RENCANA PEMBELAJARAN SEMESTER

PROGRAM STUDI S2 SAINS DATA

FAKULTAS SAINS DAN MATEMATIKA
Universitas Kristen Satya Wacana

Form						
Semester	Antara 2025/2026					
Mata Kuliah	BD020 DEEP LEARNING					
Beban	3	SKS	T/A/P:	1/2/0	W/P:	Pilihan
Dosen Pengampu	1. Prof. Dr. Hanna Arini Parhusip, M.Sc.nat 2. Dr. Suryasatriya Trihandaru, S.Si., M.Sc.nat 3. Prof. Darmawan Utomo, S.T., M.Eng., Ph.D. 4. Dr. Bambang Susanto, M.S.					

A. Program Learning Outcome / Capaian Pembelajaran Lulusan (CPL)	
CPL01	Mampu menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.
CPL02	Menguasai konsep teoretis bidang pengetahuan dan keterampilan tertentu secara umum dan khusus untuk menyelesaikan masalah secara prosedural sesuai dengan lingkup pekerjaannya
CPL03	Mampu menganalisis kebutuhan perangkat lunak untuk menghasilkan spesifikasi yang tepat.
CPL04	Mampu merancang perangkat lunak yang sesuai dengan spesifikasi dan kebutuhan pengguna.
CPL05	Mampu mengimplementasikan perangkat lunak berdasarkan spesifikasi yang telah dirancang.
CPL06	Mampu berkomunikasi secara efektif, baik lisan maupun tulisan, dalam konteks profesional.
CPL07	Mampu bekerjasama dalam tim serta menunjukkan kemampuan kepemimpinan dalam konteks kerja kelompok.
CPL08	Mampu mengintegrasikan prinsip etika dan tanggung jawab sosial dalam pengambilan keputusan profesional.

B. Course Learning Outcome / Capaian Pembelajaran Mata Kuliah (CPMK)	
CPMKBD02011	(CPL01) Mampu menunjukkan sikap bertanggung jawab atas pekerjaan di bidang deep learning secara mandiri dalam proses pembelajaran, penyelesaian tugas, dan kegiatan akademik.
CPMKBD02022	(CPL02) Menguasai konsep teoretis deep learning, arsitektur model, dan proses pelatihan jaringan secara prosedural.
CPMKBD02043	(CPL04) Mampu merancang arsitektur dan model deep learning sesuai kebutuhan pemecahan masalah pengguna.
CPMKBD02054	(CPL05) Mampu mengimplementasikan model deep learning ke dalam sistem perangkat lunak sesuai arsitektur dan spesifikasi yang ditetapkan.

C. Prerequisite/Corequisite Courses /Prasyarat Mata Kuliah	
Code	Course Name

D. Description/Deskripsi
This course introduces deep learning concepts and architectures at the graduate level, covering: deep feedforward networks, optimization for deep learning (SGD, Momentum, Adam), regularization techniques (dropout, batch normalization), Convolutional Neural Network (CNN) architectures (LeNet, AlexNet, VGG, ResNet), recurrent and sequence models (LSTM, GRU), attention mechanisms and the Transformer architecture, autoencoders and representation learning, generative models (GAN), transfer learning, and deep learning model deployment. Mata kuliah ini membahas konsep dan arsitektur deep learning pada level magister, meliputi: deep feedforward network, optimisasi untuk deep learning (SGD, Momentum, Adam), teknik regularisasi (dropout, batch normalization), arsitektur Convolutional Neural Network (CNN) (LeNet, AlexNet, VGG, ResNet), model rekuren dan sekuensial (LSTM, GRU), mekanisme attention dan arsitektur Transformer, autoencoder dan representation learning, model generatif (GAN), transfer learning, serta deployment model deep learning.

