RENCANA PEMBELAJARAN SEMESTER

PROGRAM STUDI S2 SAINS DATA

FAKULTAS SAINS DAN MATEMATIKA
Universitas Kristen Satya Wacana

Form						
Semester	Ganjil 2026/2027					
Mata Kuliah	BD110 NEURAL NETWORK					
Beban	2	SKS	T/A/P:	1/1/0	W/P:	Pilihan
Dosen Pengampu	1. Dr. Suryasatriya Trihandaru, M.Sc.nat 2. Prof. Hanna Arini Parhusip, M.Sc.nat					

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)	
CPMKBD11011	(CPL01) Mampu menunjukkan sikap mandiri dan bertanggung jawab dalam mempelajari serta menerapkan konsep jaringan saraf tiruan.
CPMKBD11022	(CPL02) Menguasai konsep teoretis jaringan saraf tiruan dan prinsip kerjanya dalam pemrosesan data.
CPMKBD11063	(CPL06) Mampu mengomunikasikan konsep, proses, dan hasil kerja jaringan saraf tiruan secara jelas dan sistematis.

C. Prerequisite/Corequisite Courses /Prasyarat Mata Kuliah

Code	Course Name

D. Description/Deskripsi

This course introduces the theoretical foundations of Artificial Neural Networks (ANN), covering: the biological inspiration and perceptron model, multi-layer perceptrons (MLP) and activation functions, the backpropagation algorithm and gradient descent, loss functions and regularization, an introduction to Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN/LSTM), techniques for training deep networks, and applications of neural networks for image and sequence data.

Mata kuliah ini membahas konsep dasar Artificial Neural Network (ANN), meliputi: inspirasi biologis dan model perceptron, multi-layer perceptron (MLP) dan fungsi aktivasi, algoritma backpropagation dan gradient descent, loss function dan regularisasi, pengenalan Convolutional Neural Network (CNN) dan Recurrent Neural Network (RNN/LSTM), teknik pelatihan deep network, serta penerapan jaringan saraf tiruan untuk data citra dan data sekuensial.

E. Learning Stage/Tahap Pembelajaran

Week	Final Ability	Material	Methods	Duration	Indicators	Assesment
1	*Have broad knowledge of the biological inspiration and the perceptron model of neural networks.* Memiliki pengetahuan luas tentang inspirasi biologis dan model perceptron jaringan saraf tiruan.	Introduction to Neural Networks: Biological Inspiration & Perceptron	Presentation Discussion Demonstration Practicum	100'	Provides information about the biological inspiration and perceptron model; Discussion	Discussion
2	*Master the Multi-Layer Perceptron (MLP) architecture and activation functions.* Menguasai arsitektur Multi-Layer Perceptron (MLP) dan fungsi aktivasi.	Multi-Layer Perceptron (MLP) & Activation Functions	Presentation Discussion Demonstration Practicum	100'	Obtain information about MLP and activation functions; Discussion and Practicum	Discussion
3	*Master the backpropagation algorithm and gradient descent for training neural networks.* Menguasai algoritma backpropagation dan gradient descent untuk melatih jaringan saraf tiruan.	Backpropagation Algorithm & Gradient Descent	Presentation Discussion Demonstration Practicum	100'	Obtain information about backpropagation and gradient descent; Discussion and Practicum	Discussion
4	*Master loss functions, optimization, and regularization techniques (overfitting, dropout, L1/L2).* Menguasai loss function, optimisasi, dan teknik	Loss Functions, Optimization & Regularization	Presentation Discussion Demonstration Practicum	100'	Obtain information about loss functions and regularization; Discussion and Practicum	Task: Submit a practicum report.

