

Lab 3: Inference by Sampling

For this part you will use the Sprinkler Bayesian network in sprinkler.xdsl.

1. For this first step, you will establish a ground truth value for $P(\text{Rain} = \text{false} \mid \text{Sprinkler} = \text{true})$. Make sure the inference algorithm is the “Clustering” algorithm (which it should be by default). To select it (or double check it) go to Network -> Algorithm and select Clustering. Compute the probability using the “Clustering” inference algorithm.
2. For this second step, you will experiment with using Logic Sampling for inference.
 - a. Change the inference algorithm to Logic Sampling (select Network->Algorithm->Logic Sampling).
 - b. Then go to Network -> Network Properties.
 - c. Select the “Sampling” tab
 - d. In the text box for “Number of Samples”, you will enter different values starting with 10 samples.
 - e. Perform inference with the Lightning Bolt to compute $P(\text{Rain} = \text{false} \mid \text{Sprinkler} = \text{true})$. Remember to clear the evidence and re-enter it each time.
 - f. How many samples did it take to converge to the ground truth value? Plot a graph of the probability $P(\text{Rain} = \text{false} \mid \text{Sprinkler} = \text{true})$ on the y-axis and the number of samples on the x-axis. Remember to plot the ground truth.
3. Now change the Sprinkler node such that $P(\text{Sprinkler} = \text{true} \mid \text{Cloudy} = \text{true}) = 0.01$ and $P(\text{Sprinkler} = \text{false} \mid \text{Cloudy} = \text{true}) = 0.99$. Repeat Step 2. Starting with 10 samples, how many samples did it take to converge to the right value? Plot a graph of the probability $P(\text{Rain} = \text{false} \mid \text{Sprinkler} = \text{true})$ on the y-axis and the number of samples on the x-axis.
4. For the last part, you will use the “Likelihood Sampling” algorithm. Repeat Step 3 with “Likelihood Sampling” instead of “Logic Sampling”. Starting with 10 samples, how many samples did it take to converge to the right value? Plot a graph of the probability $P(\text{Rain} = \text{false} \mid \text{Sprinkler} = \text{true})$ on the y-axis and the number of samples on the x-axis.