UNSW SYDNEY | Australia's Global University

Built Environment

BENV7503 Introduction to Geocomputation

Dr Simone Z Leao

3+ Abbreviated Course Outline – T3

Disclaimer

This abbreviated course outline is indicative of the outcomes, delivery and assessment. While Course Learning Outcomes will remain constant, other details may be subject to change. The full and most accurate course outline will be available in Moodle.

1. COURSE STAFF

Course Convenor	Dr Simone Z Leao
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2. COURSE DETAILS

Credit Points: 6 UoC

Learning Activity	Hours per week
Lecture	24
Tutorial	24
Online learning activity	1

*Course is delivered in intensive mode, with 2 full-days/week for 3 weeks.

Description

This course will provide students the skills to undertake sophisticated spatial (statistical) analysis and simulation. GeoComputation is in part the continuing development and application of analytical statistics that can be applied to clustering, search and measures of association over space and through time. The course will provide students with the mathematical background behind numerous spatial analytical techniques, and also with the select and integrate these methods in a way that it is appropriate for the problems addressed and the data available. Ultimately, the course will enhance the intellectual and methodological capacity of students in the domain of urban problem-solving. The course will use varied analytical environments, including the geographic information systems QGIS, as well as programming using PySal (Python for Spatial Analysis Library), and GeoDa software.

Program Learning Outcomes (PLOs)

The Program Learning Outcomes addressed from the Master of City Analytics are:

1. Demonstrate both theoretical and practical grounding to be competent and confident in understanding, analysing, modelling, and visualising urban data.
2. Develop skills and applications in relevant computer technologies and a critical appreciation technology transfer in practice in the changing global context.
3. Develop and apply specialised knowledge and analytical skills to inform evidence-based policy and decision-making processes.

Course Learning Outcomes (CLOs) with Alignment to PLOs and Assessment

CLO #	CLO Statement	PLO #	Related Assessment
CLO 1	Manipulate and analyse data in a reproducible fashion using computational techniques.	1, 2	Assessments 2, 4
CLO 2	Demonstrate an understanding of the concepts and methods for computational analysis through interaction with real-world data.	1, 2	Assessments 1, 3
CLO 3	Select and employ a range of data analysis tools and methods including demonstrating understanding of the appropriateness of different methods for different data.	2, 3	Assessments 2, 4, 5

CLO 4	Demonstrate computationally-oriented independent research applied to the urban context.	2, 3	Assessment 5

3. ASSESSMENT

This course has 5 assignments, including:

- 2 Quizzes to assess understanding of concepts;
- 2 project-based exercises to develop executable codes to assess geocomputation skills; and
- 1 summative assessment to demonstrate the application of geocomputation skills to an urban issue.

Assessment Task	Weight	Course Learning Outcomes assessed	Due Date
1. Assignment 1 (Quiz 1)	10%	2	Week 5
2. Assignment 2 (Executable code 1)	15%	1, 2	Week 7
3. Assignment 3 (Quiz 2)	10%	2	Week 9
4. Assignment 4 (Executable code 2)	20%	1, 2	Week 11
5. Assignment 5 (Final project)	45%	3, 4	Week 15

ASSESSMENT CRITERIA AND STANDARDS

Assessment 1 – QUIZ 1 (10%), due Sunday 26 August 11:59 pm

Online multiple-choice quiz via Moodle to be completed by the student in week 5 (week after the first block of classes). The Quiz will test the understanding of important concepts and techniques of Geocomputation covered in the first two days of classes. The Quiz will be available online for one week but will need to be completed within 3 hours since started. Students will have only one attempt to complete the quiz.

The marking will be a ratio of the number of right answers in relation to the total number of questions (20).

Assessment 2 – Executable code 1 (15%), Due Sunday 9 September 11:59 pm

Students are asked to develop an executable code in Python to develop an urban analysis using one or more techniques learned in day 1 and day 2 of the course (spatial weights, spatial autocorrelation, Markov chain, etc). The executable code comprises a short section of Python code to execute data analysis using one or more datasets from a list provided (some data as csv or shapefiles, others accessible via API). The code should enable reproduction of the analysis by others (i.e. it should work), be well commented (i.e. so that others can easily understand what each piece of code does) and aim to be efficient but elegant (i.e. quick without being overly compact).

