CSCI 580 Assignment #2

Submission

- Due: 10/8
- PDF on Canvas

Problem

1. (50 pts) How well can we approximate π using Monte Carlo methods?

(a) (10 pts) Recall the formula for the area A of a circle with radius r: $A = \pi r^2$. Explain how this can be used to approximate π by considering the ratio of this area to the area of a square. In particular, determine a formula for π using this ratio.

(b) (20 pts) Write a function approxPi(n) taking advantage of the formula from part (a) to approximate π with n samples. You can use the programming language of your choice (Python, C++, Java). Include a code snippet of this function in your PDF submission.

(c) (20 pts) Create a figure showing how this approximation improves as the number of samples increases. This figure will have sample size on the x-axis and absolute difference (|π − π̂| where π̂ is the approximation) on the y-axis. Include error bars. Consider sample sizes from 10 to 10,000 in increments of 100 with at least 10 repeats for each size. An example is included in Figure 1.

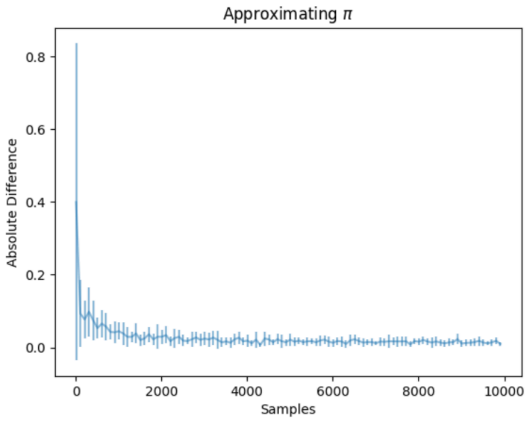

Figure 1: Example figure showing $|\pi - \hat{\pi}|$ as a function of the number of samples used to determine $\hat{\pi}$.

2. (50 pts) Describe your understanding of the red dashed lines connecting the two categories of AI algorithms. If you identified additional connecting red lines, discuss the reasoning behind them. If it makes sense, you get extra credit (up to 20 pts) – please print your answers, no handwritten one will be accepted.