



INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS SAINS DAN ANALITIKA DATA
PROGRAM STUDI DOKTOR ILMU STATISTIK
DEPARTEMEN STATISTIKA

Kode Dokumen

RENCANA PEMBELAJARAN SEMESTER

MATA KULIAH (MK)		KODE	Rumpun MK	BOBOT (sks)		SEMESTER	Tgl Penyusunan
Analisis Bayesian Lanjut		SS236212	Statistika Komputasi dan Sains Data	T=3	P=0	2	18 Februari 2025
OTORISASI		Pengembang RPS		Koordinator RMK		Ketua PRODI	
				Prof. Drs. Nur Iriawan, M.Ikomp, Ph.D		Irhamah, Ph.D.	
Capaian Pembelajaran (CP) <i>Learning Outcome (LO)</i>	CPL-PRODI yang dibebankan pada MK						
	CPL-2 <i>PLO-2</i>	Mampu mengembangkan teori / konsepsi / gagasan baru dan memecahkan permasalahan ilmu pengetahuan dan/ atau teknologi dalam bidang keilmuan nya melalui riset dengan pendekatan inter, multi dan transdisiplin hingga menghasilkan karya kreatif, original, dan teruji dalam bentuk disertasi dan makalah yang telah diterbitkan di jurnal internasional bereputasi. <i>Able to develop new theories/concepts/ideas and solve scientific and/or technological problems in their field through research with inter, multi, and transdisciplinary approaches to produce creative, original, and tested works in the form of dissertations and papers that have been approved published in reputable international journals.</i>					
	CPL-5 <i>PLO-5</i>	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik. <i>Able to use modern computing devices to solve statistical problems.</i>					
	CPL-6 <i>PLO-6</i>	Mampu menerapkan dan mengembangkan teknik komputasi untuk menyelesaikan permasalahan statistik. <i>Able to apply and develop computational techniques to solve statistical problems.</i>					
	CPL-7 <i>PLO-7</i>	Mampu menerapkan metode statistika dengan tepat serta mengevaluasi dan mengembangkannya untuk menganalisis permasalahan teoritis dan riil. <i>Able to apply statistical methods appropriately as well as evaluate and develop them to analyze theoretical and real problems.</i>					
	CPL-8 <i>PLO-8</i>	Mampu menerapkan metode Statistika Bisnis, Industri, Ekonomi Finansial, Sosial Kependudukan, Lingkungan atau Kesehatan yang berbasis Komputasi pada permasalahan riil <i>Able to apply Computing-based Business, Industrial, Financial Economics, Social-Population, Environmental, or Health Statistics methods to real problems.</i>					
	Capaian Pembelajaran Mata Kuliah (CPMK)						
		CPMK-1	Memahami konsep berfikir Bayesian, pemilihan prior sesuai dengan pola data, konsep data augmentation, dan resampling dengan MCMC				
		CPMK-2	Memahami struktur Bayesian untuk distribusi normal, non-normal ataupun neo-normal				
		CPMK-3	Memahami struktur Bayesian untuk pemodelan GLMs				

	- Kaplan, D. (2024) Bayesian Statistics for the Social Sciences. The Guilford Press, New York. - Gelman, A., Carlin, J. B., Stern, H. S. Dunson, D.B., Vehtari, A. dan Rubin, D. B., 2014, Bayesian Data Analysis, Chapman & Hall, London. - Albert, J., 2009, <i>Bayesian Computation with R</i> 2nd Edition, Springer, London. - Robert, C. P., 2007, <i>The Bayesian Choice from Decision-Theoretic Foundations to Computational Implementation</i> 2nd Edition, Springer, New York - Software: WinBUGS 1.4, R2WinBUGS, RStan. Pendukung : - Carlin, B. P. dan Louis, T. A., 1996, <i>Bayes and Empirical Bayes Methods for Data Analysis</i>, Chapman & Hall, London - Ntzoufras, N. (2009) Bayesian Modeling Using WinBUGS., John-Wiley & Sons, New Jersey. - Svetlozar T. Rachev, S. T., Hsu, J. S., J., Bagasheva, B., S., dan Fabozzi, F., J., 2008, <i>Bayesian Methods in Finance</i>, John Wiley & Sons, New Jersey - Kruschke, J., K., 2010, <i>Doing Bayesian Data Analysis: A Tutorial with R and BUGS</i>, Academic Press / Elsevier - McLachlan, G. and Basford, K., 1988, <i>Mixture models: inference and application to clustering</i>, Marcel and Decker Inc. - Tanner, M. A., 1996, <i>Tools for Statistical Inference: Methods for the Exploration of Posterior Distributions and Likelihood Functions</i>, 3rd Edition, Springer-Verlag: New York. - Box, G. E. P. and Tiao, G. C., 1973, Bayesian Inference in Statistical Analysis, Reading, MA, Addison-Wesley. - Casella, G. and Berger, R. L., 1990, Statistical Inference, Duxbury, Belmont California, USA. - Zellner, A., 1971, An Introduction to Bayesian Inference in Econometrics, Wiley, New York. - Titterton, M., Makov, G., and Smith A.F.M., 1985, Statistical analysis of finite mixtures, John Wiley & Sons, UK. - Martz, H.F. and Waller, R. A., 1982, <i>Bayesian Reliability Analysis</i>, John Wiley & Sons, New York
Dosen Pengampu	Prof. Drs. Nur Iriawan, M.Ikomp, Ph.D; Irhamah, Ph.D.
Matakuliah syarat	

