Assignment 2 ADRL - 2022

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October 8, 2022

Diffusion Models and Family

1. Construct a generative model on the CelebA (https://mmlab.ie.cuhk.edu.hk/projects/CelebA.html) and Bitmoji datasets (https://www.kaggle.com/datasets/romaingraux/bitmojis) using (a) Noise prediction formulation, (b) score-based formulation (Denoising Score Matching). Use a UNET with sinusoidal embedding for the time variable in both cases. Experiment with different time steps for langevian sampling, generate 1000 data samples, compute the FID and compare with results obtained with GAN-based models training in A1. Plot the denoising steps for 10 steps for 10 generated images in a grid for both noise prediction and score-based formulations. Finally, choose 10 random catagories from the Celeb-A dataset and construct a classifier-guided diffusion model. Plot a 10x10 grid of generated images with each row corresponding to a catagory of the dataset.

2. Train an EBM with contrastive divergence loss on the Bitmoji dataset and plot the generated images with different langevin steps.

Domain Adapatation

For these experiments, we use two sets of datasets: MNIST-USPS (https://www.kaggle.com/datasets/bistaumanga/usps-dataset), Clipart and Real-world categories of the Office-Home dataset (https://www.hemanthdv.org/officeHomeDataset.html). The former is the case where both the datastes contain images of handwritten digits and the latter contains images of 65 categories from four domains (of which you are supposed to work on only Clipart and Real-world categories). The following are the tasks:

1. First build a Resnet-50 based classifiers for both the pairs of datasets. You should train the classifier on one of the domains in both the cases and report the test accuracy on the other (on which the classifier is not trained).

2. Implement Domain-Adversarial Training of Neural Networks (DANN) where you modify the base Resent-50 with the gradient reversal layer. Report

the results with gradient reversal layer at three different stages of the base classifier.

3. Implement Adversarial Discriminative Domain Adaptation (ADDA) with Resent-50 as the base classifier on the source data. Use the Wasserstein metric for adversarial feature learning.

4. Implement a Cycle-GAN for the pair of MNIST-USPS datasets. Use the output of the converted target in the source classifier and report the result on adaptation.