

Introduction to Deep Learning

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Course Objectives

To understand the **basics** of deep learning

To **design and implement** deep neural networks

To structure machine learning **projects**

To use **convolutional, sequence, and generative** models in applications

Syllabus

Before
Mid-term

Introduction (65 slides, 2 weeks)

Neural Networks: Basics, Shallow NN, Deep NN (86 slides, 2 weeks)

Tuning NN: Regularization, Dropout, Optimization, Gradient Checking, Momentum, RMSprop, Adam, Learning rate decay, Hyperparameter tuning, Batch Normalization, Softmax Regression (72 slides, 4 weeks)

Machine Learning Projects: Error Analysis, Transfer Learning, Multi-task Learning (32 slides, 1 week)

After
Mid-term

Convolutional Neural Network: Introduction, Classic Networks, Object Detection, YOLO Algorithm, Face Recognition, Neural Style Transfer (82 slides, 2 weeks)

Sequence Models (33 slides, 1 week)

Deep Generative Models (# slides, 2 weeks)

Paper Presentations (after mid-term, every week 1~2 papers)

Term Projects (in groups, 2 weeks demos)

Grading

Labs*7: 21%

Programming Homework*6: 18%

Mid-Term Exam: 15%

Final Exam: 15%

Team Project: 21%

Paper Presentation: 6%

Invited Talks: 4%

Labs*7 (21%)

#	Dates	Labs
1	2/26	Python
2	3/14	DNN
3	3/28	Regularization + Dropout
4	5/2	Building CNN
5	5/9	Car Detection (YOLO)
6	5/16	Building RNN
7	5/30	Building GAN

Programming Homework*6 (18%)

#	Announcement	Deadline	Homework
1	3/5	3/19	Tensorflow Tutorial
2	4/9	4/23	Adam+RMSprop+Momentum
3	4/23	4/30	Keras
4	4/30	5/07	Resnet
5	5/07	5/14	Face Recognition or Neural Style Transfer
6	5/14	5/28	Jazz Music Creation with LSTM

Mid-Term and Final Exams

2 parts in each exam

50% Written Quiz (closed book)

50% Take Home Programming Exam

Team Projects (21%)

Select 3 preferred topics and submit a proposal

Deadline: **March 5, 2019 12:00 Noon**

Proposal format: (English only, typed out, no handwritten, PDF file)

Your preferred list of topics (in order)

Your expertise corresponding to what you selected

Why should I give you that topic to do?

Your team members (names in Chinese, registration numbers)

Mid-term report: submit by **April 30, 2019.**

Final presentation and report:

Report Submission: **June 3, 2019.**

Presentation: **June 4~13, 2019.**

Paper Presentations (6%)

Select **at least one** paper published within **5 years**

Reading

Need to understand the **architecture** of deep neural network used in the paper

Need to understand the **domain** of application

Need to run and understand the **programming code** related to that paper

Presentation

Deep neural network model **architecture**

Main **contributions of the paper**

Examples to illustrate the model or method

Code demonstration, if any (bonus for demo)

Invited Talks (4%)

Some **experts** from the industry or academia will be invited for talks either in class or in weekends

Attendance in **at least one talk** will be required

A simple **1-page report** on the attended talk will be required for grading purpose

Whether you liked the talk and if you learnt anything from the talk

Programming Environment

Programming Language: **Python**

Programming assignments will be done in **Jupyter Notebooks**

Deep Learning Frameworks: **Tensorflow, Keras, Pytorch, etc.**

Computing Resources:

A GPU-based server will be provided for training large network models ; however, since resource is restricted, you are advised to have your own GPU resources (display card).

Weights will be provided for large pre-trained network models

Contacts and Office Hours

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2019 Spring Team Project Topics (Image Related)

1. Select an industry AI problem from the following site and if permitted solve the problem
<https://aigo.org.tw/ai-plus/competitions>
2. Autonomous driving
Identify: vehicles, pedestrians, traffic signs, traffic signals
3. Vehicle License Plate Identification
Taiwan's car license plates
4. Crop Pathology Identification
38 classes of crop with pathology (disease)
5000 images
5. Batik Creation
Use at least 1000 Batik styles
Create new ones

2019 Spring Team Project Topics (Voice, text, data)

- 6. Voice transfer
Use neural style transfer to convert a familiar song into your own voice
- 7. Voice control
A set of commands for operating a smart home
Identify the commands (using Trigger Word)
- 7. Create new poems (text)
Use at least 100 poems of the same category
- 8. Smart Factory
Create a dataset for the health of machineries (temperature, vibration, etc.)
Detect problems (anomalies)
- 9. IoT security
Anomaly detection using deep learning