Sabanci University
Graduate School of Engineering and Natural Sciences
Computer Science and Engineering Program
CS 515 Deep Learning
2023-2024 Spring

Section	Instructor	Lectures	Office Hours
Single	Erchan Aptoula	Wednesday 09.40-11.30 FENS L056	Friday 10.40-11.30
		Friday 09.40-10.30 FASS G006	erchan.aptoula@sabanciuniv.edu

Week	**Topic** (The schedule is **tentative** and subject to change)
1	Introduction, motivation, the perceptron and its limitations
2	Multivariate gradients, constrained optimization, algebra and numerical analysis recall
3	Feedforward networks and backpropagation
4	Convolutional neural networks
5	Training CNNs: loss functions, activations, augmentations
6	CNN architectures
7	Object detection and detectors
8	Segmentation
9	**Midterm exam**
10	Unsupervised and self-supervised learning – part 1
11	Unsupervised and self-supervised learning – part 2
12	Sequence learning, recurrent neural networks and long short term memory networks
13	Natural language processing, attention and transformers
14	Transfer learning, domain adaptation, domain generalization
15	Group project presentations

Catalogue information: This course covers the theory and foundations of Artificial Neural Networks (ANN) and various shallow neural network architectures, including the single & multi-layer perceptrons and deep learning architectures (e.g. convolutional neural networks, recurrent networks, autoencoders, generative adversarial networks, transformers). Students will be expected to develop deep learning systems for machine learning problems in computer vision and natural language understanding areas.

Textbooks and reading material
Simon J. D. Prince, Understanding Deep Learning – available online (https://udlbook.github.io/udlbook/)
Michael Nielsen, Neural Networks and Deep Learning – available online (http://neuralnetworksanddeeplearning.com/)
Goodfellow, Bengio and Courville, Deep Learning – available online (https://www.deeplearningbook.org/)
Journal articles and conference papers will be shared during the semester as reading material

Evaluation
Midterm exam (30%): at the classroom, closed book exam.
Group project (30%): 1 to n students per group; n will depend on the number of enrolled students.
Assignments (30%): their number will depend on the number of enrolled students; they will be in python.
Presentation (10%): each student will present in class m published papers (m will depend on the number of enrolled students).

Makeup policy
Only for students with official excuses (e.g. medical reports, etc), and only one per grade assessment item.

Attendance: will be collected regularly.

Communication: All communication will run through SUcourse (questions, announcements, assignments, etc)

Honor code: All cases of confirmed cheating will be reported for disciplinary action.

Prerequisites: CS412 or CS512 or EE566 or equivalent or instructor approval