



Universitas Negeri Surabaya  
Fakultas Matematika dan Ilmu Pengetahuan Alam  
Program Studi S1 Sains Data

Kode  
Dokumen

RENCANA PEMBELAJARAN SEMESTER

| MATA KULIAH (MK)          | KODE                                   | Rumpun MK | BOBOT (sks)                |     |           | SEMESTER                  | Tgl Penyusunan  |
|---------------------------|----------------------------------------|-----------|----------------------------|-----|-----------|---------------------------|-----------------|
| Pembelajaran Mesin Lanjut | 4920203015                             |           | T=3                        | P=0 | ECTS=4.77 | 7                         | 30 Agustus 2024 |
| OTORISASI                 | Pengembang RPS                         |           | Koordinator RMK            |     |           | Koordinator Program Studi |                 |
|                           | Riskyana Dewi Intan Puspitasari, M.Kom |           | Dr. Elly Matul Imah, M.Kom |     |           | YULIANI PUJI ASTUTI       |                 |

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|--------------------|------------------------|
| Model Pembelajaran | Project Based Learning |
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| Capaian Pembelajaran (CP) | CPL-PRODI yang dibebankan pada MK       |                                                                                                                                                                                                                                 |  |  |  |
|                           | CPL-2                                   | Menunjukkan karakter tangguh, kolaboratif, adaptif, inovatif, inklusif, belajar sepanjang hayat, dan berjiwa kewirausahaan                                                                                                      |  |  |  |
|                           | CPL-19                                  | Mampu menerapkan pemikiran logis, kritis, sistematis, dan inovatif dalam mendesain, mengimplementasi dan mengevaluasi ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora dalam bidang sains data. |  |  |  |
|                           | CPL-22                                  | Mampu merancang dan mengembangkan algoritma untuk berbagai keperluan seperti analisis big data, kecerdasan artifisial, basis data, penambangan data, statistika inferensial, desain dan analisis algoritma, dan data warehouse. |  |  |  |
|                           | CPL-26                                  | Menguasai konsep teoritis bidang pengetahuan sains data khusus dalam bidang pengetahuan tersebut secara mendalam, serta mampu memformulasikan penyelesaian masalah prosedural.                                                  |  |  |  |
|                           | Capaian Pembelajaran Mata Kuliah (CPMK) |                                                                                                                                                                                                                                 |  |  |  |
|                           | CPMK - 1                                | Mahasiswa memahami sejarah dan perkembangan deep learning serta memahami konsep gradient descent                                                                                                                                |  |  |  |
|                           | CPMK - 2                                | Mahasiswa memahami konsep Artificial Neural Networks dan Deep Neural Networks dan perkembangannya                                                                                                                               |  |  |  |
|                           | CPMK - 3                                | Mahasiswa memahami proses training dan menerapkan teknik-teknik dalam pembelajaran deep learning (regularisasi)                                                                                                                 |  |  |  |
|                           | CPMK - 4                                | Mahasiswa memahami model Representation Learning dan perkembangannya                                                                                                                                                            |  |  |  |
|                           | CPMK - 5                                | Mahasiswa mampu menerapkan model deep learning pada permasalahan computer vision                                                                                                                                                |  |  |  |
|                           | CPMK - 6                                | Mahasiswa mampu merancang penyelesaian masalah menggunakan berbagai model deep learning                                                                                                                                         |  |  |  |
| Matrik CPL - CPMK         |                                         |                                                                                                                                                                                                                                 |  |  |  |
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|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <table><tr><td rowspan="2">CPMK</td><td colspan="16">Minggu Ke</td></tr><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td></tr><tr><td>CPMK-1</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CPMK-2</td><td></td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CPMK-3</td><td></td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CPMK-4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CPMK-5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CPMK-6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr></table> | CPMK                                                                                                                                                                                                                                                                            | Minggu Ke                                                                        |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | CPMK-1 | ✓ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | CPMK-2 |  | ✓ | ✓ |  |  |  |  |  |  |  |  |  |  |  |  |  | CPMK-3 |  |  |  | ✓ | ✓ | ✓ | ✓ |  |  |  |  |  |  |  |  |  | CPMK-4 |  |  |  |  |  |  |  |  | ✓ | ✓ | ✓ |  |  |  |  |  | CPMK-5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | CPMK-6 |  |  |  |  |  |  |  |  |  |  |  | ✓ | ✓ | ✓ | ✓ | ✓ |
| CPMK                 | Minggu Ke                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
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| CPMK-1               | ✓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| CPMK-2               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ✓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ✓                                                                                                                                                                                                                                                                               |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| CPMK-3               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 | ✓                                                                                | ✓               | ✓                                                                                                                                                                                                                                                                                                                        | ✓ |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| CPMK-4               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     | ✓ | ✓  | ✓  |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| CPMK-5               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| CPMK-6               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    | ✓  | ✓  | ✓  | ✓  | ✓  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| Deskripsi Singkat MK | Mata kuliah ini mempelajari metodologi pembelajaran mesin lanjut dengan fokus pendekatan dari model deep learning. Topik-topik yang dibahas antara lain: sejarah dan motivasi pengembangan metode deep learning, gradient descent, artificial neural network, pendekatan modern dari artificial neural network, berbagai macam bentuk arsitektur deep learning, proses training dan teknik-teknik dalam pembelajaran deep learning. Mahasiswa akan dilatih untuk mengimplementasikan berbagai macam model dan arsitektur deep learning menggunakan Python dan berbagai libraries untuk deep learning pada permasalahan computer vision. Selain itu mahasiswa juga akan memperoleh pengalaman dalam merancang penyelesaian masalah dalam dunia nyata menggunakan berbagai model deep learning. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| Pustaka              | Utama :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <div>1. Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</div> <div>2. Geron, Aurelien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media, 2019.</div> |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
|                      | Pendukung :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| Dosen Pengampu       | Riskyana Dewi Intan Puspitasari, M.Kom.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                 |                                                                                  |                 |                                                                                                                                                                                                                                                                                                                          |   |                     |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |
| 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                    | 1.Mampu menjelaskan sejarah deep learning<br>2.Mampu menjelaskan motivasi pengembangan model deep learning<br>3.Mampu menjelaskan perkembangan model Artificial Neural Networks seperti: Perceptron, Multi-Layer Perceptron, and Backpropagation<br>4.Mampu menjelaskan konsep gradient descent<br>5.Mampu menjelaskan jenis gradient descent seperti Batch Gradient Descent, Stochastic Gradient Descent, dan Mini-batch Gradient Descent                                                                                                                                                                                                                                                                                                                                                    | Penerapan konsep pembelajaran mesin lanjut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Bentuk Penilaian :<br>Aktifitas Partisipatif                                                                                                                                                                                                                                    | Pembelajaran Berbasis Proyek.<br>150 menit                                       | -               | Materi: Sejarah deep learning, tantangan dalam penggunaan Machine Learning, konsep deep learning, konsep Artificial Neural Networks, Perceptron, Multi Layer Perceptron, Konsep gradient descent, Jenis-jenis gradient descent<br>Pustaka:<br>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016. |   | 2%                  |   |    |    |    |    |    |    |    |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |        |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |   |   |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |   |   |   |   |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |   |   |   |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |

