

MODULE HANDBOOK

STATISTICAL MACHINE LEARNING



**STATISTICS UNDERGRADUATE PROGRAM
DEPARTMENT OF STATISTICS
FACULTY OF SCIENCE AND DATA ANALYTICS
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA**

ENDORSEMENT PAGE



MODULE HANDBOOK STATISTICAL MACHINE LEARNING STATISTICS UNDERGRADUATE PROGRAM 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>	Tanda tangan <i>Signature</i>	
Perumus <i>Preparation</i>	Dr.rer.pol. Dedy Dwi Prastyo, S.Si, M.Si	Dosen Lecturer		
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr.rer.pol. Dedy Dwi Prastyo, S.Si, M.Si; Dr. Kartika Fithriasari, M.Si	Tim kurikulum Curriculum team		
Persetujuan <i>Approval</i>	Dr. Ir. Setiawan, MS	Koordinator RMK Course Cluster Coordinator		
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

MODULE HANDBOOK

STATISTICAL MACHINE LEARNING

Module name	STATISTICAL MACHINE LEARNING	
Module level	Undergraduate	
Code	SS234526	
Course (if applicable)	STATISTICAL MACHINE LEARNING	
Semester	5	
Person responsible for the module	Dr.rer.pol. Dedy Dwi Prastyo, S.Si, M.Si	
Lecturer	Dr.rer pol. Dedy Dwi Prastyo, S.Si, M.Si Dr. Dra. Kartika Fithriasari, M.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory, 5th semester.	
Type of teaching, contact hours	Other SCL Methods (87.5%) Non-SCL Methods (12.5%)	
Workload	1. Lectures[L]: 2 x 50 = 100 minutes per week. 2. Practicum in Laboratory [P]: 1x150 = 150 minutes perweek 3. Exercises and Assignments [EA]: 3 x 60 = 180 minutes (3 hours)per week. 4. Independent learning [IL]: 3 x 60 = 180 minutes (3 hours) perweek.	
Credit points	3 credit points (SKS) Equivalent to 4.8 ECTS	
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	<p>CLO-1. Understand and able to explain the concept of supervised and unsupervised in machine learning and its application in various fields.</p> <p>CLO-2. Able to identify, formulate, and solve statistical problems using machine learning.</p> <p>CLO-3. Able to apply computing techniques and to use modern computer tools/software used in machine learning for clustering.</p> <p>CLO-4. Able to apply computational techniques and to use modern computer tools/software used in machine learning for predictions of regression and classification.</p> <p>CLO-5. Able to apply computational techniques and to use modern computer tools/software</p>	<p>PLO-2</p> <p>PLO-7</p> <p>PLO-8</p> <p>PLO-9</p> <p>PLO-10</p>

	used in machine learning for time series forecasting. CLO-6. Able to write a written report of the analysis obtained from project.	
Content	The Statistical Machine Learning (SML) course equips students to master the latest developing methods and algorithms that are used to make computers capable of learning and behaving intelligently. This lecture will discuss theory and practice for the latest methods and algorithms with topics including unsupervised learning and supervised learning methods/algorithms for regression, classification, and time series forecasting.	
Assessment and its weight	Assignment 1 (20%) Project 1 – Midterm Exam (20%) Assignment 2 (20%) Project 2 – Final Exam (40%)	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom	
Reading list	<ol style="list-style-type: none"> 1. Hastie, T., Tibshirani, R., and Friedman, J., 2017, <i>The Elements of Statistical Learning: Data Mining, Inference, and Prediction</i>, Second Edition, Springer New York 2. Haykin, S. 1999, <i>Neural Networks, 2nd .</i>, ed., Prentice Hall 3. Fausett, L., 1994, <i>Fundamental of Neural Networks</i>, Prentice Hall 4. Limin Fu, 1994, <i>Neural Network in Computer Intelligence</i>, McGraw Hill 5. Sivanandam, S.N., Sumathi, S., and Deepa, S. N., 2006, <i>Introduction to Neural Networks using MATLAB 6</i>, McGraw-Hill 6. James, G., Witten, D., Hastie, T., and Tibshirani, R., 2014, <i>An Introduction to Statistical Learning (with Application in R)</i>, Springer. 7. Cristianini, N and Shawe-Taylor, J., 2000, <i>An Introduction to Support Vector Machines and Other Kernel-based Learning Methods</i>, 1st Edition, Cambridge University Press. 8. Goodfellow, I., Yoshua, B., and Courville, A., 2016. <i>Deep Learning</i>. 9. Haerdle, W.K., Prastyo, D.D., Hafner, C.M. (2014). "Support vector machines with evolutionary model selection for default prediction." In: Racine, J., Su, L., Ullah, A. (eds.). <i>The Oxford Handbook of Applied Nonparametric and Semiparametric Econometrics and Statistics</i>, pp. 346–373. Oxford University Press, New York. 10. Berry, M., Mohamed, A., Yap, B. (eds). 2020. <i>Supervised and Unsupervised Learning for Data Science</i>. Springer. 	



INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS SAINS DAN ANALITIKA DATA
PROGRAM STUDI SARJANA STATISTIKA
DEPARTEMEN STATISTIKA

Kode Dokumen

RENCANA PEMBELAJARAN SEMESTER/
SEMESTER LEARNING PLAN

MATA KULIAH (MK)/ <i>Course</i>	KODE/ <i>Code</i>	Rumpun MK/ <i>Course Group</i>	BOBOT (sks)/ <i>Weight (credit)</i>		SEMESTER/ <i>Semester</i>	Tgl Penyusunan/ <i>Drafting Date</i>
STATISTICAL MACHINE LEARNING / <i>STATISTICAL MACHINE LEARNING</i>	SS234526	ANDEF	T=3	P=3	V	11 January 2023
OTORISASI/ <i>AUTHORIZATION</i>	Pengembang RPS/ <i>RPS Developer</i>		Koordinator RMK/ <i>Course Group Coordinator</i>		Ketua PRODI/ <i>Head of Department</i>	
	Dr.rer.pol. Dedy Dwi Prastyo, S.Si, M.Si		Dr. Ir. Setiawan, M.S		Dr. Kartika Fithriasari, M.Si	
Capaian Pembelajaran (CP)/ <i>Learning Achievement</i>	CPL-PRODI yang dibebankan pada MK/ <i>PLO</i>					
	CPL-2	Mampu mengkaji dan memanfaatkan ilmu pengetahuan dan teknologi dalam rangka mengaplikasikannya pada bidang Statistika, serta mampu mengambil keputusan secara tepat dari hasil kerja sendiri maupun kerja kelompok dalam bentuk laporan tugas akhir atau bentuk kegiatan pembelajaran lain yang luarannya setara dengan Tugas Akhir melalui pemikiran logis, kritis, sistematis dan inovatif.				
	CPL-7	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik.				
	CPL-8	Mampu menggunakan teknik komputasi untuk menyelesaikan permasalahan statistik				
	CPL-9	Mampu menerapkan metode statistika untuk menganalisis permasalahan teoritis dan riil.				
	CPL-10	Mampu menerapkan metode statistika Bisnis, Industri, Ekonomi, Sosial, Lingkungan atau Kesehatan pada permasalahan riil.				
	PLO-2	<i>Able to study and utilize science and technology in order to apply it to the field of Statistics, and be able to make appropriate decisions from the results of their own work or group work in the form of final project reports or other forms of learning activities whose output is equivalent to the Final Project through logical, critical thinking, systematic and innovative.</i>				
	PLO-7	<i>Able to use modern computing devices to solve statistical problems.</i> <i>Able to use computational techniques to solve statistical problems.</i>				

