CSCI 1051 Homework 4

January 30, 2023

Submission Instructions

Please upload your solutions by **5pm Wednesday February 1, 2023.** Remember you have 24 hours no-questions-asked *combined* lateness across all assignments.

- You are encouraged to discuss ideas and work with your classmates. However, you **must acknowledge** your collaborators at the top of each solution on which you collaborated with others and you **must write** your solutions independently.
- Your solutions to theory questions must be typeset in LaTeX or markdown. I strongly recommend uploading the source LaTeX (found on the homepage of the course website) to Overleaf for editing.
- Your solutions to coding questions must be written in a Jupyter notebook. I strongly suggest working with colab as we do in the demos.
- You should submit your solutions as a **single PDF** via the assignment on Canvas.

Problem 1 (from January 30)

In class, we motivated diffusion by arguing that GANs can "cheat to win". Why do diffusion models not suffer from mode collapse like GANs do?

Problem 2 (from January 31)

Refer to the notebook here to solve this problem.

Part 1

In class, we showed that we could find weights with minimum ℓ_2 norm which satisfied the standard linear regression loss, if we followed gradient descent from the right initialization. Plot the optimal weights with minimum ℓ_2 norm and argue that the plot is evidence of our claim.

Part 2

In class, we did a strange re-parameterization of the standard linear regression loss. I told you that we could find weights with minimum ℓ_1 norm which satisfied the modified linear regression loss, if we followed gradient descent from the right initialization. Copying and modifying the code in the notebook, plot the gradient and comment on whether the plot is evidence of our claim.