空間分析 208 26830 / Geog 2017
Spatial Analysis

課程網址：https://ceiba.ntu.edu.tw/1072_Geog2017/
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課程概述：

本課程屬於地理系大學部的地理資訊科學領域進階課程，先修科目應包括：**統計學、程式設計、地圖學與地理資訊系統**等相關課程。課程目的在於介紹空間資料分析方法、應用並深化資料分析的實作能力等，使其瞭解各種分析方法運用的時機、模式分析與報表解讀等，並補充實證研究論文的導讀，說明在空間分析研究上的實用性，提供地理系或相關系所同學能運用適當的空間分析方法，進行地理學相關議題的研究。本學期的授課主題包括：地理空間視覺化（geospatial visualization）、地理數據處理（geo-processing）、點型態分析（point pattern analysis）、空間自相關（spatial autocorrelation）、熱區分析（hot spot analysis）等；輔以導讀地理空間觀點的實證論文，理解各種方法的延伸應用。本課程將使用 **R 程式**及其空間分析套件，培養同學對於資料分析的實作能力。

課程目標：

本課程將介紹空間分析方法的理論觀念，將以統計學、程式設計、地圖學與地理資訊系統等相關課程為先修基礎，進一步從機率與推論統計的觀點，深化各種空間分析方法的理論基礎，提供同學進階的地理資訊分析能力。本課程將提供同學了解空間分析方法的基本觀念與理論，並透過各種領域的應用實例，瞭解空間分析作為一種跨學科應用的潛在可能。

課程要求：

課程參與討論、電腦實習與作業、論文研讀

評量方式：

實習與作業 (30%)
期中考 1 (20%)
期中考 2 (20%)
期末考 (20%)
期末報告 (10%)

Textbooks:

- Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication.
- O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.

Further Reading:

- Bivand, Pebesma, Gomez-Rubio (2013). *Applied Spatial Data Analysis with R*. Springer.
- Fischer and Getis (2010). *Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications*. Springer.
- Fotheringham and Rogerson (2009). *The SAGE Handbook of Spatial Analysis*. Sage Publications Ltd.
- Oyana and Margai (2016), *Spatial Analysis: Statistics, Visualization, and Computational Methods*, CRC Press.

Weekly Topics:

1. 2.18 Course Introduction
2. 2.25 Geospatial Visualization: using ggplot2
3. 3.04 Handling Spatial Data: using R as a GIS (1)
4. 3.11 Handling Spatial Data: using R as a GIS (2)
5. 3.18 Publishing Interactive Maps to the Web: using R Shiny
6. 3.25 Comprehensive Practice
7. **4.01 ## Mid-term Exam 1**
8. 4.08 Point Pattern: Description Measures
9. 4.15 Point Pattern: Quadrat Analysis
10. 4.22 Point Pattern: Nearest-Neighbor Methods
11. 4.29 Point Pattern: Distance-based Methods
12. 5.06 Point Pattern: Density-based Methods
13. **5.13 ## Mid-term Exam 2**
14. 5.20 Spatial Autocorrelation
15. 5.27 Localized Spatial Analysis
16. 6.03 Issues of Multiple Testing in Spatial Analysis
17. 6.10 ## Oral Presentation: Term Project
18. **6.17 ## Final Exam**

Required Reading and Tutorial Materials

Week # 1 (2/18) **Course Introduction**

- ESRI. (2013). *The Language of Spatial Analysis*. New York: ESRI Press www.esri.com/library/books/the-language-of-spatial-analysis.pdf

Geo-visualization & data manipulation

Week # 2 (2/25) **Geospatial Visualization: using ggplot**

- Cheshire and Cheshire (2015), Spatial data visualization with R, In Brunsdon and Singleton (eds). *Geocomputation: a Practical Primer*, Sage Publications.

Week # 3 (3/04) **Handling Spatial Data: using R as a GIS (1)**

- Chapters 3 and 4, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 4 (3/11) **Handling Spatial Data: using R as a GIS (2)**

- Chapter 5, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 5 (3/18) **Publishing Interactive Maps to the Web: using R Shiny**

- The basic parts of a Shiny app (Tutorial) http://shiny.rstudio.com/articles/basics.html
- 中文教材 http://blog.infographics.tw/2016/04/interactive-r-with-shiny/

Week # 6 (3/25) **Comprehensive Practice**

Week # 7 (4/01) **## Mid-term Exam 1**

Point Patterns

Week # 8 (4/08) **Description Measures**

- Chapter 5, O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.

Week # 9 (4/15) **Quadrat Analysis**

- Chapter 5, O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.

Week # 10 (4/22) **Nearest-Neighbor Methods**

- Chapter 5, O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.

Week # 11 (4/29) **Distance-based Methods**

- Chapter 6, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 12 (5/06) **Density-based Methods**

- Chapter 6, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 13 (5/13) **## Mid-term Exam 2**

Hotspot Analysis

Week # 14 (5/20) **Spatial Autocorrelation**

- Chapter 7, O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.
- Chapter 7, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 15 (5/27) **Localized Spatial Analysis**

- Chapter 8, O'Sullivan and Unwin (2010), *Geographic Information Analysis, 2nd Edition*. Wiley.
- Chapter 8, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 16 (6/03) **Issues of Multiple Testing in Spatial Analysis**

- Chapter 8, Brunsdon and Comber (2015), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

Week # 17 (6/10) **## Oral Presentation: Term Project**

Week # 18 (6/17) **## Final Exam**