Deep Learning

Syllabus

A. Course Description

This course provides the foundations of Deep Learning, understand how to build neural networks, You will learn about NN, Convolutional networks, RNNs, LSTM, Adam, Dropout, BatchNorm, Xavier/He initialization, and more. You will work on case studies from healthcare, autonomous driving, sign language reading, music generation, and natural language processing. You will master not only the theory, but also see how it is applied in industry. You will practice all these ideas in Python and in TensorFlow/Keras, which we will teach.

B. Course Overview

1. Course Composition

This course is composed of 25 hours of practical programming sessions

2. Target Skills and Learning Outcomes

The skills that should be acquired while taking this course are summarized in the following table

Skills	Learning outcomes
Supervised/Unsupervised Learning	Be able to distinguish between supervised and unsupervised learning
Optimizations algorithms	Gradient descent, Adam …
Understanding and implementation of Neural Network	Be able to, explain how neural networks work (loss function, number of weights, Dropout …) Be able to implement a neural network using keras
Understanding and implementation of CNN	Be able to explain how CNN work (Convolutional layers, Max Pooling layer, loss function, number of weights, optimization algorithms …), and in which cases we should use them. Be able to implement a CNN using keras.
Understanding and implementation of RNN	Be able to explain how RNN work and in which cases we should use them. Be able to implement a RNN using keras. Example of LSTM

C. Assessment Model

30% PP

70% examination

D. References & Resources

https://www.coursera.org/specializations/deep-learning

Deep learning in Python – Francois chollet (Book)

E. Hardware and Software

Students should have Anaconda3 installed on their computer.

F. Prerequisites

Students should have knowledge in Python.

Students should have knowledge in Calculus, Linear algebra, Statistics and Probability

G. Sessions Contents

1. Supervised/Unsupervised Learning
    a. Supervised Learning
        Example of KNN Classification
    b. Unsupervised Learning
        Example of K-Means Clustering

2. Optimizations algorithms
    a. Gradient Descent
    b. Stochastic Gradient Descent
    c. Minibatch Stochastic Gradient Descent
    d. Adam

3. Deep Neural Network
    a. Hidden layers
    b. Activation functions
        Relu, softmax, …

c. Forward Propagation, Backward Propagation, and Computational Graphs

d. Loss function
e. Model selection, Underfitting and Overfitting
f. Project: Predicting House prices on Kaggle

4. CNN
    a. Convolutional layers
    b. Max Pooling layers
    c. Padding and stride
    d. Transfer learning
    e. Project: Cat Dog classification using keras

5. RNN
    a. Sequence Models
    b. Text preprocessing
    c. Implementation of RNN from scratch
    d. Project: LSTM implementation

H. Class Policies

Participation