INTRODUCTION TO DEEP LEARNING

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

Tên học phần (Course name):   Introduction to Deep Learning

Mã học phần (Course code):   INT_E14122

Số tín chỉ (Number of credits):   3

Loại học phần (Course type):   Elective

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.
    - Phòng thực hành (Laboratory): Computers (can do python programming), microphone, speaker.

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

    - Lý thuyết (Lectures):   32h
    - Bài tập (Exercises):   4h
    - Bài tập lớn (Projects):   4h
    - Thực hành (Labs):   4h
    - Tự học (Individual reading): 1h

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 the fundamentals of deep learning components. The learners are required to understand:

- basic concepts of deep learning.

- various kinds of problems in which deep learning-based methods outperform traditional methods.

- various kinds of successful deep learning-based applications.

Kỹ năng (Skills):

Learners will learn the skills to develop various kinds of deep learning-based applications, including:

- applying deep learning frameworks to solve the problems.
- modifying parameters to achieve expected performance.
- evaluation of deep learning-based applications.

Thái độ, Chuyên cần (Attitude):
    - Learners are required to attend all classes and do exercises , assignments.

3. Tóm tắt nội dung học phần (Description)

This course will cover the basic knowledge of applied deep learning in research and practice. Learners will go from basic knowledge of deep learning building blocks to advanced deep learning architectures. Some real-world applications of deep learning are also introduced. On completion of this course, the learners will be able to understand the fundamentals of deep learning as well as how to apply deep learning models to solve practical problems.

4. Nội dung chi tiết học phần (Outlines)
Chapter 1: What is deep learning ?
1.1. Basic concepts
    1.1.1. Artificial intelligence
    1.1.2. Machine learning
    1.1.3. Deep learning
1.2. Why deep learning? Why now?
    1.3.1. What makes deep learning different
    1.3.2. The modern machine-learning landscape
    1.3.3. Available resources
    1.3.4. Community interests

Chapter 2: Mathematical building blocks of neural networks
2.1. Data representation of neural networks
    2.1.1. Overview of neural networks
    2.1.2. Tensor
    2.1.3. Tensor manipulation with Numpy
    2.1.4. Real-world examples of data tensors
2.2. Tensor operations
    2.2.1. Basic operations
    2.2.2. Geometric interpolation of tensor operations
    2.2.3. A geometric interpolation of deep learning
2.3. Gradient-based optimization
    2.3.1. What is derivative?
    2.3.2. Stochastic gradient descent
    2.3.3. Back-propagation algorithm

Chapter 3: Neural networks
3.1. Anatomy of neural networks
    3.1.1. The building blocks of deep learning
    3.1.2. Network of layers
    3.1.3. Loss functions and optimizers
3.2. Introduction to Keras
    3.2.1. Keras, Tensorflow, Theano, CNTK
    3.2.2. Quick overview of Keras
3.3. Keras in practice
    3.3.1. Keras, Tensorflow, Theano, CNTK
    3.3.2. Quick overview of Keras
    3.3.2. Keras environment setting

3.3.2. Keras examples 1: Classifying movie reviews
3.3.2. Keras examples 2: Classifying newswires
3.3.2. Keras examples 3: Predicting house prices

Chapter 4: Deep learning in practice
4.1. Convolutional networks
    4.1.1. The convolution operation
    4.1.2. The pooling operation
    4.1.3. The fully connected operation
    4.1.3. Regularization, dropout operation
4.2. Recurrent neural networks
    4.2.1. Support for sequences in neural networks
    4.2.2. Architecture of RNN
4.3. Commonly used deep learning architectures
    4.3.1. Resnet for image classification
    4.3.2. Facenet for face recognition
    4.3.3. RCNN for object detection
    4.3.4. Long Short-Term Memory for text classification
    4.3.4. Generative adversarial networks
4.4. How to build working deep learning model from scratch
4.5. Project and lab

Chapter 5: Conclusions
5.1. Benefits of Deep learning
5.2. Deep learning applications
    5.2.1. Deep learning for Optical Character Recognition (OCR).
    5.2.1. Deep learning for Video surveillance.
    5.2.3. Deep learning for Document summarization.

5. Học liệu (Textbooks)

5.1. Học liệu bắt buộc (Required Textbooks)

[1] Deep learning with python - Francois Chollet, Manning Publications Company, 2017, ISBN 1617294438, 9781617294433

5.2. Học liệu tham khảo (Reference Textbooks)

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

[3] Deep learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 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)

Ngô Xuân Bách

Giảng viên biên soạn
(Lecturer)

Vũ Hoài Nam