

Project 4: Generative Modeling Using Diffusion Models

CSE 849 Deep Learning (Spring 2025)

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1 Quick Overview of Hyper-parameters

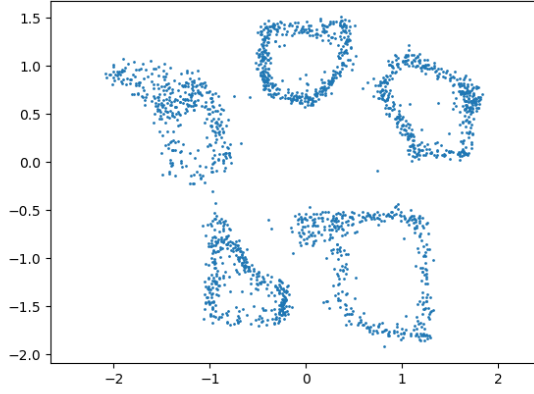
Here are the hyper-parameters used for the unconditional generation task:

```
batch_size = 10_000
num_epochs = 500
lr = 1e-3
weight_decay = 1e-4
cosine_scheduler = CosineAnnealingLR(optimizer, T_max=num_epochs, eta_min=5e-6)
```

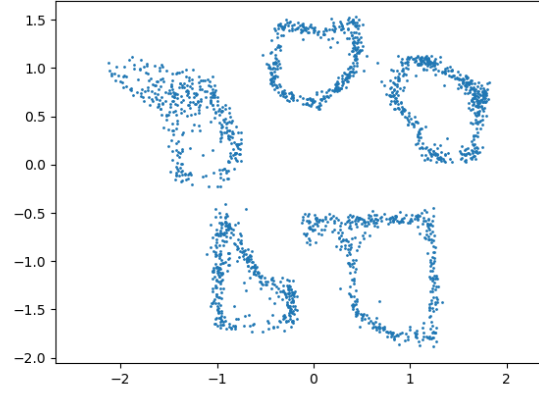
Here are the hyper-parameters used for training the classifier:

```
num_steps = 500
batch_size = 20_000
lr = 1e-3
weight_decay = 1e-5
num_epochs = 10
scheduler = CosineAnnealingLR(optimizer, T_max=num_epochs, eta_min=1e-5)
```

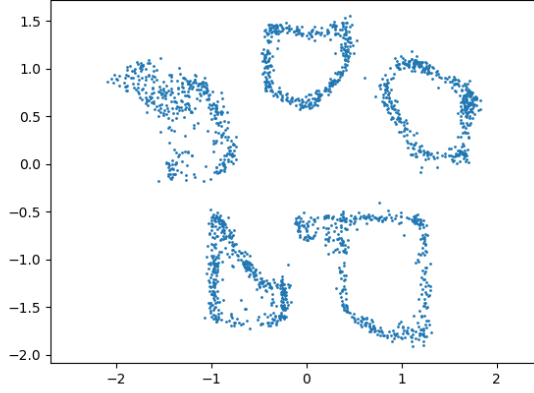
Regarding the conditional generation, denoiser and classifier models with the same structure are instantiated and the trained weights are loaded. Further, the same number of time steps are used.



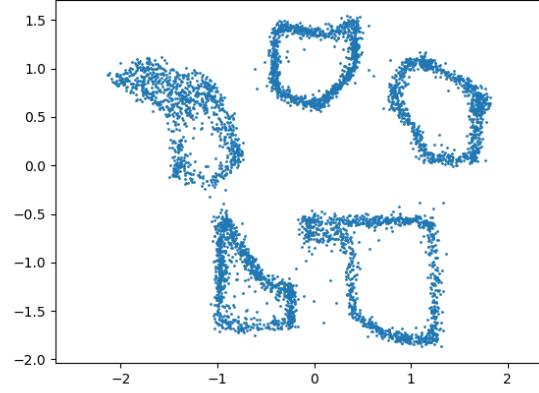
(a)



