

ARTIFICIAL INTELLIGENCE GRADUATION MODULE 2

1. Thông tin về học phần (General Information):

Tên học phần (Course name): Artificial Intelligence Graduation Module 2

Mã học phần (Course code):

Số tín chỉ (Number of credits): 4

Loại học phần (Course type): Compulsory

Học phần tiên quyết (Prerequisites):

- Algebra (BAS1201)
- Probability and Statistics (BAS1226)

Học phần trước (Previous courses):

Học phần song hành (Parallel courses):

Các yêu cầu đối với học phần (Course requirements):

- Phòng học lý thuyết (Lecture room): Projector, microphone and speaker, black board or white board.

- Phòng thực hành (Laboratory): Computers (can do python programming)

Giờ tín chỉ đối với các hoạt động (Teaching and Learning hours):

- Lý thuyết (Lectures): 40h
- Bài tập (Exercises): 8h
- Bài tập lớn (Projects): 8h
- Thực hành (Labs): 4h
- Tự học (Individual reading): 0h

Địa chỉ Khoa/Bộ môn phụ trách học phần (Address of the Faculty/Department in charge of the course):

- Địa chỉ (Address): Khoa Công nghệ Thông tin 1 - Học viện Công nghệ Bưu chính Viễn thông, Km10, Nguyễn Trãi, Hà Đông, Hà Nội

Faculty of Information Technology 1 - Posts and Telecommunications Institute of Technology, Km10, Nguyen Trai Street, Ha Dong District, Hanoi.

- Điện thoại (Phone number): (024) 33510432

2. Mục tiêu học phần (Objectives)

Về kiến thức (Knowledge):

This course provides learners with advanced concepts of deep learning. The learners are required to understand:

- advanced concepts of deep learning and their applications.
- new topics in deep learning research

Kỹ năng (Skills):

Learners will learn the skill set to develop various kinds of deep learning-based systems. These skills consist of:

- using python and deep learning frameworks.
- modifying deep learning architecture to adapt to the problem.
- evaluating various deep learning models.

Thái độ, Chuyên cần (Attitude):

- Learners are required to attend all classes, do exercises and assignments.

3. Tóm tắt nội dung học phần (Description)

This course will cover the advanced knowledge of applied deep learning in research and practice. Learners will learn how advanced deep learning architectures work. Some real-world problems that have been solved by advanced deep learning architectures are also introduced. On completion of this course, the learners will be able to know how to apply and when to apply these architectures to real-world problems. Furthermore, the learners will be able to analyze when the accuracy of the applied architecture is not as high as expected.

4. Nội dung chi tiết học phần (Outlines)

Chapter 1: Deep learning basic

- 1.1. Deep learning concepts
 - 1.1.1. Deep learning components
 - 1.1.2. Deep learning operations
- 1.2. Deep learning frameworks in python

Chapter 2: Deep learning models for image classification

- 2.1. Introduction to convolutional neural network (CNN)
- 2.2. Residual network learning
 - 2.2.1. Overview of Resnet
 - 2.2.2. ResNet architecture and evaluation
 - 2.2.3. Application of ResNet
- 2.3. 3DCNN for video processing
 - 2.3.1. Overview of 3DCNN
 - 2.3.2. 3DCNN architecture and evaluation
 - 2.3.3. Application of 3DCNN
- 2.4. CapsNet
 - 2.4.1. Overview of CapsNet
 - 2.4.2. CapsNet architecture and evaluation
 - 2.4.3. Application of CapsNet

Chapter 3: Deep learning models for object detection

- 3.1. Faster RCNN
 - 3.1.1. Overview of faster RCNN
 - 3.1.2. Faster RCNN architecture and evaluation
 - 3.1.3. Application of Faster RCNN
- 3.2. YOLO object detection
 - 3.2.1. Overview of YOLO
 - 3.2.2. YOLO architecture and evaluation
 - 3.2.3. Application of YOLO

Chapter 4: Deep learning models for Natural language processing

- 4.1. Introduction to recurrent neural network (RNN)
- 4.2. Word embedding
 - 4.2.1. One-hot encoding
 - 4.2.2. Word2Vec
 - 4.2.3. Global vectors for word representation (GloVe)
- 4.3. Long-short term memory (LSTM)
 - 4.3.1. Overview of LSTM

- 4.3.2. LSTM architecture and evaluation
- 4.3.3. Bi-LSTM architecture and evaluation
- 4.3.3. Application of LSTM and Bi-LSTM
- 4.4. Gated recurrent unit (GRU)
 - 4.4.1. Overview of GRU
 - 4.4.2. GRU architecture and evaluation
 - 4.4.3. Application of GRU

Chapter 5: Advanced Topics in Deep Learning

- 5.1. Introduction
- 5.2. Attention Mechanisms
 - 5.2.1. Recurrent models of visual attention
 - 5.2.2. Attention mechanisms for machine translation
- 5.3. Neural network with external memory
 - 5.3.1. A Fantasy game: sorting by example
 - 5.3.2. Implementing swaps with memory operations
 - 5.3.3. Neural turing machines
 - 5.3.4. Differentiable neural computer: A brief overview
- 5.4. Generative Adversarial Networks (GANs)
 - 5.4.1. Training a Generative Adversarial Networks
 - 5.4.2. Comparison with Variational Autoencoder
 - 5.4.3. Using GANs for Generating Image Data
 - 5.4.4. Conditional Generative Adversarial Networks
- 5.5. Limitations of Neural networks
 - 5.5.1. An aspirational goal: One-shot learning
 - 5.5.2. An aspirational goal: Energy-efficient learning

Chapter 6: Deep learning in practical applications

- 6.1. Implement of video classification.
 - 6.1.1. The datasets and algorithms of video classification
 - 6.1.2. Training model for visual features on an individual frame
 - 6.1.3. Implement 3D convolution in video
 - 6.1.4. Implement I3D framework.
- 6.2. Implement of object segmentation.
 - 6.2.1. The datasets and algorithms of object segmentation
 - 6.2.2. Implement salient object detection
 - 6.2.3. Implement Region-based segmentation
 - 6.2.4. Implement Mask R CNN
- 6.3. Implement of machine translation
 - 6.3.1. The datasets and algorithms of machine translation
 - 6.3.2. Implement Bi-LSTM based method for machine translation
 - 6.3.3. Implement Encoder Decoder structure with attention
- 6.4. Implement of document classification
 - 6.4.1. The datasets and algorithms of document classification
 - 6.4.2. Implement Bi-LSTM based method for document classification
 - 6.4.3. Implement Random multimodel deep learning for document classification

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook, Springer, 2018.

5.2. Học liệu tham khảo (Reference Textbooks)

[2] Adrian Rosebrock. Deep learning for computer vision with Python, ebook, 2017.

[3] Ian Goodfellow, Yoshua Bengio, and Aaron Courville . Deep learning, The MIT Press, 2016, ISBN: 0262035618

6. Phương pháp, hình thức kiểm tra – đánh giá kết quả học tập học phần (Grading Policy)

Grading method	Percentage	Group/Individual
- Attendance	10%	Individual
- Exercises	10%	Individual
- Mid-term projects/exam	20%	Group or individual
- Final examination	60%	Individual

**Trưởng Bộ môn
(Head of Department)**

**Giảng viên biên soạn
(Lecturer)**

Ngô Xuân Bách

Vũ Hoài Nam