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Memahami konsep berfikir Bayesian dan mengetahui bedanya dengan konsep berfikir frekuentis Understand the concept of Bayesian thinking and know the difference with the	- Memahami konsep hukum Bayes - Memahami perbedaan cara berfikir Bayesian vs frequentist - Understand the concept of Bayes' law - Understanding the difference in Bayesian vs frequentist thinkin	Tugas 1, Observasi di kelas Task 1, Observation in class	Ceramah, diskusi dan latihan soal 150 Menit Lectures, discussions and exercise 150 Minutes		Pendahuluan: Teorema Bayes dan Bayesian inference Introduction: Bayes' theorem and Bayesian inference	5 %

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	concept of frequency thinking					(1) Bab 2 (2) Bab 1	
2	Memahami konsep prior, pemilihan prior sesuai dengan pola data. Understanding the concept of priors, prior selection according to data patterns.	1. Mampu memilih prior yang tepat untuk sebuah model Bayesian 2. Mampu memodelkan fenomena riil dengan Bayesian 3. Mampu menghitung probabilitas posterior suatu event 1. Be able to choose the right prior for a Bayesian model 2. Able to model phenomena with Bayesian 3. Be able to calculate the posterior probability of an event	Tugas 2, Observasi di kelas Task 2, Observation in class	Ceramah, diskusi dan latihan soal 150 Menit Lectures, discussions and exercise 150 Minutes		Prior, posterior, dan Bayesodds Prior, Posterior and Bayesodds (1) Bab 3 (2) Bab 2 dan Bab 3 (3) Bab 2	10 %
3 & 4	Memahami konsep data augmentation dan resampling dengan MCMC dan HMC Understand the concept of data augmentation and resampling with MCMC and HMC	1. Mampu mengimplementasikan model Bayesian dengan MCMC, khususnya Gibbs sampler dan Metropolis Hasting 2. Mampu menggunakan WinBUGS, R2WinBUGS, dan RStan untuk penyederhanaan pemodelan Bayesian dengan MCMC dan HMC 1. Able to implement Bayesian model with MCMC, especially Gibbs sampler and Metropolis Hasting 2. Able to use WinBUGS, R2WinBUGS, and RStan for Bayesian modeling simplification with MCMC and HMC	Tugas 3, Observasi di kelas Task 3, Observation in class	Ceramah, diskusi dan latihan soal 300 Menit Lectures, discussions and exercise 300 Minutes		Data augmentation dan Markov Chain Monte Carlo (MCMC) Data augmentation and Markov Chain Monte Carlo (MCMC) (1) Bab 4 (2) Bab 10, Bab 11, Bab 12, & Bab 13 (3) Bab 5, Bab 6, Bab 10, dan Bab 11 (4)	10 %
5 & 6	Memahami struktur posterior untuk single dan multiple parameter yang tersusun secara hierarchy ataupun tidak Understand the posterior structure for single and multiple parameters that are	1. Mampu membedakan dan memodelkan permasalahan dengan Bayesian single dan multipleparameter 2. Mampu mengkonstruksikan pemodelan Bayesian dengan struktur Hierarchy	Tes tulis Tugas 2 Observasi di kelas Writing test Task 2 Observation in class	Ceramah, diskusi dan latihan soal 300 Menit Lectures, discussions and exercise 300 Minutes		Single-parameter model dan Multi-parameter model Single-parameter model and Multi-parameter model	10 %