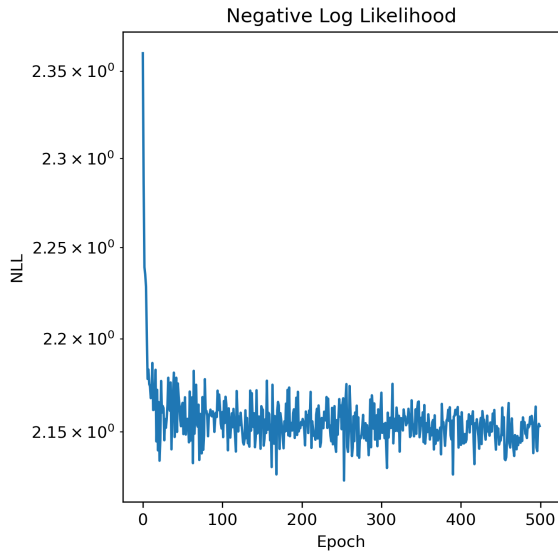
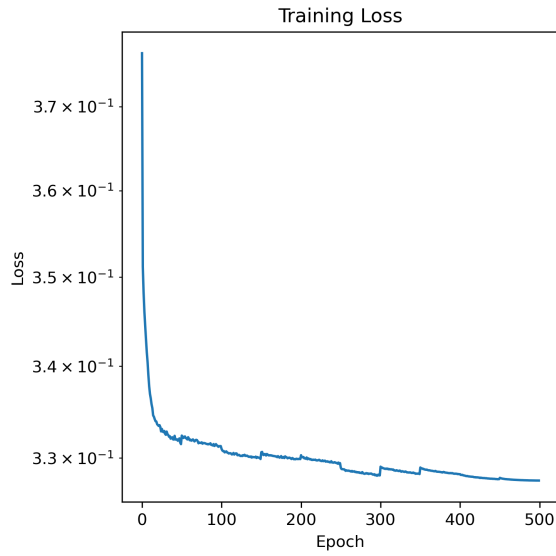
(b)



(c)



(d)



(e)

Figure 1: Evolution of the unconditional generation during epochs (with 2000 samples) of (a) 100, (b) 300, (c) 500, (d) full generation (with 5000 samples), and (e) training loss and negative likelihood values.

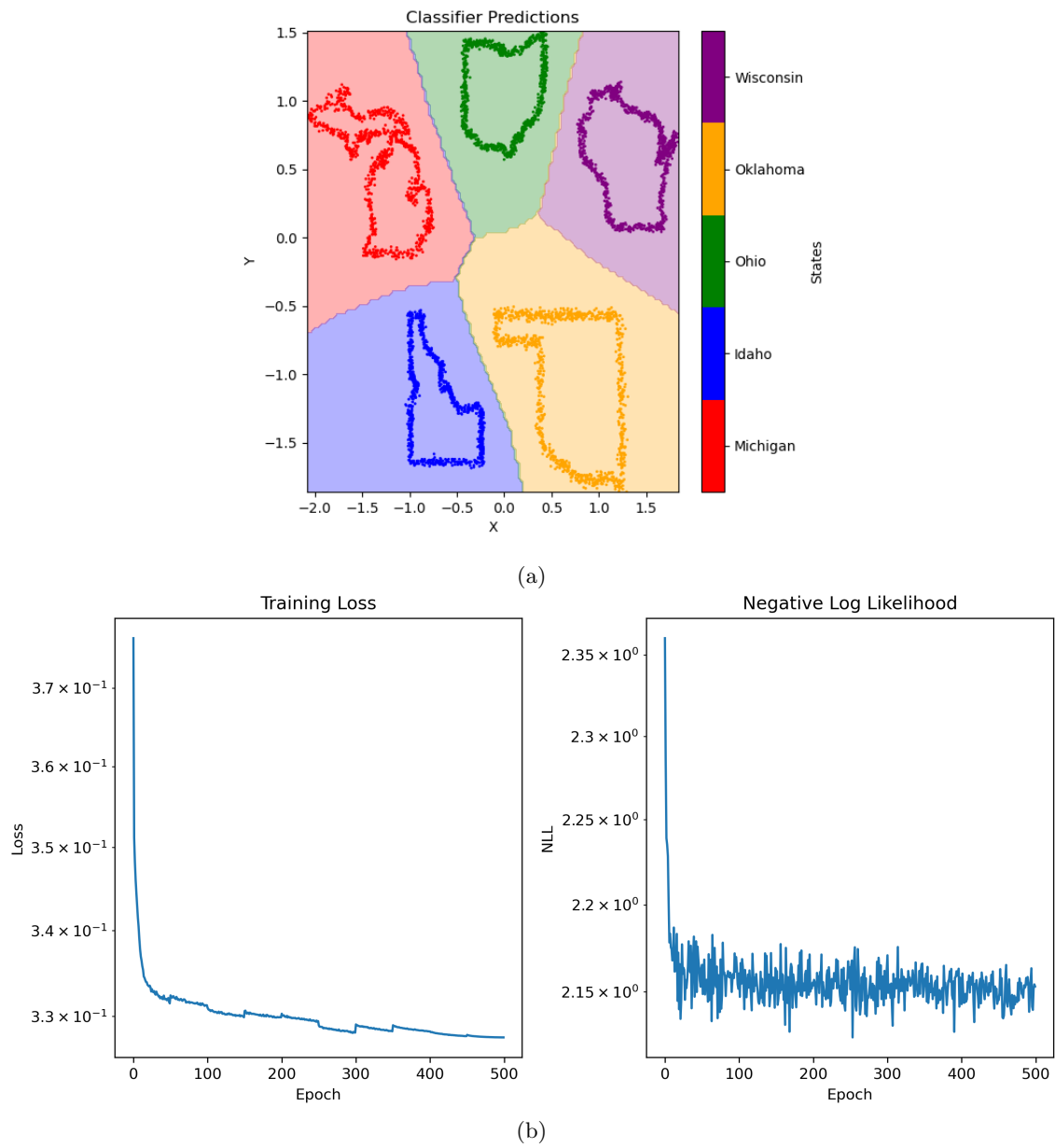
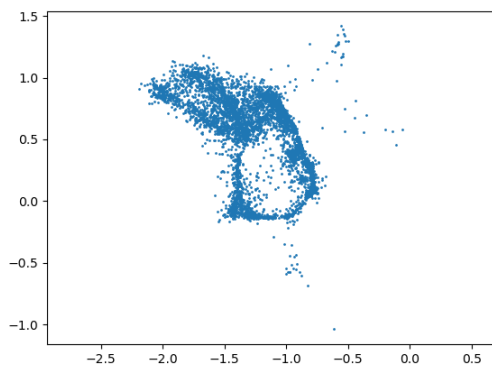
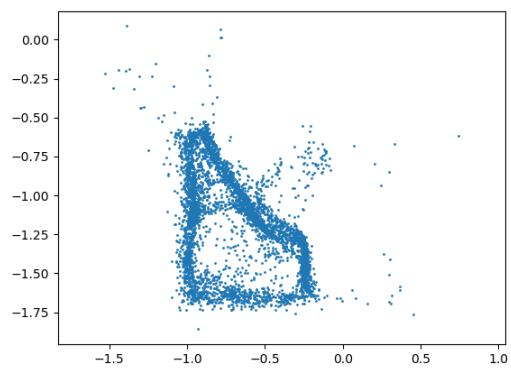


