

Subject Description Form

Subject Code	LSGI535
Subject Title	Spatial Data Analysis and Mining
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Concepts and principles of GIS
Objectives	Understand the purpose of spatial data analysis and spatial data mining and critically evaluate and analyze spatial data to construct spatial statistical models and validate their reliability.
Intended Learning Outcomes	<p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> a. understand the purpose of spatial data analysis and data mining (L5); b. understand a range of exploratory spatial data analysis techniques and their use in analyzing geomatics data (L5); c. evaluate data quality and identify appropriate GIS, cartographical, graphical and tabular tools in processing spatial data to use in the spatial data analysis and data mining (L5); d. analyze the data using appropriate statistical spatial analysis tools to make inferences and to construct spatial and spatial statistical models (L5); e. appreciate the limitation of the spatial models (L5); f. test models through validation and able to criticize their reliability (L5).
Subject Synopsis/ Indicative Syllabus	<ul style="list-style-type: none"> • Introduction: GIS analysis and spatial data analysis, objectives of spatial analysis, why to use statistics to identify patterns? Understanding spatial data, data attributes, schematic representation of entity-attribute spatial data types, stages of spatial data analysis with statistics, definition and classification of spatial data, spatial data types through GIS representation, data quality, question of scale. • Spatial statistics: central feature, median center, mean center, weights, weighted mean center, standard and weighted standard distance measures, calculations and their interpretations. • Spatial distributions: standard deviational ellipse and its interpretation, measuring the direction and orientation of line features, measuring variability in direction or orientation. Spatial randomness. • Principles of descriptive and inferential statistics: distribution of random variables: histogram, probability density function and normal distribution, t, chi-square and f distributions, hypothesis testing. • Spatial analysis: point pattern analysis: point density approach, point interaction approach. Quadrat analysis. Kolmogorov-smirnov (k-s) test. Nearest-neighbour analysis. Point distribution under complete spatial randomness. K function. Pattern of future location: pattern of future values, finding pattern for areas with categories, patterns of features having continuous values, joint count statistics, testing the significance of joint count statistic results.

	<ul style="list-style-type: none"> Measuring the similarity of nearby features: the weights matrix, autocorrelation, Geary's C and Moran's I measures and their statistical significance, G-statistics and the significance of G-statistics. LISA. Analyzing spatial processes: spatial autocorrelation and testing the mean of a spatial data set, spatial autocorrelation and tests of bivariate association, Pearson's correlation coefficient, using Pearson's rank correlation coefficient. Multiple regression and locally weighted spatial regression: key variable identification, factor influencing regression results, regression analysis and spatial data, regional variation, local trends, residual analysis. Overview of spatial data mining and knowledge discovery: spatial characteristics rules, spatial classification rules, spatial clustering rules, spatial association rules, spatial dependency rules, spatial serial rules. Spatial data mining vs. exploratory spatial data analysis. Spatial data warehouse, online visualization for spatial data mining.
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Teaching/Learning Methodology	Learning approach is of hybrid problem type. Introductions to the concepts are followed by tutorial problem assignments and a group project.
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Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks		% weighting		Intended subject learning outcomes to be assessed (Please tick as appropriate)					
					a.	b.	c.	d.	e.	f.
	Assignments		30%		✓	✓	✓	✓	✓	✓
	Project		30%		✓	✓	✓	✓	✓	✓
	Test		40%		✓	✓	✓	✓	✓	✓
	Total		100%							
<p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>It consists of 100% continuous assessment through tests, tutorial assignments, and group projects. Tests are designed to monitor student learning on basic concepts at knowledge level. Problem based learning is carried out during the tutorials and is reinforced by assignments. Group project contributes to the all-round development of students. Students are expected to achieve a minimum standard to be able to obtain a passing grade in line with criterion referenced assessment approach.</p>										

Student Study Effort Expected	Class contact:	
	Lecture	26Hrs.
	Tutorial	13Hrs.

	Other student study effort:	
	Assignment	31Hrs.
	Project	35Hrs.
	Total student study effort:	105Hrs.
Reading List and References	<p>Allen D.W. (2013) <i>GIS Tutorial 2: Spatial Analysis Workbook</i>, 3rd Ed, ESRI Pub.</p> <p>Cressie N. (1991) <i>Statistics for Spatial data</i>. Wiley.</p> <p>Cressie N., C.K. Wikle (2011), <i>Statistics for Spatio-Temporal Data</i>, Wiley Desktop Ed.</p> <p>Diggle P. (2013) <i>Statistical Analysis of Spatial and Spatio-Temporal Point Patterns</i>, Wiley, 3rd Ed.</p> <p>Dubé J., D. Legros (2013) <i>Spatial and Spatio-temporal Data Analysis</i>.</p> <p>Fotheringham S., C. Brunson, M. Charlton (2002) <i>Geographically Weighted Regression: The Analysis of Spatially Varying Relationships</i>, Wiley.</p> <p>Getis A., B. Boots (2008) <i>Models of Spatial Processes: An Approach to the Study of Point, Line and Area Patterns</i>, Cambridge Geographical Studies.</p> <p>Law, M., A. Collins (2013) <i>Getting to Know ArcGIS for Desktop</i>, Environmental Systems Research Institute Inc., 3rd Ed.</p> <p>Miller H.J., J. Han (2001) <i>Geographic Data Mining and Knowledge Discovery</i>, CRC Press.</p> <p>Mitchell A. (2005) <i>The ESRI Guide to GIS Analysis, Vol 2, Spatial Measurements and Statistics</i>, ESRI Press. Subject Textbook, available as eBook via PolyU lib: http://lib.myilibrary.com/Open.aspx?id=290116&loc=&srch=undefined&src=0</p> <p>Ripley B.D. (2004) <i>Spatial Statistics</i>, Wiley Series in Probability and Statistics.</p>	