

MODULE HANDBOOK
SPATIAL
STATISTICS



BACHELOR DEGREE PROGRAM
DEPARTMENT OF STATISTICS
FACULTY OF SCIENCE AND DATA ANALYTICS
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA, INDONESIA

ENDORSEMENT PAGE



MODULE HANDBOOK SPATIAL STATISTICS DEPARTMENT OF STATISTICS INSTITUT TEKNOLOGI SEPULUH NOPEMBER

Proses <i>Process</i>	Penanggung Jawab <i>Person in Charge</i>			Tanggal <i>Date</i>
	Nama <i>Name</i>	Jabatan <i>Position</i>	Tandatangan <i>Signature</i>	
Perumus <i>Preparation</i>	Dr. Sutikno, S.Si, M.Si	Dosen <i>Lecturer</i>		March 28, 2019
Pemeriksa dan Pengendalian <i>Review and Control</i>	Ahmad Choirudin, S.Si., M.Sc., Ph.D	Tim kurikulum <i>Curriculum team</i>		April 15, 2019
Persetujuan <i>Approval</i>	Dr. Bambang Widjanarko Otok, M.Si	Koordinator RMK <i>Course Cluster Coordinator</i>		July 17, 2019
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen <i>Head of Department</i>		July 30, 2019

MODULE HANDBOOK

SPATIAL STATISTICS

Module name	Spatial Statistics	
Module level	Undergraduate	
Code	KS184656	
Course (if applicable)	Spatial Statistics	
Semester	6 (Even)	
Person responsible for the module	Dr. Sutikno, S.Si, M.Si	
Lecturer	Dr. Sutikno, S.Si, M.Si Ahmad Choirudin, S.Si., M.Sc., Ph.D	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, elective , 6 th semester.	
Type of teaching, contact hours	Lectures, <50 students	
Workload	1. Lectures: 3 x 50 = 150 minutes per week. 2. Exercises and Assignments: 3 x 60 = 180 minutes (3 hours) per week. 3. Private learning: 3 x 60 = 180 minutes (3 hours) per week.	
Credit points	3 credit points (sks)	
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit in the exams.	
Mandatory prerequisites	-	
Learning outcomes and their corresponding PLOs	CLO.1 Explain the use of the spatial statistics concept and its implementation in various fields CLO.2 Able to explain spatial statistical procedures and select the appropriate method	PLO.1
	CLO.3 Able to analyze the data with appropriate spatial statistical methods and effective to the problems CLO.4 Able to identify, formulate, and solve statistical problems in the field of spatial statistics	PLO.3
	CLO.5 Able to use computational techniques and modern computer that required to analyze the spatial data CLO.6 Have insight about the current issue and upcoming issue relating to the biostatistics CLO.7 Able to communicate effectively and collaborate with the teams in interdisciplinary and multidisciplinary CLO.8 Have responsibilities and professional ethics CLO.9 Able to motivate themselves to think creatively and lifelong learning	PLO.4

Content	The objectives of the spatial statistics course are the students able to design the data collection based on location and analyze the spatial data particularly in the health and environment sectors, and able to interpret the result. The theoretical material from basic spatial concepts to various methods of spatial analysis is conveyed through lectures and discussions. Improving the analytical skills, students are given examples of relevant cases. These examples are resolved with and without software through a practicum in class. In addition, students are given assignments both independently and in groups to find out the application of various real problems, particularly in the environmental and health sectors. The objective of these assignments is to prepare students to be able to manage and work in teams and to be responsible for the results of individual and group work.
Study and examination requirements and forms of examination	• In-class exercises • Assignment • Mid-term exam • Final exam
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom.
Reading list	1. Anselin, L. 1988. Spatial Econometrics: Methods and Models. Dordrecht: Kluwer Academic Publishers. 2. Anselin, L. and Rey, S.J., 2010. Perspective on Spatial Data Analysis. Springer. 3. Arbia, G. 2006. Spatial Econometrics: Statistical Foundations and Applications to Regional Convergence. Berlin: Springer. 4. Ficher, M.M. and Getis, A., 2010. Handbook of Applied Spatial Analysis Software Tools, Methods and Applications. Springer-Verlag Berlin Heidelberg. 5. Fotheringham, A.S., Brundson, C., and Charlton, M. 2002. Geographically Weighted Regression: the analysis of spatially varying relationships. England : John Wiley dan Sons Ltd.