E. Learning Stage/Tahap Pembelajaran

Week	Final Ability	Material	Methods	Duration	Indicators	Assesment
1	*Have broad knowledge of deep learning: from shallow to deep networks and their applications.* Memiliki pengetahuan luas tentang deep learning: dari shallow network hingga deep network dan aplikasinya.	Introduction to Deep Learning: From Shallow to Deep Networks	Presentation Discussion Demonstration Practicum	150'	Provides information about deep learning concepts and applications; Discussion	Discussion
2	*Master deep feedforward networks and backpropagation, including the vanishing/exploding gradient problem.* Menguasai deep feedforward network dan backpropagation, termasuk permasalahan vanishing/exploding gradient.	Deep Feedforward Networks & Backpropagation Revisited	Presentation Discussion Demonstration Practicum	150'	Obtain information about deep feedforward networks and gradient problems; Discussion and Practicum	Discussion
3	*Master optimization techniques for deep learning: SGD, Momentum, Adam, and learning rate scheduling.*	Optimization for Deep Learning: SGD, Momentum, Adam & LR Scheduling	Presentation Discussion Demonstration Practicum	150'	Obtain information about deep learning optimization techniques;	Discussion

	Menguasai teknik optimisasi untuk deep learning: SGD, Momentum, Adam, dan learning rate scheduling.				Discussion and Practicum	
4	*Master regularization techniques for deep networks: Dropout, Batch Normalization, and weight decay.* Menguasai teknik regularisasi untuk deep network: Dropout, Batch Normalization, dan weight decay.	Regularization Techniques: Dropout, Batch Normalization & Weight Decay	Presentation Discussion Demonstration Practicum	150'	Obtain information about regularization techniques; Discussion and Practicum	Task: Submit a practicum report.
5	*Master practical work related to deep feedforward networks, optimization, and regularization.* Menguasai praktikum terkait deep feedforward network, optimisasi, dan regularisasi.	Practicum/Case Study related to Meeting 1-4	Presentation Discussion Demonstration Practicum	150'	Carrying out practicum and tutorials related to Meeting 1 to Meeting 4	Practical Assignment /Report - CPMK2 (10%)
6	*Master Convolutional Neural Network (CNN) architectures: LeNet, AlexNet, VGG, and ResNet.* Menguasai arsitektur Convolutional Neural Network (CNN): LeNet, AlexNet, VGG, dan ResNet.	CNN Architectures: LeNet, AlexNet, VGG & ResNet	Presentation Discussion Demonstration Practicum	150'	Obtain information about CNN architectures; Discussion and Practicum	Discussion
7	*Master recurrent and sequence models: LSTM, GRU, and sequence-to-sequence models.* Menguasai model rekuren dan sekuensial: LSTM, GRU, dan sequence-to-sequence.	Recurrent & Sequence Models: LSTM, GRU & Sequence-to-Sequence	Presentation Discussion Demonstration Practicum	150'	Obtain information about recurrent and sequence models; Discussion and Practicum	Discussion
8	*Master attention mechanisms and the Transformer architecture.* Menguasai mekanisme attention dan arsitektur Transformer.	Attention Mechanisms & the Transformer Architecture	Presentation Discussion Demonstration Practicum	150'	Obtain information about attention mechanisms and Transformer; Discussion and Practicum	Task: Submit a practicum report.
9	*Master practical work related to CNN, recurrent/sequence models, and attention/Transformer.* Menguasai praktikum terkait CNN, model rekuren/sekuensial, dan attention/Transformer.	Practicum/Case Study related to Meeting 6-8	Presentation Discussion Demonstration Practicum	150'	Carrying out practicum and tutorials related to Meeting 6 to Meeting 8	Practical Assignment /Report - CPMK2 (15%)
10	*Master autoencoders and representation learning.*	Autoencoders & Representation Learning	Presentation Discussion Demonstration	150'	Obtain information about autoencoders and	Discussion