The marking will be done according to the following criteria:

1. Appropriateness of the data and geocomputation techniques to the urban issue addressed (20%)
2. Provision of visual outputs in the code/graphs or maps (20%)
3. Applicability of the scrip, and whether nor not it works! (20%)

4. The quality of the code; commented, indented, debugged, efficient, reliable, etc, and with a link to GitHub repository (40%)

Assessment 3 – QUIZ 2 (10%), due on Sunday 23 September 11:59 pm

Online multiple-choice quiz via Moodle to be completed by the student in week 9 (week after the second block of classes). The Quiz will test the understanding of important concepts and techniques of Geocomputation covered in the day 3 and 4 of classes. The Quiz will be available online for one week but will need to be completed within 3 hours since started. Students will have only one attempt to complete the quiz.

The marking will be a ratio of the number of right answers in relation to the total number of questions (20).

Assessment 4 – Executable code 2 (20%), due on Sunday 6 October 11:59 pm

Students are asked to develop an executable code in Python to develop an urban analysis using one or more techniques learned in day 3 and day 4 of the course (point pattern analysis, spatial clustering, spatial regression, etc). The executable code comprises a short section of Python code to execute data analysis using one or more datasets from a list provided (some data as csv or shapefiles, others accessible via API). The code should enable reproduction of the analysis by others (i.e. it should work), be well commented (i.e. so that others can easily understand what each piece of code does) and aim to be efficient but elegant (i.e. quick without being overly compact).

The marking will be done according to the following criteria:

1. Appropriateness of the data and geocomputation techniques to the urban issue addressed (20%)
2. Provision of visual outputs in the code/graphs or maps (20%)
3. Applicability of the scrip, and whether nor not it works! (20%)
4. The quality of the code; commented, indented, debugged, efficient, reliable, etc, and with a link to GitHub repository (40%)

Assessment 5 – Final Project (45%), due on Sunday 3 November 11:59 pm

This assignment is designed to test students understanding of geocomputation concepts and capacity to independently select and apply proper techniques to dataset(s) within the domain of an urban problem. The submission should include a report (pdf), a zipfile with the data used, and a link to script shared on GitHub.

In the report (with a maximum work count of 1,500 words + references), the student will (1) state the urban issue being addressed and provide some brief background (use references); (2) describe the dataset(s) used; (3) describe and justify the geocomputation technique(s) applied (a simple flow diagram to demonstrate the sequence of steps is expected); (4) present a summary of results and analysis; and (5) conclude the report with a brief analysis of main insights, as well as strengths and limitations of the work developed. This script can use a combination of Geocomputation methods learned during the course; and should be properly commented to facilitate understanding of steps by other users.

The marking will be done according to the following criteria:

1. Quality of the writing, including staying within the word count (20%)
2. The depth of understanding of the urban issue and the Geocomputation techniques, and complementary readings (20%)
3. The quality of figures and diagrams (15%)
4. Applicability and complexity of the scrip, and whether nor not it works! (20%)

5. The quality of the code; commented, indented, debugged, efficient, reliable, etc, and with a link to GitHub repository (25%)

4. WEEKLY COURSE SCHEDULE

Week	Topic [Module]	Activity [Learning opportunity]	Related CLO
Week 3 (12 hours over 2 days)	Introduction to Geocomputation Geocomputation analysis part 1	• Understand what geocomputation is • Recap on Python programming • Introduction to PySAL (Python Sptial Analysis Library) • Introduction to Geocomputation techniques and development of hands-on tutorial (spatial weights analysis, exploratory spatial and temporal analysis)	1, 2, 3
Week 6 (12 hours over 2 days)	Geocompuation analysis part 2	• Introduction to Geocomputation techniques and development of hands-on tutorial (point pattern analysis, spatial clustering, regression analysis)	1, 2, 3
Week 10 (12 hours over 2 days)	Geocompuation analysis part 3	• Introduction to Geocomputation techniques and development of hands-on tutorial (machine learning, agent-based modelling)	1, 2, 3