



UNIVERSITAS GADJAH MADA

Faculty of Mathematics and Natural Sciences

Mathematics Department

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Doctoral Program in Mathematics

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MODULE HANDBOOK
Doctoral in Mathematics

Module name:	Machine Learning															
Module level, if applicable:	Doctoral															
Code, if applicable:	MMM 5521															
Semester(s) in which the module is taught:	2 nd (second) year															
Person responsible for the module:	Chair of Statistical Computing Research Group															
Lecturer(s):	Prof. Dr.rer.nat. Dedi Rosadi, S.Si., M.Sc.															
Language:	Bahasa Indonesia															
Relation to curriculum:	Doctoral Degree in Mathematics, Elective Course															
Credit points:	3 Semester Credit Unit															
Type of teaching, contact hours:	3x50 minutes lectures, 3x60 minutes structured activities.															
Workload:	3 hours lectures, 3 hours structured activities, 3 hours individual study, 16 weeks per semester (including mid-term and final examinations), 144 hours per semester.															
Recommended prerequisites:	Students have learned mathematical statistics and introductory statistics courses Students also have some knowledge on statistical software, such as R															
Module objectives/intended learning outcomes:	After completing this course the students have ability to : CO 1. understand some fundamental concept in machine learning CO2.. use statistical software to do some machine learning task, in particular R CO3. Understand and be able to apply some supervised and unsupervised machine learning methods															
Content:	The course will introduce the main fundamental concepts in machine learning (supervised learning, training, scoring, accuracy measures, test set, overfitting, cross validation, model capacity, hyperparameter tuning, grid and random search, regularization, ensembles, model selection etc.). It will further discuss state-of-the-art algorithms for supervised learning (linear models, lasso, decision trees, random forests, gradient boosting machines, neural networks, support vector machine, deep learning etc.). A large part of the course will be dedicated to using (hands-on) the software tools for machine learning used by data scientists in practice (various high-performance R packages, xgboost, libraries for deep learning etc.).															
Study and examination requirements and forms of examination:	The final mark will be weighted as follows: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>No</th> <th>Assessment methods (components, activities)</th> <th>Weight (percentage)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Final Examination</td> <td>35%</td> </tr> <tr> <td>2</td> <td>Mid-Term Examination</td> <td>30%</td> </tr> <tr> <td>3</td> <td>Projects/Presentation</td> <td>25%</td> </tr> <tr> <td>4</td> <td>Peer Assessment/Quiz</td> <td>10%</td> </tr> </tbody> </table> <p>Final grade will be determined as follows: Grade Criteria The initial cut-off points for grades A, B, C, and D should not be less than 80%, 65%, 50%, and 40%, respectively.</p>	No	Assessment methods (components, activities)	Weight (percentage)	1	Final Examination	35%	2	Mid-Term Examination	30%	3	Projects/Presentation	25%	4	Peer Assessment/Quiz	10%
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1	Final Examination	35%														
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4	Peer Assessment/Quiz	10%														
Media employed:	Board, LCD Projector, Laptop/Computer															

Reading List:	<ol style="list-style-type: none"> Hastie, T., Tibshirani, R., Friedman, J., The Elements of Statistical Learning (2nd Edition), Springer Verlag, New York Provost, F. and Fawcett, T., 2019, Data Science for Business, O'Reilly Recent publication on machine learning topic
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Mapping of The COs and PLOs

	PLO – 1 S3 Mat	PLO – 2 S3 Mat	PLO – 3 S3 Mat	PLO – 4 S3 Mat	PLO – 5 S3 Mat	PLO – 6 S3 Mat
CO 1	v	v	v		v	
CO 2	v	v	v		v	
CO 3	v	v	v		v	v

Programme Learning Outcomes (PLO) Doctoral Programme in Mathematics

PLO-1	:	Attitude: Devote to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working in the area of expertise independently.
PLO-2	:	Knowledge: Mastering philosophy of mathematics and one of the fields in mathematics (algebra, analysis, applied mathematics, statistics, computational mathematics, computational statistics).
PLO-3	:	Knowledge: Able to think logically, analytically, inductively, deductively, and structured; having the ability to manage, lead, and develop research programs independently, and able to communicate the thoughts as well as his work to the scientific community and the general public.
PLO-4	:	Skill: Creating new concepts and / or new methods (original) in the field of mathematics that are recognized nationally and internationally.
PLO-5	:	Skill: Able to apply mathematics according to their field of expertise to solve problems including those that require a multidisciplinary, cross-disciplinary, or trans-disciplinary approach.
PLO-6	:	Life Long Learning: Having lifelong learning skills and adaptive to the development of science and technology, especially in fields related to Mathematics and its applications.