Module title

Deep Learning for Image Classification and Segmentation

Module code	Level	Hours per week	ECTS credits	Duration
	Bachelor (B.Sc.)	4	5	3 weeks

Module instructor	Lecture type	Prerequisite(s)	Grading
Dr. Chih-Yu Hsu Associate Professor, ChaoYang University of Technology, Taiwan	Regular lecture, on line consultations, in-class exercises	Good academic standing	Coursework

Objectives

- Understand Machine Learning and Artificial Neural Networks
- Understand Deep Learning and Convolutional Neural Networks (CNNs)
- Code and Employ Artificial Neural Networks and CNN

Content

- Artificial Neural Networks
  - Perceptrons and Sigmoid Neuron
  - Loss Function
  - Gradient Descent Algorithm
  - Backpropagation
- Image Classification and Segmentation
  - Fuzzy C-means Method and Gaussian Mixture Models
  - Segmentation by Classification of Voxels
  - Model Estimation Segmentation
  - Artificial Neural Network for Image Classification
- Deep Learning
  - Convolutional Neural Network (CNN)
  - Gradient Descent Optimization Algorithms
  - Convolutional Neural Networks for Image Classification
  - Convolutional Neural Networks for Image Segmentation

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- This module will provide students with knowledge of Deep Learning.
- By using lab examples from Image Classification and Segmentation to illustrate aspects of Deep Learning.
- The examples show students how to leverage deep neural networks (DNN) - specifically convolutional neural networks (CNN) - within the deep learning workflow to solve a real-world image classification and segmentation problems with the MNIST hand-written digits and medical image datasets.
  In the labs, students will learn how to:
- Architect a Deep Neural Network to run on a GPU
- Manage the process of data preparation, model definition, model training and troubleshooting
- Use validation data to test and try different strategies for improving for improving model performance

Textbook/teaching material

- Christopher M. Bishop (1995). Neural Networks for Pattern Recognition. Oxford University Press. ISBN: 0198538642
- John L. Semmlow (2004). Biosignal and Medical Image Processing. Marcel Dekker, Inc. ISBN: 1420062301
- Duda, R.O., Hart, P.E. and Stork, D.G. (2001). Pattern Classification. Wiley. ISBN: 978-0-471-05669-0
- Bengio Y., Goodfellow, I.J. and Courville, A. (2015). Deep Learning. MIT Press (in preparation). http://www.iro.umontreal.ca/~bengioy/dlbook/

Note: this is not the official course descriptor according to the "Studien- und Prüfungsordnung" (SPO)