2019 Spring COM526000 Deep Learning - Homework 5

Variational Autoencoder for Image Reconstruction

Due: May, 10, 2019

INSTRUCTIONS

1. In this homework, you have to construct a variational autoencoder (VAE) for EMNIST which is a set of handwritten character digits derived from the NIST Special Database 19 and converted to a 28x28 pixel images.
2. Please use **emnist-balanced-train.csv**.
   (a) Each row is a separate image
   (b) 785 columns
      i. First column = class_label
      ii. Each column after represents one pixel value (784 total for a 28 x 28 image)
3. **Please only use tensorflow to build the model.**
4. Name your source code that contains your *main* function as *hw5_StudentID.py* and your report as *hw5_StudentID.pdf*.
5. **You should write your own codes independently. Plagarism is strictly prohibitted.**

PROBLEMS

1. (10%) Please sort out the dataset to just contain the image from A to Z and describe in details how to pre-process images and explain why. You have to submit your preprocessing code as *data_prepro.py*.
2. (30%) Please use the dataset and carry out the VAE model with L2 regularization for image reconstruction. You need to design the network architecture and compare the effect of different settings including dimension of latent code and minibatch size. [Hint: You can add some Gaussian noise in the dataset to obtain the good results.]
3. (15%) Plot learning curve.

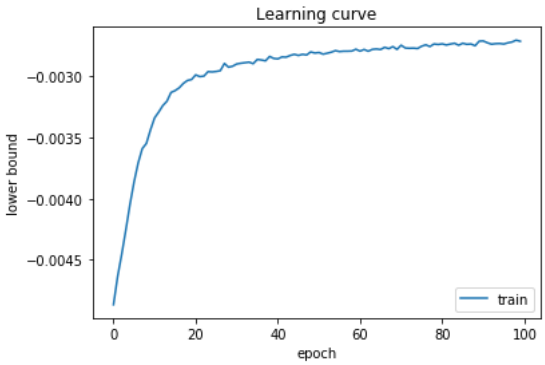

Figure 1: Learning curve.

4. (15%) Please show some examples reconstructed from the decoder.

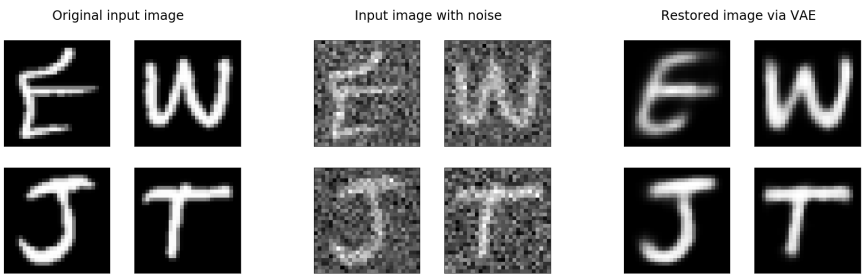

Figure 2: Reconstruction via VAE.

5. (15%) Choose two components from your latent variable and plot the reconstructed images by varying the value of the latent variable.

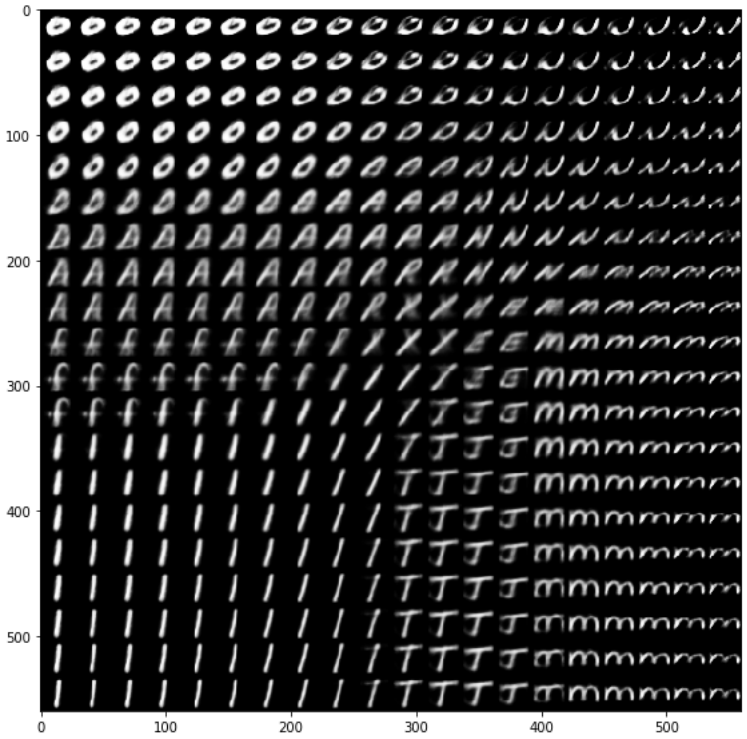

Figure 3: Two-dimensional latent space.

6. (15%) Sample noise vectors from N(0,1) as latent variables and use the decoder to generate some images.

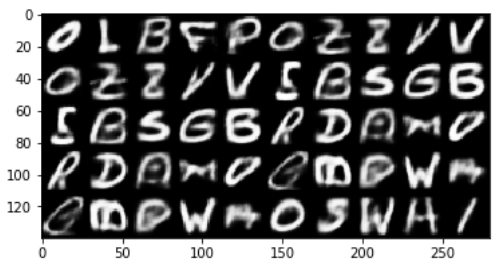

Figure 4: Generated images.