PLO-8 PLO-9 PLO-10	<i>Able to apply statistical methods to analyze theoretical and real problems.</i> <i>Able to apply business, industrial, economic, social, environmental or health statistical methods to real problems</i>
Capaian Pembelajaran Mata Kuliah (CPMK)/ CLO	
<p>CPMK-1. Mampu memahami konsep <i>supervised</i> dan <i>unsupervised</i> pada pembelajaran mesin (<i>Machine Learning</i>) dan aplikasinya di berbagai bidang.</p> <p>CPMK-2. Mampu mengidentifikasi, memformulasi, dan menyelesaikan masalah statistika menggunakan machine learning.</p> <p>CPMK-3. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang digunakan dalam <i>Machine Learning</i> untuk pengelompokan (<i>clustering</i>).</p> <p>CPMK-4. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk prediksi pada permasalahan regresi dan klasifikasi.</p> <p>CPMK-5. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk peramalan deret waktu.</p> <p>CPMK-6. Mampu menyajikan hasil penelitian dalam bentuk laporan tertulis.</p> <p><i>CLO-1. Understand and able to explain the concept of supervised and unsupervised in machine learning and its application in various fields.</i></p> <p><i>CLO-2. Able to identify, formulate, and solve statistical problems using machine learning.</i></p> <p><i>CLO-3. Able to apply computing techniques and to use modern computer tools/software used in machine learning for clustering.</i></p> <p><i>CLO-4. Able to apply computational techniques and to use modern computer tools/software used in machine learning for predictions of regression and classification.</i></p> <p><i>CLO-5. Able to apply computational techniques and to use modern computer tools/software used in machine learning for time series forecasting.</i></p> <p><i>CLO-6. Able to write a written report of the analysis obtained from project.</i></p>	

	<p>Matrik CPL – CPMK <i>PLO-CLO Matrix</i></p> <table border="1"> <thead> <tr> <th>CPMK</th> <th>CPL-2</th> <th>CPL-7</th> <th>CPL-8</th> <th>CPL-9</th> <th>CPL-10</th> </tr> </thead> <tbody> <tr> <td>CPMK-1</td> <td></td> <td></td> <td></td> <td>V</td> <td>V</td> </tr> <tr> <td>CPMK-2</td> <td></td> <td></td> <td></td> <td>V</td> <td>V</td> </tr> <tr> <td>CPMK-3</td> <td></td> <td>V</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-4</td> <td></td> <td>V</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-5</td> <td></td> <td>V</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-6</td> <td>V</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	CPMK	CPL-2	CPL-7	CPL-8	CPL-9	CPL-10	CPMK-1				V	V	CPMK-2				V	V	CPMK-3		V	V		V	CPMK-4		V	V		V	CPMK-5		V	V		V	CPMK-6	V				
CPMK	CPL-2	CPL-7	CPL-8	CPL-9	CPL-10																																						
CPMK-1				V	V																																						
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CPMK-3		V	V		V																																						
CPMK-4		V	V		V																																						
CPMK-5		V	V		V																																						
CPMK-6	V																																										
<p>Deskripsi Singkat MK/ Course Description</p>	<p>Mata kuliah Machine Learning (SML) membekali mahasiswa untuk menguasai metode dan algoritma yang berkembang terkini yang digunakan untuk membuat komputer dapat melakukan pembelajaran dan berperilaku cerdas. Pada perkuliahan ini akan dibahas teori dan praktik untuk metode dan algoritma terkini dengan topik mencakup metode/algoritma unsupervised learning dan supervised learning untuk regresi, klasifikasi, dan peramalan deret waktu.</p> <p><i>The Machine Learning (SML) course equips students to master the latest developing methods and algorithms that are used to make computers capable of learning and behaving intelligently. This lecture will discuss theory and practice for the latest methods and algorithms with topics including unsupervised learning and supervised learning methods/algorithms for regression, classification, and time series forecasting.</i></p>																																										
<p>Bahan Kajian: Materi Pembelajaran/ Course Material</p>	<p>Teknik Komputasi Modern, Perangkat Komputasi Modern, Metode dan Pemodelan, Aplikasi di Berbagai Bidang (Lab) <i>Modern Computing Techniques, Modern Computing Tools, Methods and Modeling, Applications in Various Fields (Lab)</i></p>																																										
<p>Pustaka/ References</p>	<p>Utama/Primary:</p> <p>Hastie, T., Tibshirani, R., and Friedman, J., 2017, <i>The Elements of Statistical Learning: Data Mining, Inference, and Prediction</i>, Second Edition, Springer New York</p> <p>Pendukung/Secondary:</p> <ol style="list-style-type: none"> Haykin, S. 1999, <i>Neural Networks</i>, 2nd ., ed., Prentice Hall Fausett, L., 1994, <i>Fundamental of Neural Networks</i>, Prentice Hall Limin Fu, 1994, <i>Neural Network in Computer Intelligence</i>, McGraw Hill Sivanandam, S.N., Sumathi, S., and Deepa, S. N., 2006, <i>Introduction to Neural Networks using MATLAB 6</i>, McGraw-Hill James, G., Witten, D., Hastie, T., and Tibshirani, R., 2014, <i>An Introduction to Statistical Learning (with Application in R)</i>, 																																										