|   |                                                                                                                                                                                                                                                                                                                                             |                                            |                                                                                                 |                                            |   |                                                                                                                                                                                                                                                                                                                                                           |    |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2 | <p>1.Mampu menjelaskan perkembangan model Artificial Neural Networks seperti: Perceptron, Multi-Layer Perceptron, and Backpropagation</p> <p>2.Mampu menjelaskan konsep gradient descent</p> <p>3.Mampu menjelaskan jenis gradient descent seperti Batch Gradient Descent, Stochastic Gradient Descent, dan Mini-batch Gradient Descent</p> | Penerapan konsep pembelajaran mesin lanjut | <p><b>Bentuk Penilaian :</b><br/>Aktifitas Partisipasif</p>                                     | Pembelajaran Berbasis Proyek.<br>150 menit | - | <p><b>Materi:</b> Sejarah deep learning, tantangan dalam penggunaan Machine Learning, konsep deep learning, konsep Artificial Neural Networks, Perceptron, Multi Layer Perceptron, Konsep gradient descent, Jenis-jenis gradient descent</p> <p><b>Pustaka:</b><br/><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i></p> | 2% |
| 3 | <p>1.Mampu menjelaskan Konsep Artificial Neural Networks</p> <p>2.Mampu menjelaskan perkembangan model Artificial Neural Networks seperti: Perceptron, Multi-Layer Perceptron, and Backpropagation</p> <p>3.Mampu menjelaskan pengembangan Artificial Neural Networks menjadi Deep Neural Networks</p>                                      |                                            | <p><b>Kriteria:</b><br/>Diskusi</p> <p><b>Bentuk Penilaian :</b><br/>Aktifitas Partisipasif</p> | Pembelajaran Berbasis Proyek.              |   | <p><b>Materi:</b> Konsep Multi-Layer Perceptron, Backpropagation, Multi-Layer Perceptron, Pengembangan Artificial Neural Networks menjadi Deep Neural Networks</p> <p><b>Pustaka:</b><br/><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i></p>                                                                           | 2% |
| 4 | <p>1.Mampu menjelaskan proses Convolution dan Pooling</p> <p>2.Mampu menjelaskan Konsep Convolutional Neural Networks (CNN)</p> <p>3.Mampu menjelaskan berbagai arsitektur CNN seperti LeNet-5, AlexNet, GoogLeNet, VGGNet, ResNet, dan Xception</p>                                                                                        |                                            | <p><b>Kriteria:</b><br/>Diskusi</p> <p><b>Bentuk Penilaian :</b><br/>Aktifitas Partisipasif</p> | Kuliah dan diskusi<br>150 menit            |   | <p><b>Materi:</b><br/>Convolutional Neural Networks</p> <p><b>Pustaka:</b><br/><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i></p>                                                                                                                                                                                      | 2% |
| 5 | Mampu melakukan Implementasi model Artificial Neural Networks dan model Deep Neural Networks pada studi kasus tertentu                                                                                                                                                                                                                      |                                            | <p><b>Kriteria:</b><br/>Diskusi</p> <p><b>Bentuk Penilaian :</b><br/>Aktifitas Partisipasif</p> | Kuliah dan diskusi<br>150 menit            |   | <p><b>Materi:</b><br/>Convolutional Neural Networks</p> <p><b>Pustaka:</b><br/><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i></p>                                                                                                                                                                                      | 2% |