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	arranged in a hierarchy or not	1. Able to distinguish and model problems with Bayesian single and multiple parameters 2. Able to construct Bayesian modeling with Hierarchy structure				(1) Bab 3 dan Bab 5 (2) Bab 5, Bab 14, dan Bab 15 (3) Bab 3, Bab 4, dan Bab 7	
7	Memahami struktur Bayesian untuk distribusi normal, non-normal ataupun neo-normal Understand Bayesian structures for normal, non-normal or neo-normal distributions	1. Mampu membedakan permasalahan normal, non-normal, dan neo-normal 2. Mampu menyusun, mengimplementasikan model Bayesian normal, non-normal, dan neo-normal dengan MCMC 1. Able to distinguish normal, non-normal, and neo-normal problems 2. Able to compose, implement normal, non-normal, and neo-normal Bayesian models with MCMC	Tes tulis Tugas 2 Observasi di kelas Writing test Task 2 Observation in class	Ceramah, diskusi dan latihan soal 150 Menit Lectures, discussions and exercise 150 Minutes		Bayesian non-Normal dan neo-Normal model Bayesian non-Normal and neo-Normal models	5 %
8, 9, & 10	Memahami struktur Bayesian untuk model-model dalam GLMs Understanding Bayesian structures for GLMS models	1. Memahami konsep estimasi model GLMs dengan Bayesian 2. Mampu memodelkan fenomena riil dalam kategori GLMs dengan Bayesian 1. Understand the concepts of estimating GLMs using Bayesian 2. Able to model real phenomena using Bayesian	Tes tulis Tugas 3 Observasi di kelas Writing test Task 3 Observation in class	Ceramah, diskusi dan latihan soal 450 Menit Lectures, discussions and exercise 450 Minutes		Bayesian GLMs Bayesian GLMs (1) Bab 5 dan Bab 10 (2) Bab 16 (3) Bab 9	15 %
11 & 12	Memahami struktur Bayesian untuk system pemodelan dengan susunan mixture distribusi, model linear atau non-linear, maupun GLMs. Understand Bayesian structure for modeling system	1. Mampu mengidentifikasi permasalahan yang mempunyai struktur model mixture 2. Mampu memodelkan fenomena mixture dalam struktur Bayesian 3. Mampu menerapkan MCMC dalam penyelesaian Bayesian mixture	Tes tulis Tugas 4 Observasi di kelas Writing test Task 4 Observation in class	Ceramah dan, diskusi 300 Menit Lectures and discussions 300 Minutes		Bayesian Mixture Model Bayesian Mixture Model (2) Bab 22 dan Bab 23	15 %

Mg Ke-	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian		Bantuan Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]		Materi Pembelajaran [Pustaka]	Bobot Penilaian (%)
		Indikator	Kriteria & Bentuk	Luring (offline)	Daring (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	containing mixture of density, linear or non-linear model, and even GLMs.	1. Able to identify problems that have a mixture model structure 2. Able to model mixture phenomena in Bayesian structure (mixture of density, of linear/non-linear model, and GLMs) 3. Able to apply MCMC in solving Bayesian mixture					
13 & 14	Memahami cara pembentukan beberapa alternatif model Bayesian dan memahami cara pemilihan model Bayesian terbaik Understand how to form several alternative Bayesian models and understand how to choose the best Bayesian model	1. Mampu menyusun model struktur perkalian distribusi 2. Mampu menerapkan Bayes faktor dalam pemilihan model 3. Mampu membangun HPD dan Credible Interval 4. Mampu menentukan jumlah komponen mixture dengan MCMC dan reversible jump 1. Able to construct a multiplication distribution structure model 2. Able to apply Bayesian factors in model selection 3. Able to determine the number of mixture components with MCMC and reversible jump	Tes tulis Tugas 4 Observasi di kelas Writing test Task 4 Observation in class	1. Ceramah interaktif 2. Diskusi 3. Latihan 4. Praktikum 5. PBL 300 Menit 1. 1.Interactive lecture 2. 2.discussion 3. 3.exercise 4. 4.Practice 5. 5.PBL 300 Minutes		Pemilihan model terbaik dengan Bayesian Selection of the best model with Bayesian (1) Bab 6 (2) Bab 6 dan Bab 7	10 %
15 & 16	Memahami materi yang ditugaskan dan memahami alternatif model Bayesian yang paling tepat untuk digunakan. Understand the assigned material and understand the most appropriate alternative Bayesian model to use	Mampu menerapkan Bayesian untuk menyelesaikan masalah riil dengan Bayesian dan MCMC menggunakan program WinBUGS atau R2WinBUGS atau RStan Able to apply Bayesian to solve real problems with Bayesian and MCMC using WinBUGS or R2WinBUGS or RStan programs	Kemampuan pemaparan hasil proyek, Aktifitas diskusi, dan Laporan proyek Ability to present project results, discussion activities, and project reports	300 Menit 300 Minutes		Presentasi Proyek Bayesian Bayesian Project Presentation (1) Bab 9, Bab 10, dan Bab 11	20 %