	Menguasai autoencoder dan representation learning.		Practicum		representation learning; Discussion and Practicum	
11	*Master generative models: Generative Adversarial Networks (GAN).* Menguasai model generatif: Generative Adversarial Networks (GAN).	Generative Models: Generative Adversarial Networks (GAN)	Presentation Discussion Demonstration Practicum	150'	Obtain information about GAN and generative models; Discussion and Practicum	Discussion
12	*Master transfer learning and fine-tuning of pretrained deep learning models.* Menguasai transfer learning dan fine-tuning model deep learning yang telah dilatih.	Transfer Learning & Fine-Tuning Pretrained Models	Presentation Discussion Demonstration Practicum	150'	Obtain information about transfer learning and fine-tuning; Discussion and Practicum	Discussion
13	*Master deep learning model deployment and MLOps practices.* Menguasai deployment model deep learning dan praktik MLOps.	Deep Learning Model Deployment & MLOps	Presentation Discussion Demonstration Practicum	150'	Obtain information about deep learning deployment and MLOps; Discussion and Practicum	Task: Submit a practicum report.
14	*Master practical work related to autoencoders, generative models, transfer learning, and deployment.* Menguasai praktikum terkait autoencoder, model generatif, transfer learning, dan deployment.	Practicum/Case Study related to Meeting 10-13	Presentation Discussion Demonstration Practicum	150'	Carrying out practicum and tutorials related to Meeting 10 to Meeting 13	Practical Assignment /Report - CPMK3 (25%)
15	*Able to implement a deep learning model into an applied software system.* Mampu mengimplementasikan model deep learning ke dalam sistem perangkat lunak secara terapan.	PROJECT WORK	Project Work	150'	Design, build, and implement a deep learning-based project	Final Project Work - CPMK4 (25%)
16	*Able to present and defend the deep learning-based project.* Mampu mempresentasikan dan mempertanggungjawabkan proyek berbasis deep learning.	PROJECT PRESENTATION	Presentation Discussion	150'	Presenting the deep learning-based project	Project Presentation - CPMK1 (25%)

Note/Catatan untuk Tabel E.

Abbreviation	Description

CPL	Capaian Pembelajaran Lulusan / Program Learning Outcome
CPMK	Capaian Pembelajaran Mata Kuliah / Course Learning Outcome
CNN	Convolutional Neural Network
LSTM	Long Short-Term Memory
GRU	Gated Recurrent Unit
GAN	Generative Adversarial Network
SGD	Stochastic Gradient Descent
MLOps	Machine Learning Operations

F. Learning Media and Tools

Python (PyTorch/TensorFlow-Keras, NumPy), Jupyter Notebook/Google Colab (GPU), Computer, Flearn (Online Learning Media), WAG and Google Meet/Zoom.

G. Student Learning Experience/Portfolio

Students gain experience in building and training deep neural networks, applying CNN, RNN/LSTM/GRU, and Transformer architectures, exploring autoencoders and generative models, applying transfer learning, and deploying a deep learning-based system as a final project.

Mahasiswa memperoleh pengalaman dalam membangun dan melatih deep neural network, menerapkan arsitektur CNN, RNN/LSTM/GRU, dan Transformer, mengeksplorasi autoencoder dan model generatif, menerapkan transfer learning, serta men-deploy sistem berbasis deep learning sebagai proyek akhir.

H. References

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
2. LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep Learning. Nature, 521, 436-444.
3. He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep Residual Learning for Image Recognition. Proceedings of CVPR.
4. Goodfellow, I., et al. (2014). Generative Adversarial Networks. Advances in Neural Information Processing Systems (NeurIPS).
5. Vaswani, A., et al. (2017). Attention Is All You Need. Advances in Neural Information Processing Systems (NeurIPS).

I. Authorization

Pengembang	Tanggal	Koordinator	Kaprodi
Dr. Suryasatriya Trihandaru, M.Sc.nat	8 Agustus 2026	Prof. Hanna Arini Parhusip, M.Sc.nat	Prof. Hanna Arini Parhusip, M.Sc.nat