Announcement @May.31

- Programming Assignment 6
  - Due: June. 14, 11:59 pm

- Homework 6
  - Due: June. 12, 11:59 pm

Project Presentation and Submission

- Project presentation
  - Time: In class, June. 7 & 9 (Tue & Thu)
  - Each group has 8 minutes for presentation
  - Schedule:
    - June 7: group 1-9
    - June 9: group 10-17
- Report & Code
  - Due: 11:59pm, June. 9 (Thu)
  - Submission link at BB -> Project -> Project Submission
  - Format: PDF, academic paper, no page requirement (Report); Code
  - Each group only needs to submit one report and code

Final Exam

- Time
  - 8:00-9:30am, June. 16 (Thu.)
- Location
  - Online: Blackboard + Tencent Meeting
- Format
  - Open-book (纸质材料)
  - 15 multiple-choices, 2 problems
- Grade
  - 25% of the total grade

- F2018 final exam paper is available at:
  - Blackboard menu → Previous Exams → Fall 2018 Final Exam

Final Review

Disclaimer

- Topics covered in this review may not appear in the exam.
- Topics not covered in this review may appear in the exam.

Probabilistic temporal models

- Markov models
  - Markov assumption, Transition model
- Hidden Markov models
  - Transition model (states) + emission model (evidence)
  - Filtering: $P(X_t|e_{1:t})$
    - Forward algorithm
  - Most likely explanation: $\text{argmax}_{x_{1:t}} P(x_{1:t} \mid e_{1:t})$
    - Viterbi algorithm
- Dynamic Bayes networks
- Approximate inference by particle filtering
  - Propagate forward → Weight → Resample

Markov Decision Processes

- Markov Decision Process
  - States S, Actions A, Transitions P(s'|s,a), Rewards R(s,a,s')
- Quantities:
  - Policy, Utility, Values, Q-Values
- Solve MDP
  - Bellman equation
  - Value iteration
  - Policy iteration
    - Policy evaluation + Policy improvement

Reinforcement Learning

- Reinforcement learning
  - MDP without knowing T and R
  - Offline planning vs. online learning
- Model-based learning
- Model-free learning
  - Policy evaluation: Temporal Difference Learning
    - Exponential moving average
  - Computing q-values/policy: Q-Learning
- Exploration vs. Exploitation
  - Random exploration, exploration function
- Approximate Q-Learning
  - Feature-based representation of states

Supervised machine learning

- To learn an unknown target function f from labeled examples

- Classification (f with discrete output value)
  - Naïve Bayes
    - All attributes are independent given class
  - Generalization and overfitting, smoothing
  - Perceptron (linear classifier), neural networks

- Regression (f with continuous output value)
  - Linear regression, minimizing summed squared error

Unsupervised machine learning

- K-means
  - Clustering
  - Iteration:
    - Assign each data instance to closest center
    - Assign each center to the average of its assigned data points
- Expectation-Maximization
  - Learning Mixture of Gaussians
  - Iteration:
    - E-step: Compute label distribution of each data point
    - M-step: Update each Gaussian based on its (proportionately) assigned points

Natural Language Parsing

- Context-free grammars
  - Terminals, Non-terminals, Start symbol, Production rules
  - Rules may have probabilities
  - Sentence generation/parsing
- Parsing: CYK
  - Convert to Chomsky normal form
  - Dynamic programming: bottom-up table filling
  - Probabilistic CYK: Bottom-up computation of probabilities of best partial parses
- Regular grammars
- Dependency parsing
  - Graph-based parsing
  - DG vs. CFG

Good luck in your final exam ☺

The Road Forward

- Related Courses
  - Undergraduate
    - SI151 Optimization and machine learning
    - CS150 Database and Data Mining
    - CS172 Computer vision I
  - Graduate
    - CS280 Deep Learning
    - CS282 Machine Learning
    - CS243 Introduction to Algorithmic Game Theory
    - CS272 Computer Vision II
    - CS283 Robotics
    - CS284 Simultaneous Localization and Mapping
    - SI232 Subspace Learning
    - SI252 Reinforcement Learning
  - More to come…

The Road Forward

- Learning recent developments in AI from top conferences
  - AI: IJCAI, AAAI
    - Caution: not top in ML, NLP, CV
  - ML: NIPS, ICML, ICLR
  - NLP: ACL, EMNLP, NAACL
  - CV: CVPR, ICCV, ECCV
  - Other: KDD, AAMAS, UAI, SIGIR, …

- A good (but not perfect) way to judge a publication venue
  - Google Scholar Metrics

That's all!