COURSE ANNOUNCEMENT FOR MACHINE LEARNING (S 2021)

Shingchern D. You

Instructor

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Lecture language

- Lecturing language: English
- However, if you have any question, you can ask me in Chinese
  - But, I will answer the questions in English (along with the translation of the problems)

Grading

- MT 35%
- Final 40%
- Homework 25%
- Term Project (Bonus) 10%

Exam

- MT/Final are **open-book exams**
- Problems may need paper-and-pen calculation
- The exam time is 3 hours (more than enough)
- Exam dates: 4/23 & 6/25
- Do not bring too many materials, as you may **not** have enough time to both read books and answer questions

Homework

- Homework assignments mix programming-based problems with non-programming problems
- Homework is due on next lecture meeting after announced
  - For example, if homework one is announce on Feb. 5, it will be due on Feb. 12
- Homework solutions will be given after the due dates

Project

- Grading is based on completeness and difficulty level
- Each term member will receive his/her points based on his/her contribution
- Project grading
  - Project presentation: 60%
  - Project report: 40%
- Read the following blog for challenging problems:

https://www.analyticsvidhya.com/blog/2015/06/start-journey-kaggle/

Textbook

- No official textbook is assigned
- Lecture PPT files will be made available
- Reference book
  - Peter Harrington, Machine Learning in Action, 2012
  - Charu C. Aggarwal, Neural Networks and Deep Learning, Springer, 2018
  - **E. Alpaydin, Introduction to machine learning, 3rd ed**
- Please DO NOT distribute my PPT over internet
  - Copyright issues

Lecture style

- Follow PPT files
- Skip most of detailed math, presenting only the main concepts
- Provide numerical examples (mainly searched over the Internet) to illustrate how to implement some algorithms

Time & place

- Lecture Day: Friday
- Time: 9:10 AM to 12:00 PM
- Place: Tech building 1322 (科研1322)

Course progress

- Week 1
  - Class announcement
  - Introduction to AI
  - introduction to machine learning
- Week 2
  - Basics of supervised learning
    - Example: k-NN
    - Classification and regression
  - VC dimension
  - Bayesian decision theory

Course progress

- Week 3
  - Naive Bayes classifiers
  - ML and MAP estimation
  - Multivariate methods
- Week 4
  - Density estimation
  - Gaussian mixture model (GMM)

Course progress

- Week 5:
  - Feature selection
  - Brief intro to Hidden Markov model (HMM)
- Week 6: Holiday
- Week 7
  - Decision trees
    - ID3
    - C4.5
    - Random forest
  - Basics of optimization

Course progress

- Week 8
  - Support vector machine (SVM)
  - Multi-class classification
- Week 9: MT
- Week 10
  - MT sol
  - Boosting methods
    - Adaboost
    - Theories & more

Course progress

- Week 11
  - Boosting methods (cont'd)
  - Clustering algorithms
  - Dimension reduction techniques: PCA
- Week 12
  - Dimension reduction techniques: ICA, FA, LDA
  - Back propagation

Course progress

- Week 13
  - Cost functions
  - Writing Keras programs
  - Convolutional neural networks
    - Depthwise spatial convolution
- Week 14
  - YOLO
  - Training neural networks
  - Visualization

Course progress

- Week 15
  - LSTM
  - Autoencoder and GAN
- Week 16
  - Ensemble learning
  - Conducting experiments
  - Design and analysis of experiments (Ng's Basics of ppt)
  - Reinforcement learning basis

Course progress

- Week 17
  - Q learning and SARSA
  - DQN & DDQN
  - Intro to Policy-based learning
    - AC3
    - PPO
- Week 18: Final exam

Why to study so many tools

- Neural networks with deep learning algorithms are good for massive training examples, but sometimes we do NOT have (e.g., medical imaging)
- It is like a chef who needs various kinds of knifes

Why to study so many tools

- Almost all existing methods have shortcomings
- When encountering problems, we can switch to another methods
- Exercise: Find out shortcomings of some well-known methods
  - Neural networks (particularly CNN)
  - Decision tree (C4.5)
  - Adaboost