6.883 Project Proposal

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Below, we answer the points in the section "Evaluating and Improving State-of-the-Art Techniques."

1. While GANs are supposed to learn to generate samples from a distribution, many of the GANs used in practice have significant issues and often only learn to generate samples from a small subset of the true distribution. The paper [Santurkar, Schmidt, Madry '17] sheds light on some of these issues such as mode collapse and gives quantitative metrics for evaluating how well a GAN imitates the true distribution. The paper also studies training classifiers from synthetic images and finds that classifiers trained using images from a GAN perform significantly worse than classifiers trained from real data. We plan to evaluate several newer GAN architectures using these methods. Additionally, motivated by the theoretical results in [Li et al. '17], we hypothesize that it may be possible to mitigate mode collapse by clustering the real data beforehand and training a separate GAN on each cluster. We will evaluate this technique as well.

2. In the original GANs paper [Goodfellow et al. '14], the authors mention the issue that the generator can map much of the input space to the same or similar outputs. In a recent paper [Li et. al. '17], the authors demonstrated mode collapse in the simple scenario of learning a mixture of Gaussians and showed that a GAN with an optimal discriminator provably converges. Another recent paper [Arora, Zhang '17] showed that the training objective can reach its optimum even when the generated distribution has very low support.

3. We will generally use the evaluation metrics outlined in [Santurkar, Schmidt, Madry '17]. We will evaluate the performance of unrolled GANs [Metz et al. '17] and mode regularized GANs [Che et al. '16].

4. Each of the GAN architectures / training algorithms have published Github code. We will implement clustering and DCGANs for our own experiment to evaluate our hypothesis that a mixture of GANs trained on clusters will avoid mode collapse.

5. For the mid-project milestone, we aim to have replicated the unrolled GANS and evaluated the quality of the learned distribution by training a classifier on samples from the generator.

6. The new GAN architectures we are evaluating are quite recent and in general, it does not appear that standard ways of evaluating GANs include the quantitative metrics outlined in [Santurkar, Schmidt, Madry '17] and actually attempting to train classifiers from synthetic data.