Sharan Sahu, Darsh Balani, and Raghav Ramanujam
EECS 182
Project Proposal
Due 11-11-22

EECS 182 Project Proposal

Project Option Choice: We will be choosing **Option 1**. In particular, we will be focusing on the paper **Wasserstein GAN**. We will be creating a homework assignment that consists of both a theory and coding section. We expect students to be familiar with the prerequisites of EECS 182. In particular, we expect students to understand the following concepts: a high-level understanding of GANS and its pitfalls, some ideas from optimization (although we will provide relevant definitions and hints), standard probability, and the ability to program in JAX. Below are the concepts we aim to teach students and how we will do so:

- Understand that Vanilla GANs have a lot of pitfalls, including non-convergence (via Nash Equilibrium), problems with low-dimensional supports, vanishing gradients, and mode collapse
    - We will attempt to teach this concept through simple theoretical examples
    - We will also attempt to use a coding example before working with the Wasserstein GAN to illustrate this
- Understand the concept of Wasserstein Distance and see why it provides a smoother measure for training using gradient descent compared to KL Divergence or JS Divergence
    - This will mainly be done using theoretical examples. This includes showing that Wasserstein distance has good convergence properties and smooth gradients compared to JS and KL
        - Remark: We are not sure about this yet, but we may include a motivating example / slightly rigorous derivation for why we cannot simply minimize Wasserstein Distance (by making the use of Kantorovich-Rubinstein duality)
- Learn how to implement GAN and WGAN with starter code, maybe compare their results, and introduce the concept of gradient clipping
    - Remark: Gradient clipping is not in the scope of the paper, but it is a very important topic to know as it is an improvement to weight clipping.

All these concepts are the baseline concepts that we intend to illustrate, but we may include more concepts as we see fit.

Estimate Of Compute Power: We estimate that the amount of computing power we will require is around the same required of students for EECS 182 HWs