

**School of Engineering and Natural Sciences / Computer Engineering (English)**

**2022 - 2023 Academic Year**

**INTRODUCTION to DEEP LEARNING**

**Syllabus**

| <b>Course Description</b>  |  |                                |                         |                           |             |
|--|--|--------------------------------|-------------------------|---------------------------|-------------|
| <b>Name</b>  | <b>Code</b>  | <b>Semester</b>                | <b>T+A Hour</b>         | <b>Credit</b>             | <b>ECTS</b> |
| INTRODUCTION to DEEP LEARNING  | COE3268010   | Spring Semester                | 3+0                     | 3                         | 6           |
| <b>Prerequisites Courses</b>   | PROGRAMLAMAYA GİRİŞ; OLASILIK VE RASSAL DEĞİŞKENLER  |                                |                         |                           |             |
| <b>Recommended Elective Courses</b>  | Calculus, Linear algebra, Probability, Introductory knowledge in Python programming.   |                                |                         |                           |             |
| <b>Language of Instruction</b>   | English  |                                |                         |                           |             |
| <b>Course Level</b>  | First Cycle (Bachelor's Degree)  |                                |                         |                           |             |
| <b>Course Type</b>   | Elective   |                                |                         |                           |             |
| <b>Course Coordinator</b>  | Prof.Dr. Bahadır Kürşat GÜNTÜRK  |                                |                         |                           |             |
| <b>Name of Lecturer(s)</b>   | Prof.Dr. Bahadır Kürşat GÜNTÜRK  |                                |                         |                           |             |
| <b>Assistant(s)</b>  |  |                                |                         |                           |             |
| <b>Aim</b>   | This course is an introduction to deep learning, a branch of machine learning concerned with the development and application of modern neural networks. We will cover a range of topics from basic neural networks, convolutional and recurrent network structures, deep unsupervised learning, and applications to problem domains like computer vision, image processing and natural language processing. The course will introduce training and optimization strategies in deep networks both for supervised and unsupervised learning tasks. |                                |                         |                           |             |
| <b>Course Content</b>  | This course contains; Introduction to Machine Learning and Neural Networks, Training Neural Networks, Convolutional Neural Networks (CNNs) , Network Layers in CNNs , Deep Learning Hardware and Software, Deep Network Architectures, Deep Learning Strategies, Midterm, Computer Vision and Deep Learning , Image processing and Deep Learning, Natural Language Processing with Deep Learning, Recurrent Neural Networks and LSTMs, Unsupervised Learning and Generative Modeling, Advanced Applications of Deep Learning .                   |                                |                         |                           |             |
| <b>Course Learning Outcomes</b>  |  |                                | <b>Teaching Methods</b> | <b>Assessment Methods</b> |             |
| Design convolutional neural networks for supervised/unsupervised learning  |  |                                | 1, 16, 4, 9             | A, C, D                   |             |
| Analyze the effects of hyper-parameters on learning performance  |  |                                | 1, 15, 16, 4, 9         | A, C, D                   |             |
| Apply learning techniques for training deep networks   |  |                                | 1, 15, 16, 4, 9         | A, C, D                   |             |
| Recognize the applications of deep networks in computer vision, image processing and natural language processing |  |                                | 1, 16, 4, 9             | C, D                      |             |
| Use current software and hardware tools for deep learning  |  |                                | 1, 16, 4, 9             | C, D                      |             |
| <b>Teaching Methods</b>  | 1: Lecture, 15: Problem solving, 16: Project Based Learning, 4: Exercise, Practice, 9: Simulation  |                                |                         |                           |             |
| <b>Assessment Methods</b>  | A: Written Exam, C: Homework, D: Project / Design  |                                |                         |                           |             |
| <b>Lecture Schedule</b>  |  |                                |                         |                           |             |
| <b>Sequence</b>  | <b>Topics</b>  | <b>Preliminary Preparation</b> |                         |                           |             |
| 1  | Introduction to Machine Learning and Neural Networks   |                                |                         |                           |             |
| 2  | Training Neural Networks   |                                |                         |                           |             |
| 3  | Convolutional Neural Networks (CNNs)   |                                |                         |                           |             |
| 4  | Network Layers in CNNs   |                                |                         |                           |             |
| 5  | Deep Learning Hardware and Software  |                                |                         |                           |             |
| 6  | Deep Network Architectures   |                                |                         |                           |             |
| 7  | Deep Learning Strategies   |                                |                         |                           |             |
| 8  | Midterm  |                                |                         |                           |             |
| 9  | Computer Vision and Deep Learning  |                                |                         |                           |             |
| 10   | Image processing and Deep Learning   |                                |                         |                           |             |
| 11   | Natural Language Processing with Deep Learning   |                                |                         |                           |             |
| 12   | Recurrent Neural Networks and LSTMs  |                                |                         |                           |             |
| 13   | Unsupervised Learning and Generative Modeling  |                                |                         |                           |             |
| 14   | Advanced Applications of Deep Learning   |                                |                         |                           |             |
| <b>Evaluation Methods</b>  |  | <b>Weight(%)</b>               |                         |                           |             |
| Midterm Exam   |  | 30                             |                         |                           |             |
| General Exam   |  | 70                             |                         |                           |             |

| <b>Resources</b>  |
|---|
| Deep Learning, I. Goodfellow, Y. Bengio and A. Courville , MIT Press, <a href="http://www.deeplearningbook.org">http://www.deeplearningbook.org</a> , 2016. Machine Learning Yearning, Andrew Ng, <a href="http://www.mlyearning.org/">http://www.mlyearning.org/</a> ,<br><br>Intel® AI Academy Deep Learning 501<br><a href="https://software.intel.com/en-us/ai-academy/students/kits/deep-learning-501">https://software.intel.com/en-us/ai-academy/students/kits/deep-learning-501</a> |