	<p>Springer.</p> <p>6. Cristianini, N and Shawe-Taylor, J., 2000, <i>An Introduction to Support Vector Machines and Other Kernel-based Learning Methods</i>, 1st Edition, Cambridge University Press.</p> <p>7. Goodfellow, I., Yoshua, B., and Courville, A., 2016. <i>Deep Learning</i>.</p> <p>8. Haerdle, W.K., Prastyo, D.D., Hafner, C.M. (2014). "Support vector machines with evolutionary model selection for default prediction." In: Racine, J., Su, L., Ullah, A. (eds.). <i>The Oxford Handbook of Applied Nonparametric and Semiparametric Econometrics and Statistics</i>, pp. 346–373. Oxford University Press, New York.</p> <p>9. Berry, M., Mohamed, A., Yap, B. (eds). 2020. <i>Supervised and Unsupervised Learning for Data Science</i>. Springer.</p>
Dosen Pengampu/ Lecturers	Dr.rer pol. Dedy Dwi Prastyo, S.Si, M.Si Dr. Dra. Kartika Fithriasari, M.Si
Matakuliah syarat/ Pre-requisite Course	Analisis Multivariat Terapan <i>Applied Multivariate Analysis</i>

Mg Ke- Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) Final capability for each learning step	Penilaian Evaluation	Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu] Learning Format Learning Methods Assignment for Student [Estimated Time]	Materi Pembelajaran [Pustaka] Learning Material [References]	Bobot Penilaian (%) Evaluation Weight (%)
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		Indikator <i>Indicator</i>	Kriteria & Bentuk <i>Criteria and Format</i>	Luring <i>Offline</i>	Daring <i>Online</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	<p>CPMK-1. Mampu memahami konsep <i>supervised</i> dan <i>unsupervised</i> pada pembelajaran mesin (<i>Machine Learning</i>) dan aplikasinya di berbagai bidang.</p> <p><i>CLO-1. Understand and able to explain the concept of supervised and unsupervised in machine learning and its application in various fields.</i></p>	<p>1.1 Dapat menjelaskan dan memahami dasar <i>Machine Learning</i></p> <p>1.2 Dapat mengidentifikasi permasalahan yang cocok (<i>supervised and unsupervised</i>) untuk diselesaikan dengan <i>Machine Learning</i></p> <p>1.3 Perkembangan terkini metode Statistika untuk <i>Machine Learning</i></p> <p><i>1.1 Be able to explain and understand the basics of</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>Ceramah Interaktif- Latihan Soal Diskusi (CILSD), Problem-based learning (PBL)</p> <p><i>Interactive Lectures, Discussion Exercises (CILSD), Problem-based learning (PBL)</i></p> <p>TM: 1 x 2 x 50" PT: 1 x 2 x 60" BM: 1 x 2 x 60"</p>		<p>1. Konsep <i>Machine Learning</i> pada permasalahan <i>supervised and unsupervised learning</i></p> <p><i>1.The concept of Machine Learning on supervised and unsupervised learning problems</i></p>	5% / kum 5%

