CS262A: Learning and Reasoning with Bayesian Networks

Syllabus – Winter 2024

Instructor: Professor Adnan Darwiche, darwiche@cs.ucla.edu.

Course Description: The course introduces the subjects of probabilistic modeling, reasoning and learning in the context of Probabilistic Graphical Models, with a particular emphasis on Bayesian Networks. It discusses the theoretical foundations of these topics, together with a coverage of associated inference/learning algorithms and practical applications.

Textbook: "Modeling and Reasoning with Bayesian Networks," by Adnan Darwiche, Cambridge University Press, 2009. Digital version available for free at the following link, which must be accessed through a UCLA IP:

https://search.library.ucla.edu/permalink/01UCS_LAL/192ecse/cdi_skillsoft_books24x7_bks00030932

Meetings: The course is based on two lectures and one discussion section per week.

Course Grade: Based on homework (30%), a midterm (35%) and a final (35%).

Tentative Outline.

- 1. Introduction to Course and Propositional Logic. (Chapters 1 & 2)
- 2. Probability Calculus and Bayesian Reasoning. (Chapter 3)
- 3. Bayesian Networks: Syntax and Semantics. (Chapter 4)
- 4. Modeling: Applications and Techniques I. (Chapter 5)
- 5. Modeling: Applications and Techniques II. (Chapter 5)
- 6. Exact Inference I. (Chapters 6, 9 & 10)
- 7. Exact Inference II. (Chapters 7 & 8)
- 8. Circuit Representations of Probabilistic Models I. (Chapter 12)
- 9. Circuit Representations of Probabilistic Models II. (Slides)
- 10. Midterm Exam (tentative).
- 11. Approximate Inference. (Chapters 14 & 15)
- 12. Maximum Likelihood Learning I. (Chapter 17)
- 13. Maximum Likelihood Learning II. (Chapter 17)
- 14. Bayesian Learning I. (Chapter 18)
- 15. Bayesian Learning II. (Chapter 18)
- 16. Causality I: Interventional reasoning. (Slides)
- 17. Causality II: Counterfactual reasoning. (Slides)
- 18. Reasoning About Bayesian Networks: Sensitivity Analysis. (Chapter 16)

<u>Tentative</u> midterm date: Monday 2/12 during class time.

No class on Monday 1/15 and Monday 2/19 due to university holidays.