

CE/CZ 4042 Learning Objectives

1. Interpret artificial neuron as an abstraction of biological neuron and explain how it can be used to build deep neural networks that are trained to perform various tasks such as regression and classification
2. Identify the underlying principles, architectures, and learning algorithms of various types of neural networks;
3. Select and design a suitable neural network for a given application;
4. Implement deep neural networks that can efficiently run on computing machines.

Pre-requisites: CE/CZ1011, CE/CZ1012, CE/CZ1003, CE/CZ1007
Comfortable with some Mathematics. Linear Algebra. Basic Calculus.

Course Hours

➤ **Lectures: Friday 11:30am – 1:30pm (ONLINE)**

➤ **Tutorial: Wednesday 2:30 – 3:30pm (ONLINE),**
Tutorials start from 3rd week

➤ **Part-time**

➤ **Lecture: Thursday 6:30 – 8:30pm (ONLINE)**

➤ **Tutorials: Thursday 8:30 - 9:30pm (ONLINE),**
Tutorials start from 2nd week

Course Topics

First Half:

1. Neural network basics
2. Regression
3. Classification
4. Layers of neurons
5. Feedforward networks
6. Model selection and overfitting

Second Half:

7. Convolution neural networks (CNN)
8. Recurrent neural networks (RNN)
9. Gated RNN
10. Autoencoders
11. Generative adversarial networks (GAN)

Python 3.8.x and Tensorflow 2.x

- **Python 3.8.x** is the programming language
- **Tensorflow 2.2 Libraries:**
 - TensorFlow: <https://www.tensorflow.org/>
- Codes of lecture examples and tutorials will be provided.

Assessment

➤ **Programming Assignments (50%) – Individual**

- **Assignment 1:** handout Sept 21, deadline Oct 16
- **Assignment 2:** handout Oct 19, deadline Nov 13

Codes and a report are to be submitted to NTULearn by the deadline

Assessment

➤ **Project (50%) – Group (up to Three)**

- Project ideas handout: August 28
- Deadline: Nov 6

The students are to propose the project and form project groups. The topic could also be selected from the ideas given.

The project includes potential research issue related to neural networks theory/application, literature survey, and design and implementation of a potential solution. Comparisons with existing solutions are to be presented.

A report, codes, and a video presentation are to be submitted to NTU Learn by the deadline by one of the group members. The project report should contain the names of all the project members.

Assignments and Projects

- Python and Tensorflow are recommended for assignments and projects
- PC with at least 1 GPU is recommended
- Access to SCSE GPU-TC server for those who needs computational power. Students will have accounts after add-and-drop period is over.
Email: scsegpu-tc@ntu.edu.sg
- Reports are to be submitted in pdf format and codes are to be submitted in a .zip file to NTU Learn before the deadline.
- The cover page of the project report should have the names of all the group members.
- Late submissions are penalized (each day at 5% up to 3 days)
- Assessment criteria are indicated in the handout.