Probabilistic Programming and AI

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Graduate Final Project Rubric

Criteria 1: Understanding of Probabilistic Programming Concepts (10 points)

- Demonstrates a deep understanding of fundamental probabilistic programming concepts and their application to solve complex problems.
- Shows a solid grasp of probabilistic programming principles with clear application in the project.

Criteria 2: Design and Implementation (20 points)

Depending on whether you have chosen a project that leans more towards exploring and implementing underlying algorithms for probabilistic programs (a) or whether you use probabilistic programming languages to perform modeling and inference (b), we differentiate our assessment guidelines.

Criteria 2a: Technical Implementation of Algorithms

- Motivation of implemented algorithm with respect to Bayesian inference and probabilistic programming
- Explanation of how the algorithm works and how it was implemented
    - Show deep understanding of the presented algorithm
    - Demonstrate steps to ensure an efficient implementation

Criteria 2b: Bayesian Modeling and Inference

- Demonstrate understanding of Bayesian modeling in terms of latent and observed variables
- Justification of modeling decisions / consideration of different modeling options, e.g.:
    - Choice of priors

- Generating observed variables from latent variables (are there multiple ways to do this that make sense?)
- Justification of choice of inference algorithm
    - Assess if inference was successful (e.g. interpret the Markov chain)
    - Experiment and compare different algorithms

Criteria 3: Experimentation and Results Analysis (20 points)

Criteria 3a: Technical Implementation of Algorithms

- Explain how your results are affected by the choice of different (hyper-)parameters to experiment with
- Generally: There may be different ways of implementing things: how does this affect the results?
- Evaluation of implemented algorithm
    - Experimental setup (choice of benchmark, comparison to different methods / existing implementations)
    - Interpretation of the results
        - What are the drawbacks / advantages of your implementation
        - Discuss the complexity / runtime / scaling properties of your algorithm compared to other methods
        - For which test cases does your implementation work well? For which not? Clearly assess the scope through your evaluation

Criteria 3b: Bayesian Modeling and Inference

- Experiment with different models and model parameters and analyze how this affects the results
- Interpretation of inference results
    - What questions can you answer with your results?
    - Discuss the uncertainty/confidence in your conclusions
    - Visualization of results: show and discuss posterior distributions plots / convergence plots

Criteria 4: Presentation and Communication (10 points)

- Design your presentations with a clear structure, engaging visuals, and proper communication of ideas for the intended audience (i.e., other students who have basic probabilistic programming knowledge, but are not necessarily experts in the subarea who focused on)
- Communicate aspects of criteria 2 and 3 succintictly, but prepare more detailed backup slides in case of follow up questions