		<p><i>Machine Learning</i></p> <p>1.2 <i>Be able to identify suitable problems (supervised and unsupervised) to be solved with Machine Learning</i></p> <p>1.3 <i>Recent developments in statistical methods for machine learning</i></p>					
		<p>1.4 Dapat mengidentifikasi permasalahan <i>supervised</i> dan <i>unsupervised</i></p> <p>1.5 Dapat mencari dan menggunakan <i>software</i> (terutama <i>library</i> di open <i>source</i>, misalkan di R) untuk permasalahan <i>supervised</i> dan</p>	<p>Observasi, Aktifitas di Lab <i>Observation, Activities in the Lab</i></p>	<p>Praktikum <i>Practice</i> P: 1 x 1 x 170"</p>		<p>2. Pre-processing data (mendeteksi missing value dan outlier, konsep imputasi data, transformasi</p> <p>3. Seleksi variabel (<i>feature</i>) dengan scatter plot dan metode korelasi</p> <p>2. <i>Data pre-processing (detecting missing values</i></p>	<p>5% / kum 10%</p>

		<p><i>unsupervised learning</i></p> <p>1.6 Dapat melakukan pre-processing data</p> <p>1.7 Dapat melakukan pemilihan variabel dengan konsep <i>scatter plot</i> dan korelasi</p> <p>1.4 <i>Be able to identify supervised and unsupervised problems</i></p> <p>1.5 <i>Can search for and use software (especially libraries in open source, for example in R) for supervised and unsupervised learning problems</i></p> <p>1.6 <i>Can do pre-processing data</i></p> <p>1.7 <i>Be able to select variables using the concept of</i></p>				<p><i>and outliers, data imputation concepts, transformations</i></p> <p>3. <i>Selection of variables (features) with scatter plots and correlation methods</i></p>	
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		<i>scatter plots and correlations</i>					
2	<p>CPMK-3. Mampu menggunakan teknik komputasi dan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk pengelompokan (<i>clustering</i>)</p> <p><i>CLO-3. Able to apply computing techniques and to use modern computer tools/software used in machine learning for clustering.</i></p>	<p>2.1 Dapat menjelaskan berbagai metode/pendekatan pendekatan pada <i>clustering</i></p> <p><i>2.1 Can explain various methods /approaches to clustering</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>CILSD, PBL</p> <p><i>TM: 1 x 2 x 50"</i></p> <p><i>PT: 1 x 2 x 60"</i></p> <p><i>BM: 1 x 2 x 60"</i></p>		<p>Metode pengelompokan (<i>clustering</i>)</p> <p><i>Clustering method</i></p>	<p>5% / kum 15%</p>
		<p>2.2 Mampu menerapkan metode <i>clustering</i> untuk pengelompokan data</p> <p><i>2.2 Able to apply the clustering method for grouping data</i></p>	<p>Observasi, Aktifitas di Lab</p> <p><i>Observation, Activities in the Lab</i></p>	<p>Praktikum</p> <p><i>Practice</i></p> <p><i>P: 1 x 1 x 170"</i></p>		<p>Praktik penerapan metode <i>clustering</i> pada data</p> <p><i>The practice of applying clustering methods to data</i></p>	<p>5% / kum 20%</p>

<p>3 - 4</p>	<p>CPMK-4. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk prediksi pada permasalahan regresi dan klasifikasi</p> <p><i>CLO-4. Able to apply computational techniques and to use modern computer tools/software used in machine learning for predictions of regression and classification.</i></p>	<p>4.1 Dapat mengidentifikasi permasalahan klasifikasi yang diselesaikan dengan JST</p> <p>4.2 Dapat menyelesaikan kasus klasifikasi dengan menggunakan metode JST</p> <p><i>4.1 Can identify classification problems that are solved by ANN</i></p> <p><i>4.2 Can solve classification cases using the ANN method</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>CILSD, PBL</p> <p><i>TM: 2 x 2 x 50"</i></p> <p><i>PT: 2 x 2 x 60"</i></p> <p><i>BM: 2 x 1 x 60"</i></p>		<p>1. Konsep dasar JST</p> <p>2. Membangun arsitektur JST untuk klasifikasi</p> <p><i>1. The basic concept of ANN</i></p> <p><i>2. Building ANN architecture for classification</i></p>	<p>5% / kum 25%</p>
		<p>4.3 Dapat menggunakan <i>software</i> (terutama <i>library</i> di open <i>source</i>, misalkan</p>	<p>Observasi, Aktifitas di Lab</p> <p><i>Observation, Activities in the Lab</i></p>	<p>Praktikum</p> <p><i>Practice</i></p> <p><i>P: 2 x 1 x 170"</i></p>		<p>3. Menerapkan JST menggunakan <i>software</i> dan coding pada data</p>	<p>5% / kum 30%</p>

