Project

- Project presentation
  - Time:
    - 7pm, Jan. 5 (Thu)
    - 7pm, Jan. 6 (Fri)
  - Tencent meeting 929-3777-9667
  - Each group has ≤ 7 minutes for presentation
  - Schedule: TBA
- Project submission
  - Report
    - Due: 11:59pm, Jan. 6 (Fri)
    - Submission link at BB => Project => Project Report Submission
    - Format: PDF, academic paper, no page requirement
    - Each group only needs to submit once
  - Source code
    - In a zip file
    - Do not include external libraries

Project

- At the end of your final presentation and report
  - List the external resources (e.g., code, lib, tools) that you use
  - Explain how/why you use them

- Grading
  - relevance to this course
  - substance, soundness, novelty
  - quality of the report and presentation

Final Exam (Online)

- Time
  - 10:30-12:10, Dec. 30 (Fri)
- Format
  - Closed-book. You can bring an A4-size cheat sheet and nothing else.
  - 10 multiple-choices, 4 problems
- Online exam
  - Detailed instructions will be sent out later
- Grade
  - 25% of the total grade

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

Final Review

Disclaimer

- Topics covered in this review may not appear in the exam.
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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
    - Empirical rate, maximum likelihood estimation
  - Generalization and overfitting, smoothing, tuning
  - Perceptron, logistic regression, neural networks
    - Gradient descent

- 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 (for CFG in Chomsky normal form)
  - Dynamic programming: bottom-up table filling
- Regular grammars, dependency grammars

Computer Vision

- Basic concepts, applications, tasks…

The Road Forward

The Road Forward – SIST Courses

- Undergraduate
  - CS172 Computer vision I
  - CS173 Data Mining
  - CS182 Introduction to Machine Learning
  - CS183 Introduction to Robotics
- Graduate
  - CS280 Deep Learning
  - CS282 Machine Learning
  - CS243 Introduction to Algorithmic Game Theory
  - CS272 Computer Vision II
  - CS274A Natural Language Processing
  - CS283 Robotics
  - CS286 AI for Science and Engineering
  - SI252 Reinforcement Learning
- And more…

The Road Forward – Research

- 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, …
- A good (but not perfect) way to judge a publication venue
  - Google Scholar Metrics
- Participating in research projects…

That's all!