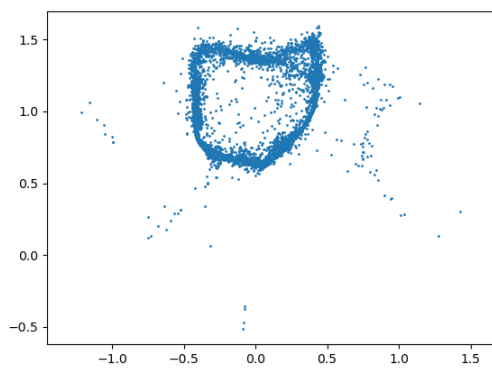
Figure 2: (a) Classifier prediction and (b) its training loss.



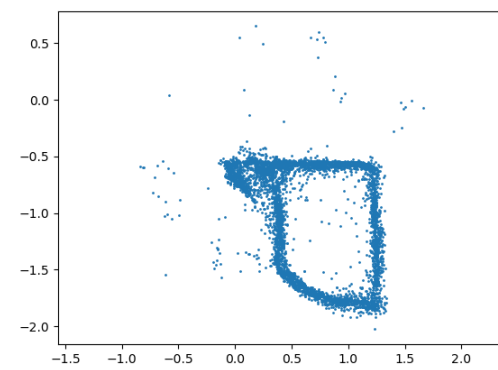
(a)



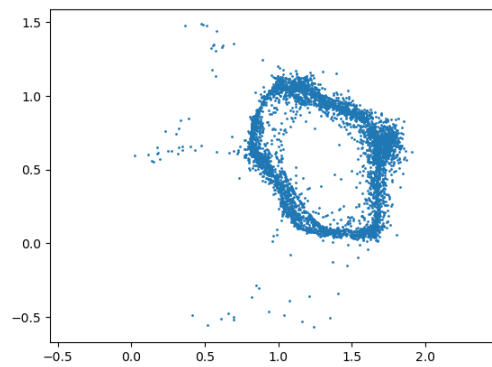
(b)



(c)



(d)



(e)

Figure 3: Conditional generation of (a) Michigan, (b) Idaho, (c) Ohio, (d) Oklahoma, and (e) Wisconsin