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	Mata Kuliah	Statistika Spasial
	Kode Mata Kuliah	KS184656
	Semester/SKS	VI/3
	MK Prasyarat	-
RP-S1	Dosen Pengampu	Dr. Sutikno, S.Si, M.Si ; Ahmad Choirudin, S.Si., M.Sc., Ph.D

Bahan Kajian	Dasar Sains, Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan Data Processing, Pemodelan, Pemerintahan dan Kependudukan, Kesehatan dan Lingkungan
Study Materials	<i>Basic Science, Statistical Theory, Data collection, Description and Exploration, Computing and Data Processing, Modeling, Government and Population, Health and Environment</i>
CPL yang dibebankan MK	CPL-1 Mampu menerapkan pengetahuan teori statistika, matematika, dan komputasi CPL-3 Mampu menganalisis data dengan metode statistika yang tepat dan menginterpretasikannya CPL-4 Mampu mengidentifikasi, memformulasi, dan menyelesaikan masalah statistika di berbagai bidang terapan
PLO	<i>PLO-1. Able to apply knowledge of science, statistical theory, mathematics, and computing to problems in various applied fields</i> <i>PLO-3. Able to analyze data using appropriate statistical methods and interpret them</i> <i>PLO-4. Able to identify, formulate, and solve statistical problems in various applied fields</i>
CP-MK	CPMK.1 Menjelaskan penggunaan konsep statistika spasial dan implementasinya di berbagai bidang CPMK.2 Mampu menjelaskan prosedur statistika spasial dan mampu memilih metode yang sesuai CPMK.3 Mampu menganalisis data dengan metode statistika spasial yang sesuai dan efektif dengan permasalahan CPMK.4 Mampu mengidentifikasi, memformulasi, dan menyelesaikan masalah statistika di bidang statistika spasial CPMK.5 Mampu menggunakan teknik komputasi dan perangkat komputer modern yang diperlukan untuk mengolah data spasial CPMK.6 Memiliki pengetahuan tentang isu terkini dan mendatang yang berkaitan dengan bidang statistika spasial CPMK.7 Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin CPMK.8 Memiliki tanggung jawab dan etika profesi CPMK.9 Mampu memotivasi diri untuk berpikir kreatif dan belajar sepanjang hayat
CLO	<i>CLO.1 Explain the use of the spatial statistics concept and its implementation in various fields</i> <i>CLO.2 Able to explain spatial statistical procedures and select the appropriate method</i> <i>CLO.3 Able to analyze the data with appropriate spatial statistical methods and effective to the problems</i> <i>CLO.4 Able to identify, formulate, and solve statistical problems in the field of spatial statistics</i> <i>CLO.5 Able to use computational techniques and modern computer that required to analyze the spatial data</i> <i>CLO.6 Have insight about the current issue and upcoming issue relating to the biostatistics</i> <i>CLO.7 Able to communicate effectively and collaborate with the teams in interdisciplinary and multidisciplinary</i> <i>CLO.8 Have responsibilities and professional ethics</i> <i>CLO.9 Able to motivate themselves to think creatively and lifelong learning</i>

