CS 480 – Introduction to Artificial Intelligence

Topic: Summary

Mustafa Bilgic

http://www.cs.iit.edu/~mbilgic

https://twitter.com/bilgicm

Covered

- Chapter 1 – Introduction
- Chapter 2 – Agents
- Chapter 3 – Search
- Chapter 5 – Game playing
- Chapter 6 – CSPs
- Chapter 7 – Propositional logic
- Chapter 8 – First-order logic
- Chapter 12 – Probabilities
- Chapter 13 – Bayesian networks
- Chapter 16 – Making simple decisions
- Machine learning
- Several discussion topics

Chapter 1 – Intro

- What does AI even mean?
- Discussed Turing's paper
- Human vs Rational and Acting vs Thinking
- Foundations of AI
- History of AI

Chapter 2 – Agents

- Rationality
- PEAS
  - Performance, Environment, Actuators, Sensors
- Various kinds of agents
  - Reflex agent, model-based agent, goal-based agent, utility-based agent, learning agent

Chapter 3 – Search

- Goal-based agent
  - Starting state, goal state, actions, costs
  - Find a sequence of actions to reach the goal state, while minimizing the cost
- Tree search vs graph search
  - One doesn't remember the states visited to save memory
- Search algorithms
  - DFS, BFS, IDS, GBFS, UCS, A*
- Complexity
  - Complete, optimal, time complexity, space complexity
- Heuristics for A*
- Discussion: SHAKEY the robot

Chapter 5 – Game Playing

- Utility-based agent
- Adversarial search
  - One maximizes, the other minimizes
- Minimax
- Alpha-beta pruning
- Monte-Carlo tree search
- Heuristic functions
- Discussion: Deep Blue, Alpha Go

Chapter 6 – CSPs

- Definition
- Constraint graphs
- Arc consistency
- AC-3 algorithm
- Backtracking search
- Variable and value ordering heuristics
  - Degree, MRV
- Min-conflicts algorithm
- Discussion: CSPs

Chapter 7 – Propositional Logic

- Thinking rationally
- Knowledge bases
- Wumpus ☺
- A model
- Logical entailment
- Syntax and semantics of propositional logic
- Truth tables and model checking
- Proof by contradiction
- CNF
- Resolution
- Horn clauses
- Forward and backward chaining
- Discussion: John McCarty
- Discussion: Expert systems

Chapter 8 - FOL

- Syntax
- Semantics
- Quantifiers
- English to FOL
- Bill and his sisters

Chapter 12

- Probability theory
- Joint distribution
- Conditional distribution
- Number of independent parameters
- Bayes rule
- Chain rule