		<p>di R) untuk klasifikasi menggunakan JST</p> <p>4.3 <i>Can use software (especially libraries in open source, for example in R) for classification using ANN</i></p>				<p>3. <i>Implement ANN using software and coding on data</i></p>	
5 - 6	<p>CPMK-4. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk prediksi pada permasalahan regresi dan klasifikasi</p> <p><i>CLO-4. Able to apply computational techniques and to use modern computer tools/software</i></p>	<p>4.4 Dapat mengidentifikasi permasalahan regresi yang diselesaikan dengan JST</p> <p>4.5 Dapat menyelesaikan kasus regresi dengan menggunakan metode JST</p> <p>4.4 <i>Can identify regression problems that are solved by ANN</i></p> <p>4.5 <i>Can solve regression cases using the ANN method</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>CILSD, PBL</p> <p><i>TM: 2 x 2 x 50"</i></p> <p><i>PT: 2 x 2 x 60"</i></p> <p><i>BM: 2 x 1 x 60"</i></p>		<p>4. Membangun arsitektur JST untuk regresi</p> <p>4. <i>Building ANN architecture for regressio</i></p>	<p>5% / kum 35%</p>

	<i>used in machine learning for predictions of regression and classification.</i>						
		<p>4.6 Dapat menggunakan <i>software</i> (terutama <i>library</i> di open source, misalkan di R) untuk regresi menggunakan JST</p> <p><i>4.6 Can use software (especially libraries in open source, for example in R) for regression using ANN</i></p>	<p>Observasi, Aktifitas di Lab</p> <p><i>Observation, Activities in the Lab</i></p>	<p>Praktikum</p> <p><i>Practice</i></p> <p>P: 2 x 1 x 170"</p>		<p>5. Menerapkan JST menggunakan software dan coding pada data</p> <p><i>5. Implementing ANN using software and coding on data</i></p>	5% / kum 40%
7-8	CPMK-5. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk	<p>Dapat menyelesaikan permasalahan peramalan deret waktu dengan ML dan mengevaluasinya</p>	<p>Presentasi, Laporan hasil kerja</p> <p><i>Presentation, Work report</i></p>	<p>TM: 1 x 2 x 50" PT: 1 x 2 x 60" BM: 1 x 1 x 60" P: 1 x 1 x 170"</p>		<p>Penerapan ML untuk prediksi klasifikasi pad adata riil</p> <p><i>Application of ML for classification predictions on real data</i></p>	5% / kum 45%

	<p>peramalan deret waktu.</p> <p><i>CLO-5. Able to apply computational techniques and to use modern computer tools/software used in machine learning for time series forecasting.</i></p>	<p><i>Can solve time series forecasting problems with ML and evaluate them</i></p>					
	<p>CPMK-2. Mampu mengidentifikasi, memformulasi, dan menyelesaikan masalah statistika menggunakan machine learning.</p> <p><i>CLO-2. Able to identify, formulate, and solve statistical problems using machine learning.</i></p> <p>CPMK-6. Mampu menyajikan hasil</p>	<p>Dapat menuliskan laporan hasil analisis dari <i>project</i> yang diberikan</p> <p><i>Can write a report on the results of the analysis of a given projec</i></p>	<p>Laporan hasil kerja</p> <p><i>Work report</i></p>	<p>BM: 1 x 3 x 150"</p>		<p>Mengerjakan project dan menulis laporan</p> <p><i>Work on projects and write reports</i></p>	<p>5% / kum 50%</p>