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Perte- muan <i>Meeting</i>	Kemampuan Akhir Sub CP-MK <i>Final Ability</i>	Keluasan (materi pembelajaran) <i>Extent (learning material)</i>	Metode Pembelajaran <i>Learning methods</i>	Estimasi Waktu <i>Duration</i>	Bentuk Evaluasi <i>Evaluation Type</i>	Kriteria dan Indikator Penilaian <i>Assessment Criteria and Indicators</i>	Bobot Penilaian <i>Scoring</i>
1	15. Dapat memahami konsep dasar Statistika Spasial <i>1. Able to understand the basic concept of spatial statistics</i>	Pengertian statistika spasial dan beberapa terapanannya diberbagai bidang <i>The definition of Spatial Statistics and its application in various fields</i>	Ceramah interaktif Diskusi <i>Interactive Lecture Discussion</i>	150 menit <i>150 minutes</i>	Tes Observasi Aktifitas di kelas <i>Test Observe the class activity</i>	1. Dapat menjelaskan pengertian data spasial dan non-spasial 2. Dapat menjelaskan konsep dasar analisis spasial: spasial dependent dan spasial heterogeniety 3. Dapat memberikan contoh permasalahan riel yang dapat diselesaikan dengan statistika spasial. <i>1. Able to explain the definition of spatial and non-spatial data</i> <i>2. Able to explain the basic concepts of spatial analysis: spatial dependent and spatial heterogeneity</i> <i>3. Able to provide examples of real problems that can be solved with spatial statistics.</i>	7,5%/ 7,5%
2	16. Dapat memahami struktur data spasial dan proses pengumpulan data spasial <i>2. Able to understand the spatial data structure and the procedure of spatial data collection</i>	Struktur data spasial (titik, area: <i>lattices</i> , dan <i>point patterns</i>), <i>isotropy</i> dan <i>anisotropy</i> , stasioner dan non stasioner <i>Spatial Data Structure (Point, Area: Lattices, and Point Patterns), Isotropy and Anisotropy, Stationary and Non Stationary</i>	Ceramah interaktif Diskusi <i>Interactive Lecture Discussion</i>	150 menit <i>150 minutes</i>	Tes & Observasi Aktifitas di kelas <i>Test & Observe the class activity</i>	4. Dapat menjelaskan tipe data spasial 5. Dapat memahami konsep proses stokastik khususnya dalam spasial. 6. Dapat memahami konsep <i>isotropy</i> dan <i>anisotropy</i> , stasioner dan non-stasioner <i>1. Able to explain the types of spatial data</i> <i>2. Able to understand the concept of stochastic processes, particularly in spatial.</i>	7,5%/ 15%

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						3. <i>Able to understand the concept of isotropy and anisotropy, stationary and non-stationary</i>	
3	17. Dapat menganalisis data univariate dan multivariate berbasis spasial serta menyajikan deskripsi data spasial melalui peta 3. <i>Able to analyze the spatial univariate and multivariate data and present the description of the spatial data through a map.</i>	Eksplorasi data spasial (<i>Exploratory Spatial Data Analysis: ESDA</i>) <i>Exploratory Spatial Data</i>	Ceramah interaktif Latihan Soal Diskusi <i>Interactive Lecture Exercises Discussion</i>	150 menit <i>150 minutes</i>	Tes & Observasi Aktifitas di kelas <i>Test & Observe the class activity</i>	1. Dapat menganalisis data univariate dan multivariate berbasis spasial (<i>Box plot, Histogram, scatter plot</i>) 2. Dapat menyajikan deskripsi data spasial melalui peta dengan software spasial 1. <i>Able to analyze the spatial univariate and multivariate data (box plot, histogram, scatter plot)</i> 2. <i>Able to present a description of spatial data through maps using spatial software</i>	7,5%/ 22,5%
4,5	18. Dapat menyusun rancangan pengumpulan data berbasis spasial 4. <i>Able to design the spatial data collection</i>	Teknik sampling dan pendugaan berbasis wilayah <i>Sampling Technique and Area Basis Estimation</i>	Ceramah interaktif Diskusi <i>Interactive Lecture Discussion</i>	300 menit <i>300 minutes</i>	Tes & Observasi Aktifitas di kelas <i>Test & Observe the class activity</i>	3. Dapat menjelaskan prosedur pengumpulan data berbasis lokasi 4. Dapat menerapkan metode pengumpulan data berbasis lokasi 1. <i>Able to explain data collection procedure based on the location</i> 2. <i>Able to apply the methods of data collection procedure based on the location</i>	7,5%/ 30%



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6,7	19. Dapat menganalisis data dengan geostatistik 5. <i>Able to analyze the data using geostatistics</i>	Prediksi dan interpolasi (<i>geostatistic: ordinary kriging, variogram</i>) <i>Prediction and interpolation (geostatistic: ordinary kriging, variogram)</i>	Ceramah interaktif Latihan Soal Diskusi <i>Interactive Lecture Exercises Discussion</i>	300 menit <i>300 minutes</i>	Tes & Observasi Aktifitas di kelas Tugas 1 <i>Test & Observe the class activity Assignment 1</i>	1. Dapat menjelaskan konsep interpolasi dengan kriging. 2. Dapat menjelaskan prosedur interpolasi kriging. 3. Dapat menjelaskan variogram teoritik dan variogram eksperimental 4. Dapat menerapkan metode kriging pada permasalahan riil dengan dan tanpa software <i>1. Able to explain the concept of interpolation with kriging. 2. Able to explain the kriging interpolation procedure. 3. Able to explain the theoretical variogram and experimental variogram 4. Able to apply the kriging method to real problems with and without software</i>	15%/ 40%
8	ETS MIDTERM EXAM						
9,10	20. Dapat memahami <i>spatial pattern</i> dan 6. <i>Able to understand the spatial pattern</i>	<i>Spatial pattern</i> dan autokorelasi spasial <i>Spatial Pattern and Spatial Autocorrelation</i>	Ceramah interaktif Latihan Soal Diskusi <i>Interactive Lecture Exercises Discussion</i>	300 menit <i>300 minutes</i>	Tes & Observasi Aktifitas di kelas <i>Test & Observe the class activity</i>	1. Dapat menjelaskan konsep dasar <i>spatial pattern</i> dan autokorelasi spasial. 2. Dapat menjelaskan beberapa metode <i>spatial pattern</i> 3. Dapat menjelaskan metode autokorelasi (Moran'I, Geary, Getis, LISA) 4. Dapat menjelaskan beberapa bobot yang digunakan dalam analisis spasial	15%/ 55%