|    |                                                                                                                                                                                                                                           |               |                                                                                                               |                              |  |                                                                                                                                                                                                                                                         |     |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------|------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 6  | 1.Mampu menjelaskan proses training dan testing pada deep learning<br>2.Mampu menjelaskan berbagai macam teknik regularisasi seperti (vanishing dan exploding gradient, transfer learning, optimizer, overfitting, tuning hyperparameter) |               | <b>Kriteria:</b><br>Diskusi<br><br><b>Bentuk Penilaian :</b><br>Aktifitas Partisipasif                        | Kuliah dan diskusi           |  | <b>Materi:</b> teknik regularisasi seperti (vanishing dan exploding gradient, transfer learning, optimizer, overfitting, tuning hyperparameter)<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i> | 2%  |
| 7  | Mampu melakukan Implementasi regularisasi pada proses training deep learning pada studi kasus tertentu                                                                                                                                    | Non-Tes Tugas | <b>Kriteria:</b><br>Diskusi<br><br><b>Bentuk Penilaian :</b><br>Aktifitas Partisipasif                        | Kuliah dan diskusi 150 menit |  | <b>Materi:</b> regularisasi pada proses training deep learning pada studi kasus tertentu<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                        | 2%  |
| 8  | Ujian Tengah Semester                                                                                                                                                                                                                     | Tes           | <b>Kriteria:</b><br>Tes<br><br><b>Bentuk Penilaian :</b><br>Tes                                               | Ujian                        |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                                                                                     | 20% |
| 9  | 1.Mampu menjelaskan konsep model Representation Learning<br>2.Mampu menjelaskan konsep Autoencoders, Variational Autoencoders (VAE)                                                                                                       | Diskusi       | <b>Kriteria:</b><br>Non-Tes Tugas<br><br><b>Bentuk Penilaian :</b><br>Aktifitas Partisipasif                  | Kuliah dan diskusi 150 menit |  | <b>Materi:</b> Konsep Autoencoders, Variational Autoencoders (VAE)<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                                              | 2%  |
| 10 | 1.Mampu menjelaskan konsep Generative Adversarial Networks (GAN)<br>2.Mampu menjelaskan regularisasi pada proses Adversarial Training                                                                                                     | Diskusi       | <b>Kriteria:</b><br>Non-Tes Tugas<br><br><b>Bentuk Penilaian :</b><br>Aktifitas Partisipasif                  | Kuliah dan diskusi 150 menit |  | <b>Materi:</b> Konsep Autoencoders, Variational Autoencoders (VAE)<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                                              | 2%  |
| 11 | 1.Mampu melakukan Implementasi Variational Autoencoders (VAE)<br>2.Generative Adversarial Networks (GAN) pada studi kasus tertentu                                                                                                        | Diskusi       | <b>Kriteria:</b><br>Non-Tes Tugas<br><br><b>Bentuk Penilaian :</b><br>Aktifitas Partisipasif                  | Kuliah dan diskusi 150 menit |  | <b>Materi:</b> Konsep Autoencoders, Variational Autoencoders (VAE)<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                                              | 2%  |
| 12 | Mampu melakukan Implementasi Convolutional Neural Networks (CNN) pada permasalahan computer vision                                                                                                                                        | Non-Tes Tugas | <b>Kriteria:</b><br>Presentasi<br><br><b>Bentuk Penilaian :</b><br>Penilaian Hasil Project / Penilaian Produk | Presentasi 150 menit         |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i>                                                                                                                     | 10% |