	regularisasi (overfitting, dropout, L1/L2).					
5	*Master practical work related to MLP, backpropagation, and regularization.* Menguasai praktikum terkait MLP, backpropagation, dan regularisasi.	Practicum/Case Study related to Meeting 1-4	Presentation Discussion Demonstration Practicum	100'	Carrying out practicum and tutorials related to Meeting 1 to Meeting 4	Practical Assignment /Report - CPMK2 (10%)
6	*Master the basics of Convolutional Neural Networks (CNN).* Menguasai dasar-dasar Convolutional Neural Network (CNN).	Convolutional Neural Networks (CNN) Basics	Presentation Discussion Demonstration Practicum	100'	Obtain information about CNN basics; Discussion and Practicum	Discussion
7	*Master the basics of Recurrent Neural Networks (RNN) and LSTM.* Menguasai dasar-dasar Recurrent Neural Network (RNN) dan LSTM.	Recurrent Neural Networks (RNN) & LSTM Basics	Presentation Discussion Demonstration Practicum	100'	Obtain information about RNN and LSTM basics; Discussion and Practicum	Discussion
8	*Master techniques for training deep networks: batch normalization, weight initialization, and learning rate scheduling.* Menguasai teknik pelatihan deep network: batch normalization, weight initialization, dan learning rate scheduling.	Training Deep Networks: Batch Normalization, Initialization & Scheduling	Presentation Discussion Demonstration Practicum	100'	Obtain information about deep network training techniques; Discussion and Practicum	Task: Submit a practicum report.
9	*Master practical work related to CNN, RNN/LSTM, and deep network training techniques.* Menguasai praktikum terkait CNN, RNN/LSTM, dan teknik pelatihan deep network.	Practicum/Case Study related to Meeting 6-8	Presentation Discussion Demonstration Practicum	100'	Carrying out practicum and tutorials related to Meeting 6 to Meeting 8	Practical Assignment /Report - CPMK2 (10%)
10	*Master neural network applications for image classification.* Menguasai penerapan jaringan saraf tiruan untuk klasifikasi citra.	Neural Network Applications: Image Classification	Presentation Discussion Demonstration Practicum	100'	Obtain information about image classification applications; Discussion and Practicum	Discussion
11	*Master neural network applications for sequential/text data.* Menguasai penerapan jaringan saraf tiruan untuk data sekuensial/teks.	Neural Network Applications: Sequential & Text Data	Presentation Discussion Demonstration Practicum	100'	Obtain information about sequential and text data applications; Discussion and Practicum	Discussion

12	*Master model evaluation and hyperparameter tuning for neural networks.* Menguasai evaluasi model dan hyperparameter tuning untuk jaringan saraf tiruan.	Model Evaluation & Hyperparameter Tuning	Presentation Discussion Demonstration Practicum	100'	Obtain information about model evaluation and hyperparameter tuning; Discussion and Practicum	Discussion
13	*Have broad knowledge of modern architectures (autoencoders and an introduction to Transformers).* Memiliki pengetahuan luas tentang arsitektur modern (autoencoder dan pengenalan Transformer).	Introduction to Modern Architectures (Autoencoders & Transformers)	Presentation Discussion Demonstration Practicum	100'	Obtain information about autoencoders and Transformers; Discussion and Practicum	Task: Submit a practicum report.
14	*Master practical work related to neural network applications and modern architectures.* Menguasai praktikum terkait penerapan jaringan saraf tiruan dan arsitektur modern.	Practicum/Case Study related to Meeting 10-13	Presentation Discussion Demonstration Practicum	100'	Carrying out practicum and tutorials related to Meeting 10 to Meeting 13	Practical Assignment /Report - CPMK2 (15%)
15	*Able to independently and responsibly complete an applied neural network project.* Mampu menyelesaikan proyek terapan jaringan saraf tiruan secara mandiri dan bertanggung jawab.	PROJECT WORK	Project Work	100'	Design and build a neural network-based project	Final Project Work - CPMK1 (30%)
16	*Able to communicate the concept, process, and results of the neural network project clearly and systematically.* Mampu mengomunikasikan konsep, proses, dan hasil proyek jaringan saraf tiruan secara jelas dan sistematis.	PROJECT PRESENTATION	Presentation Discussion	100'	Presenting the neural network-based project	Project Presentation - CPMK3 (35%)

Note/Catatan untuk Tabel E.

Abbreviation	Description
CPL	Capaian Pembelajaran Lulusan / Program Learning Outcome
CPMK	Capaian Pembelajaran Mata Kuliah / Course Learning Outcome
ANN	Artificial Neural Network
MLP	Multi-Layer Perceptron
CNN	Convolutional Neural Network
RNN	Recurrent Neural Network
LSTM	Long Short-Term Memory

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

G. Student Learning Experience/Portfolio
Students gain experience in building and training neural networks from scratch, applying CNN and RNN/LSTM architectures to image and sequential data, tuning model performance, and presenting a neural network-based project. Mahasiswa memperoleh pengalaman dalam membangun dan melatih jaringan saraf tiruan dari dasar, menerapkan arsitektur CNN dan RNN/LSTM pada data citra dan data sekuensial, melakukan tuning performa model, serta mempresentasikan proyek berbasis jaringan saraf tiruan.

H. References
1. Rumelhart, D. E., Hinton, G. E., & Williams, R. J. (1986). Learning Representations by Back-Propagating Errors. Nature, 323, 533-536.
2. LeCun, Y., Bottou, L., Bengio, Y., & Haffner, P. (1998). Gradient-Based Learning Applied to Document Recognition. Proceedings of the IEEE, 86(11), 2278-2324.
3. Hochreiter, S., & Schmidhuber, J. (1997). Long Short-Term Memory. Neural Computation, 9(8), 1735-1780.
4. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.

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