

空間分析 208 26830 / Geog 2017

## Spatial Analysis

課程網址：[https://ceiba.ntu.edu.tw/1082\\_Geog2017/](https://ceiba.ntu.edu.tw/1082_Geog2017/)

授課教師：溫在弘 (E-mail: [wenthung@ntu.edu.tw](mailto:wenthung@ntu.edu.tw))

上課時間：每週一 789

上課地點：地理系電腦教室

課程助教：杜承軒 [r07228005@ntu.edu.tw](mailto:r07228005@ntu.edu.tw)；江偉銘 [schoolusejiang@gmail.com](mailto:schoolusejiang@gmail.com)

課後釋疑助教：游孟純 [b07610046@ntu.edu.tw](mailto:b07610046@ntu.edu.tw)

簡微 [b07208043@ntu.edu.tw](mailto:b07208043@ntu.edu.tw)

李蕙均 [b07208028@ntu.edu.tw](mailto:b07208028@ntu.edu.tw)

Office Hour: 地理系館 501 室 (以 E-mail 聯繫另約時間)

### 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+作業	40%
Warm-up Exam	10%
Mid-term Exam	20%
Final Exam	30%

## Textbooks:

- Brunsdon and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping, 2nd Edition*. London: Sage Publication.
- O'Sullivan and Unwin (2010), *Geographic Information Analysis*, 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.

## Weekly Topics:

1. 2.22 Course Introduction
2. 3.01 例假補假 (複習：基礎統計學)
3. 3.08 Handling Spatial Data
4. 3.15 Using R as a GIS: Geoprocessing Operations
5. 3.22 ## Warm-up Exam (基礎統計學 + 空間資料處理與繪圖)
6. 3.29 R Spatial: More Complex Operations
7. 4.05 春假 (聽演講：R for Spatial Analysis)
8. 4.12 Describing Spatial Patterns
9. 4.19 ## Mid-term Exam
10. 4.26 Point Pattern Analysis: Quadrat Analysis
11. 5.03 Point Pattern Analysis: Nearest-Neighbor Methods
12. 5.10 Point Pattern Analysis: Distance-based Methods
13. 5.17 Point Pattern Analysis: Density-based Methods
14. 5.24 Spatial Autocorrelation: Moran's I statistic
15. 5.31 Localized Spatial Analysis
16. 6.07 ## Final Exam
17. 6.14 端午節 (聽演講：Spatial Statistics in R)
18. 6.21 Building Interactive Dashboard for Geo-visualization

## Tutorial Materials :

### Week # 1 (2/22) **Course Introduction**

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

- GIS Career Videos:

GIS as a Career: <https://www.youtube.com/watch?v=dPw8KuyfFPk>

(1) Geospatial Data Scientist: <https://www.youtube.com/watch?v=tRpkQa0rXo4>

(2) Geospatial Application Developer: <https://www.youtube.com/watch?v=x2KtC0LkRIc>

### Week # 2 (3/01) === **Spring Break (Recap: Basic Statistics)** ===

- **Hypothesis Testing** (YouTube playlist: 16 videos)

<https://www.youtube.com/watch?v=tTeMYuS87oU&list=PLvxOuBpazmsNo893xlpXNfMzVpRBjDH67>

- **Confidence Intervals** (YouTube playlist: 10 videos)

<https://www.youtube.com/watch?v=27iSnzss2wM&list=PLvxOuBpazmsMdpBRxBTvwLv5Lhuk0tuXh>

### Week # 3 (3/06) **Handling Spatial Data**

- Chapters 3 and 4, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### Week # 4 (3/15) **Using R as a GIS: Geoprocessing Operations**

- Chapters 3 and 4, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### Week # 5 (3/22) ## **Warm-up Exam**

### Week # 6 (3/29) **R Spatial: More Complex Operations**

- Chapter 5, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### Week # 7 (4/05) === **Spring Break (Online Lecture)** ===

**R for Spatial Analysis** @ Center for Geographic Analysis, Harvard University (2017)

<https://www.youtube.com/watch?v=Ms7U5camBrw>

### **Week # 8 (4/12) Describing Spatial Patterns**

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

### **Week # 9 (4/19) ## Mid-term Exam**

### **Week # 10 (4/26) Quadrat Analysis**

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

### **Week # 11 (5/03) Nearest-Neighbor Methods**

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

### **Week # 12 (5/10) Distance-based Methods**

- Chapter 6, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### **Week # 13 (5/17) Density-based Methods**

- Chapter 6, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### **Week # 14 (5/24) Spatial Autocorrelation: Moran's I statistic**

- Chapter 7, O'Sullivan and Unwin (2010), *Geographic Information Analysis*, Wiley.
- Chapter 7, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

### **Week # 15 (5/31) Localized Spatial Analysis**

- Chapter 8, O'Sullivan and Unwin (2010), *Geographic Information Analysis*, Wiley.
- Chapter 8, Brunson and Comber (2018), *An Introduction to R for Spatial Analysis and Mapping*, London: Sage Publication

**Week # 16 (6/07) ## Final Exam**

**Week # 17 (6/14) === Holiday Break (Online Lecture) ===**

- **Spatial Statistics in R: An Introductory Tutorial with Examples**  
<https://www.youtube.com/watch?v=fvgLH5tMig8>

**Week # 18 (6/21) Workshop: Building Interactive Dashboard for Geo-visualization**