|    |                                                                                                                      |               |                                                                                                                                     |                         |  |                                                                                                                                     |     |
|----|----------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------|-----|
| 13 | Mampu menyusun pertanyaan penelitian dari permasalahan dunia nyata yang akan diselesaikan dengan model deep learning | Non-Tes Tugas | <b>Kriteria:</b><br>Presentasi<br><br><b>Bentuk Penilaian :</b><br>Penilaian Hasil Project / Penilaian Produk                       | Presentasi<br>150 menit |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i> | 5%  |
| 14 | Mampu mengimplementasikan metode penyelesaian masalah menggunakan model deep learning                                | Non-Tes Tugas | <b>Kriteria:</b><br>Presentasi<br><br><b>Bentuk Penilaian :</b><br>Penilaian Hasil Project / Penilaian Produk                       | Presentasi<br>150 menit |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i> | 5%  |
| 15 | Mampu mengimplementasikan metode penyelesaian masalah menggunakan model deep learning                                | Non-Tes Tugas | <b>Kriteria:</b><br>Presentasi<br><br><b>Bentuk Penilaian :</b><br>Penilaian Hasil Project / Penilaian Produk                       | Presentasi<br>150 menit |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i> | 20% |
| 16 | Mampu mengimplementasikan metode penyelesaian masalah menggunakan model deep learning                                | Non-Tes Tugas | <b>Kriteria:</b><br>Presentasi<br><br><b>Bentuk Penilaian :</b><br>Penilaian Hasil Project / Penilaian Produk, Penilaian Portofolio | Presentasi<br>150 menit |  | <b>Materi:</b> Semua materi<br><b>Pustaka:</b><br><i>Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.</i> | 20% |

#### Rekap Persentase Evaluasi : Project Based Learning

| No | Evaluasi                                   | Persentase |
|----|--------------------------------------------|------------|
| 1. | Aktifitas Partisipasi                      | 20%        |
| 2. | Penilaian Hasil Project / Penilaian Produk | 50%        |
| 3. | Penilaian Portofolio                       | 10%        |
| 4. | Tes                                        | 20%        |
|    |                                            | 100%       |

#### Catatan

- Capaian Pembelajaran Lulusan Prodi (CPL - Prodi)** adalah kemampuan yang dimiliki oleh setiap lulusan prodi yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
- CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-Prodi) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampilan umum, ketrampilan khusus dan pengetahuan.
- CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
- Sub-CPMK Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
- Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
- Kreteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
- Bentuk penilaian:** tes dan non-tes.
- Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
- Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yg setara.
- Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
- Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
- TM=Titik Muka, PT=Penugasan terstruktur, BM=Belajar mandiri.

Koordinator Program Studi S1  
Sains Data



YULIANI PUJI ASTUTI  
NIDN 0031077804

UPM Program Studi S1 Sains  
Data



NIDN 0021059403

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