	<p>penelitian dalam bentuk laporan tertulis.</p> <p><i>CLO-6. Able to write a written report of the analysis obtained from project.</i></p>						
9-12	<p>CPMK-4. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk prediksi pada permasalahan regresi dan klasifikasi</p> <p><i>CLO-4. Able to apply computational techniques and to use modern computer tools/software used in machine learning for predictions of</i></p>	<p>4.7 Dapat mengidentifikasi permasalahan klasifikasi yang diselesaikan dengan SVM, Random Forest, dan Metode ML lainnya</p> <p>4.8 Dapat menyelesaikan kasus klasifikasi dengan menggunakan metode SVM, Random Forest, dan Metode ML lainnya</p> <p><i>4.7 Can identify classification problems that are solved by SVM, Random Forest, and</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>CILSD, PBL</p> <p><i>TM: 4 x 2 x 50"</i></p> <p><i>PT: 4 x 2 x 60"</i></p> <p><i>BM: 4 x 1 x 60"</i></p>		<p>6 Konsep dasar JST</p> <p>7 Membangun arsitektur JST untuk klasifikasi</p> <p><i>6 The basic concept of ANN</i></p> <p><i>7 Building ANN architecture for classification</i></p>	<p>10% / kum 60%</p>


	<i>regression and classification.</i>	<i>other ML Methods</i> 4.8 <i>Can solve classification cases using the SVM method, Random Forest, and other ML Methods</i>					
		Dapat menggunakan <i>software</i> (terutama <i>library</i> di open source, misalkan di R) untuk klasifikasi menggunakan SVM, Random Forest, dan Metode ML lainnya <i>Can use software (especially libraries in open source, for example in R) for classification using SVM, Random Forest, and other ML Methods</i>	Observasi, Aktifitas di Lab <i>Observation, Activities in the Lab</i>	Praktikum <i>Practice</i> P: 4 x 1 x 170"		Menerapkan JST menggunakan software dan coding pada data <i>Implementing ANN using software and coding on data</i>	10% / kum 70%
13-14	CPMK-4. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine</i>	4.9 Dapat mengidentifikasi permasalahan regresi yang diselesaikan dengan SVR, Random Forest,	Tes lisan, observasi Aktifitas di kelas <i>Oral test, observation Class activity</i>	CILSD, PBL TM: 2 x 2 x 50" PT: 2 x 2 x 60" BM: 2 x 1 x 60"		8 Membangun arsitektur JST untuk regresi 8 <i>Building ANN architecture for regression</i>	5% / kum 75%

	<p><i>Learning</i> untuk prediksi pada permasalahan regresi dan klasifikasi</p> <p><i>CLO-4. Able to apply computational techniques and to use modern computer tools/software used in machine learning for predictions of regression and classification.</i></p>	<p>dan Metode ML lainnya</p> <p>4.10 Dapat menyelesaikan kasus regresi dengan menggunakan metode SVR, Random Forest, dan Metode ML lainnya</p> <p>4.9 <i>Can identify regression problems that are solved by SVR, Random Forest, and other ML Methods</i></p> <p>4.10 <i>Can solve regression cases using the SVR method, Random Forest, and other ML methods</i></p>					
		<p>Dapat menggunakan <i>software</i> (terutama <i>library</i> di open <i>source</i>, misalkan di R) untuk regresi</p>	<p>Observasi, Aktifitas di Lab <i>Observation, Activities in the Lab</i></p>	<p>Praktikum <i>Practice</i></p> <p>P: 2 x 1 x 170"</p>		<p>Menerapkan JST menggunakan <i>software</i> dan coding pada data</p>	<p>5% / kum 80%</p>

