Machine Intelligence

Assignment 3

(Chapters Slides)

Team 1

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Chapter 13

- **Why may agents be uncertain of their state ?**

  1- Partial Observability 2- Nondeterminism 3- Laziness 4- Ignorance

- **Why is probability theory is the best way to summarize uncertainty ?**

  1- Numeric 2- Easily updatable 3- Vectorization 4- basic component of Decision Theory

- **Why is full joint probability distribution ineffective at all ? And how to solve this problem ?**

  Not scalable with number of RVs of interest (exponential complexity). Solution: the concept of independence between RVs to factor the full joint distribution into separate joint distributions.

- **Why is Bayes' Rule important ?**

  1- Evaluates diagnostic based on causal and prior knowledge of cause existence in an online fashion.

  2- Combines evidences to evaluate posteriors.

Chapter 14

- Bayesian Networks represents independence relationships between random variables.
- Each variable has a conditional distribution that is represented in a table CPT.
- Each CPT entry has conditional probability for at most *k* parents.
- Exact inference methods use enumeration to calculate P(Query | event)
- Variable elimination is applied to speedup exact inference in multiply connected trees.
- Approximate inference using direct sampling, rejection sampling and Monte carlo methods is used to eliminate the complexity of exact inference.
- First order logic and Relational Probability models are using to construct well-defined distributions.
- Other methods can be used for probabilistic reasoning such as rule-based systems and fuzzy logic.

Chapter 15

- Representation of probabilistic temporal (dynamic) processes :

  1) States and observations. 2) Transition and sensor models.
- Inference in probabilistic temporal (dynamic) processes :

  1) Filtering. 2) prediction. 3) Smoothing. 4) Most likely explanation.
- Three families of temporal models :

  1) Hidden Markov Models (HMMs). 2) Kalman Filters.

  3) Dynamic Bayesian Networks (DBNs).
- Data association : keeping track of many objects.

Chapter 21

- Reinforcement Learning uses a feedback (reward) from environment to learn and take actions.
- Passive Reinforcement Learning can be done through :
  1) Direct Utility Estimation.
  2) Adaptive Dynamic Programming.
  3) Temporal-Difference (TD) Learning.
- Active Reinforcement Learning :
  1) Exploration vs. Exploitation.
  2) Q-Learning & SARSA.
- Function Approximation for generalization and dealing with large state spaces.
- Policy Search through policy gradient (differentiable) or empirical gradient (hill climbing).
- Reinforcement Learning for game playing and robot control.