AGU Graduate School of Engineering and Science Electrical and Computer Engineering Program

COURSE RECORD

Code	**ECE 566**
Name	**Deep Learning in Python**
Hour per week	3+0 (Theory + Practice)
Credit	3
ECTS	7.5
Level/Year	Graduate
Semester	Fall, Spring
Type	Elective
Location	
Prerequisites	
Special Conditions	
Coordinator(s)	Dr. Zafer Aydın
Webpage	
Content	This course introduces deep learning using Keras library of Python programming language. It covers deep architectures for multi-layer perceptrons, convolutional neural networks, recurrent neural networks, and generative models including autoencoders and adversarial networks. Students will get hands-on practical knowledge implementing deep learning models and applying them to various machine learning problems.
Objectives	- Develop knowledge for the fundamentals of machine learning and neural networks - Develop knowledge and skills for practical aspects and techniques of different deep learning architectures - Provide an understanding of the deep learning models and the problem domains they are used for - Study the basic commands and building blocks for implementing deep learning models using Keras library
Learning Outcomes	LO1 List fundamental techniques of deep learning methods LO2 Implement deep learning models using Keras library of Python LO3 Perform simulations and experiments to train, optimize and evaluate deep learning models on real data sets LO4 Apply the appropriate deep learning techniques and models to solve machine learning problems
Requirements	Familiarity with scripting languages
Reading List	1. *Deep Learning with Python,* François Chollet, Manning, 2018. 2. *Hands-On Machine Learning with Scikit-Learn, Keras and Tensorflow Concepts Tools and Techniques to Build Intelligent Systems*, Aurelien Geron, O'Reilly, 2019.
Ethical Rules and Course Policy	Cheating in assignments and exams is strictly prohibited.

LEARNING ACTIVITIES

Activities	**Number**	**Weight (%)**
Lectures (on-site)	14	37%
Lectures (online videos)	7	6%
Problem solving and assignments	7	27%
Project and Presentations	2	30%
	Total	100

ASSESSMENT

Evaluation Criteria	**Weight** (%)
Quizzes	10%
Homework Assignments	25%
Project Assignments and Presentation	25%

Midterm Exam	20%
Final Exam	20%
Total	100%

For a detailed description of grading policy and scale, please refer to the website https://goo.gl/HbPM2y section 28.

COURSE LOAD

Activity	**Duration** (hour)	**Quantity**	**Work Load** (hour)
Lectures	3	14	42
Required Readings	1	14	14
Online course videos	1	7	7
Assignments	5	7	35
Project	20	2	40
Pre-work for Presentation	5	2	10
Pre-work for Quizzes	1	5	5
Pre-work for Midterm	15	1	15
Pre-work for Final	20	1	20
		General Sum	**188**

ECTS: 7.5 (Work Load/25-30)

CONTRIBUTION TO PROGRAMME OUTCOMES*

	PO1	PO2	PO3	PO4	PO5	PO6
LO1	4	2	1	3	3	1
LO2	4	3	5	3	2	1
LO3	4	3	5	3	2	1
LO4	4	4	5	4	4	2

* Contribution Level: 0: None, 1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High

WEEKLY SCHEDULE

W	**Topic**	**Outcomes**
1	Data representations of neural networks: tensors, tensor operations, gradient based optimization	LO1, LO2
	Activity: Reading chapters 1-2	
2	Anatomy of neural networks: Keras library, codes for classification and regression examples	LO1, LO2
	Activity: Quiz 1, reading chapter 3	
3	Fundamentals of machine learning: evaluating machine learning models	LO1, LO2, LO3, LO4
	Activity: Homework 1, reading chapter 4	
4	Training deep neural networks: activations, batch normalization, transfer learning, optimization, regularization	LO1, LO2
	Activity: Quiz 2, reading chapter 11 from Geron	
5	Convolutional networks: data preprocessing, data augmentation	LO1, LO2, LO3, LO4
	Activity: Homework 2, reading chapter 5	
6	Convolutional networks: using a pretrained convnet, feature extraction, fine-tuning, visualizing what convnets learn	LO1, LO2
	Activity: Quiz 3	
7	Convolutional networks: convnet architectures, transfer learning, object detection, segmentation	LO1, LO2, LO3, LO4
	Activity: Homework 3, reading chapter 14 from Geron	
8	Midterm Exam	LO1, LO2, LO4
9	Recurrent networks: text data, word embeddings, recurrent neurons and layers	LO1, LO2
	Activity: Quiz 4, reading chapter 6	
10	Recurrent networks: LSTM and GRU layers, LSTM example, advanced	LO1, LO2, LO3,

	techniques, recurrent dropout, bidirectional RNNs	LO4
	Activity: Homework 4, reading chapter 15 from Geron	
11	Recurrent networks: 1D convolution and sequence processing with convnets, combining CNNs and RNNs	LO1, LO2, LO3, LO4
	Activity: Quiz 5, project 1	
12	Advanced deep learning practices: Keras functional API, models as layers, monitoring deep learning models, hyperparameter optimization, model ensembling	LO1, LO2, LO3, LO4
	Activity: Homework 5, reading chapter 7	
13	Generative deep learning: text generation with LSTM, autoencoders	LO1, LO2, LO3, LO4
	Activity: Homework 6, reading chapter 8	
14	Generative deep learning: GAN networks	LO1, LO2, LO3, LO4
	Activity: Homework 7	

Prepared by Dr. Zafer Aydın
Date 13.06.2020