		<p>menggunakan SVR, Random Forest, dan Metode ML lainnya</p> <p><i>Can use software (especially libraries in open source, for example in R) for regression using SVR, Random Forest, and other ML Methods</i></p>					
15	<p>CPMK-5. Mampu menerapkan teknik komputasi dan menggunakan perangkat komputer modern yang diperlukan dalam <i>Machine Learning</i> untuk peramalan deret waktu.</p> <p><i>CLO-5. Able to apply computational techniques and to use modern computer tools/software used in machine learning for time series forecasting.</i></p>	<p>5.1 Dapat melakukan pemodelan dan peramalan data deret waktu dengan JST, SVR, dan metode ML lainnya</p> <p>5.2 Dapat melakukan pemilihan input (feature selection) untuk meningkatkan akurasi kinerja model peramalan dengan ML</p> <p><i>5.1 Can perform modeling and forecasting of time series data with ANN, SVR, and other ML methods</i></p>	<p>Tes lisan, observasi</p> <p>Aktifitas di kelas</p> <p><i>Oral test, observation</i></p> <p><i>Class activity</i></p>	<p>CILSD, PBL</p> <p>TM: 1 x 2 x 50"</p> <p>PT: 1 x 2 x 60"</p> <p>BM: 1 x 1 x 60"</p>		<p>1. Membangun model ML untuk peramalan deret waktu</p> <p>2. Evaluasi kinerja model peramalan</p> <p><i>1. Building an ML model for time series forecasting</i></p> <p><i>2. Evaluation of forecasting model performance</i></p>	<p>5% / kum 85%</p>

		<i>5.2 Can perform input selection (feature selection) to improve the performance accuracy of forecasting models with ML</i>					
16	<p>CPMK-1. Mampu memahami konsep supervised dan unsupervised pada pembelajaran mesin (Machine Learning) dan aplikasinya di berbagai bidang.</p> <p><i>CLO-1. Understand and able to explain the concept of supervised and unsupervised in machine learning and its application in various fields.</i></p> <p>CPMK-2. Mampu mengidentifikasi, memformulasi,</p>	<p>Dapat menuliskan laporan hasil analisis dari <i>project</i> yang diberikan</p> <p><i>Can write a report on the results of the analysis of a given projec</i></p>	<p>Laporan hasil kerja</p> <p><i>Work report</i></p>	BM: 1 x 3 x 150"		<p>Mengerjakan project dan menulis laporan</p> <p><i>Work on projects and write reports</i></p>	15% / kum 100%

	<p>dan menyelesaikan masalah statistika menggunakan machine learning.</p> <p><i>CLO-2. Able to identify, formulate, and solve statistical problems using machine learning.</i></p> <p>CPMK-6. Mampu menyajikan hasil penelitian dalam bentuk laporan tertulis.</p> <p><i>CLO-6. Able to write a written report of the analysis obtained from project.</i></p>						
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	RENCANA ASESMEN & EVALUASI <i>Assesment and Evaluation Plan</i> Program Studi Sarjana Statistika / <i>Statistics Undergraduate Program</i> STATISTICAL MACHINE LEARNING / STATISTICAL MACHINE LEARNING		RA&E
			SLK-26
Kode MK: SS234526 <i>Course Code:</i> SS234526	Bobot sks (T/P): 3 <i>CREDITS : 3</i>	Rumpun MK: Analitika Data Ekonomi dan Finansial <i>Course cluster:</i> <i>Economic And Financial Data Analytics</i>	Smt: V <i>Semester V</i>
OTORISASI <i>AUTHORIZATION</i>	Penyusun <i>Author</i>	Koordinator RMK <i>Coordinator of course cluster</i>	Kaprodi <i>Head of Department</i> Dr. Kartika F, M.Si.

Mg ke (1)	Sub CP-MK (2)		Bentuk Asesmen (Penilaian) / Evaluation Type (3)	Bobot / Scoring (%) (4)
	No	Kemampuan akhir / Final Capability		
1		Tuliskan kemampuan akhir Sub CP-MK <i>Write down the final capability of Sub CP-MK</i>	Tuliskan bentuk asesmen <i>Write down the form of assessment</i>	
2				
3				
Total Bobot Penilaian				100%