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						1. Able to explain the basic concepts of spatial patterns and spatial autocorrelation. 2. Able to explain several methods of spatial pattern 3. Able to explain the autocorrelation method (Moran'I, Geary, Getis, LISA) 4. Able to explain several weights used in spatial analysis	
11,12	21. Dapat menganalisis data spasial dengan regresi spasial basis area 7. <i>Able to analyze the spatial data using spatial regression based on the area</i>	Pemodelan regresi spasial dengan basis area (SAR, SEM, SARMA) <i>Spatial Regression Modeling based on the Area (SAR, SEM, SARMA)</i>	Ceramah interaktif Latihan Soal Diskusi <i>Interactive Lecture Exercises Discussion</i>	300 menit <i>300 minutes</i>	Tes & Observasi Aktifitas di kelas Tugas 2 <i>Test & Observe the class activity Assignment 2</i>	3. Dapat menjelaskan formulasi model regresi spasial basis area 4. Dapat menjelaskan estimasi dan pengujian parameter pada regresi spasial basis area 5. Dapat menerapkan regresi spasial basis area di berbagai bidang dengan bantuan software 1. <i>Able to explain the formulation of a spatial regression model based on the area</i> 2. <i>Able to explain the estimation and testing of parameters in spatial regression based on the area</i> 3. <i>Able to apply spatial regression based on the area in various fields using a software</i>	20%/ 80%

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13-15	22. Dapat menganalisis data spasial dengan regresi spasial basis titik 8. <i>Able to analyze the spatial data using spatial regression based on the point</i>	Pemodelan regresi spasial dengan basis titik (GWR, GWLR) <i>Spatial Regression Modeling based on the Point (GWR, GWLR)</i>	Ceramah interaktif Latihan Soal Diskusi <i>Interactive Lecture Exercises Discussion</i>	450 menit <i>450 minutes</i>	Tes & Observasi Aktifitas di kelas Tugas 2 <i>Test & Observe the class activity Assignment 2</i>	1. Dapat menjelaskan formulasi model regresi spasial basis titik 2. Dapat menjelaskan estimasi dan pengujian parameter pada regresi spasial basis titik 3. Dapat menerapkan regresi spasial basis titik di berbagai bidang dengan bantuan software <i>1. Able to explain the formulation of a spatial regression model based on the point</i> <i>2. Able to explain the estimation and testing of parameters in spatial regression based on the point</i> <i>3. Able to apply spatial regression based on the point in various fields using a software</i>	20%/100%
16	EAS <i>FINAL EXAM</i>						

PUSTAKA/REFERENCES:

- Anselin, L. 1988. Spatial Econometrics: Methods and Models. Kluwer Academic Publishers, Dordrecht.
- Fotheringham, A.S., Brundson, C., dan Charlton, M. 2002. Geographically Weighted Regression: the analysis of spatially varying relationships. John Wiley & Sons Ltd, England.

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8. Roger et al. 2008. Applied Spatial Data Analysis with R. Springer-Verlag
9. Arbia, G. 2006. Spatial Econometrics: Statistical Foundations and pplications to Regional Convergence.Springer, Berlin
10. Anselin L, Rey SJ. 2010. Perspective on Spatial Data Analysis. Springer
11. Ficher MM and Getis A. 2010. Handbook of Applied Spatial Analysis Software Tools, Methods and Applications. Springer-Verlag Berlin Heidelberg