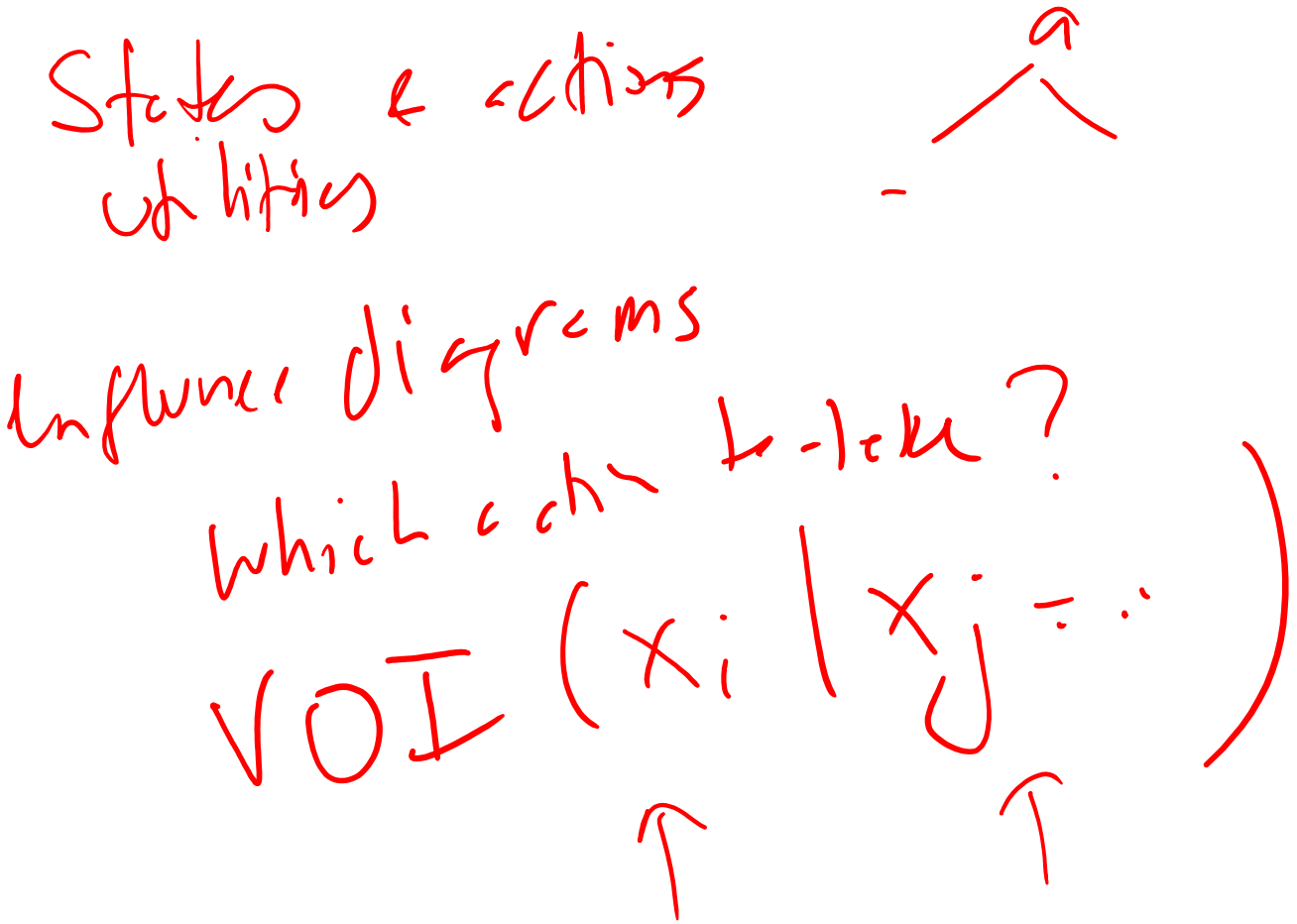
CHAPTER 13 - BNS

efficient representation $-\prod P(V_i \mid P_a(V_i))$

and $V_i : \text{IND}(V_i) \mid P_a(V_i)$

efficient inference $P(Q \mid E)$ $X = W \cup Q \cup E$

Chapter 16 – Making Simple Decisions



Learning

Measurements Acc Prec Rec F1

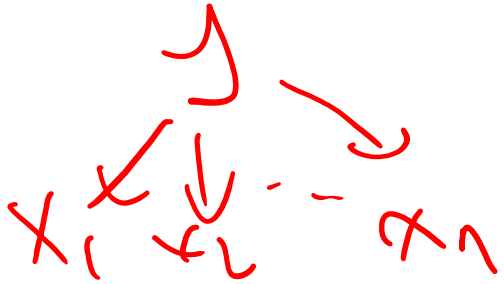
Parameter estimation

MLE, BE (α, β) $\alpha = \beta = 1$ LS

PE for BNs

Naive Bayes $P(Y|X_1 \ldots X_n)$

$\propto P(Y) \prod P(X_i|Y)$



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Ethics

- Discussion: AI safety and ethics
- Discussion: ML and bias

Programming Assignments

- PA1
  - Search
- PA2
  - Game playing
- PA3
  - Logic
- PA4
  - Learning