- (j) Revision.

Topics 4 (f)-(g) will be covered in weeks 7-9, (g)-(h) in weeks 10-12, and revision in week 13.

5. **Class date and time:** Lectures/tutorials are on Monday 7-10pm in LT32 and Tuesday 7-10pm in UTSRC-LT52. Tutorials start on Week 3. You need only attend one day as the Tuesday lecture/tutorial is a repeat of the Monday lecture/tutorial. If you are unable to attend on either day you can watch the video recording of the lecture.
6. **Continuous assessments and finals:** A long assignment is given out on Week 6. It includes topics covered in Weeks 1-6 and makes up 30% of your grades. The deadline of the assignment is in Week 9. The remaining 70% of your grades comes from a face-to-face written final exam. The majority of the questions in the final exam are on topics covered in Weeks 7-13.
7. **Lecture Notes:** Lecture notes are posted in Canvas before the lectures.

- 8. Tutorials:** Tutorials are discussed two weeks after the tutorial sheets are given out. You are strongly encouraged to try out the problems independently. Students are most welcome to contribute to the discussions. Solutions of tutorials are posted in Canvas after the discussions. Tutorials are not graded.
  
- 9. Programming language:** The module teaches students how to use R packages for spatial data. R is a free software and can be downloaded from <https://www.r-project.org/>. RStudio is a user-friendly platform for writing and running R codes and displaying graphs. It is a free software and can be downloaded from <https://www.rstudio.com/products/rstudio/download/>.
  
- 10. Office hours:** If you have questions on the lectures/tutorials you can make an appointment to meet with us either physically or via zoom.