Proposal

An Exploratory Study on MNIST Dataset

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1 Introduction

Image classification and generation are two important parts in the field of picture processing. They are also used in many different applications, ranging from recognizing handwritten text and detecting any object in an image to generating relative accurate images according to the text descriptions. MNIST dataset containing 10-class handwritten digits is very classical and comes up over and over again in scientific papers, blog posts, and so on. It was introduced by Yann LeCun in 1998. It contains 28x28 grayscale images of handwritten digits, each with an associated label indicating which number is written (an integer between 0 and 9). Since MNIST dataset is easy to deal with compared to other image datasets, we decide to use this to test models of image classification & generation, and focus on the comparison and realization of these models.

2 Classification on MNIST Dataset

Image recognition and classification is a classic topic in machine learning. Therefore, in the first part of our project, we will explore how computer recognizes images, using MNIST Dataset and classification algorithms. We will apply different classification models, such as Multinomial Logistic Regression(MLR), Support Vector Machine(SVM), K-nearest neighbors(KNN) and Convolutional Neural Network(CNN) to train our data, and then check the model's accuracy on the validation dataset. At the end of this part, we will also compare the accuracy among these models and their computational complexity, based on their running time.

3 GANs on MNIST Dataset

Generative adversarial nets are an example of generative models proposed in 2014 with a wide application in image generation. Recent years have seen a lot of research striking to improve the original model. Generative adversarial nets are a network structure with two models, generator C and discriminator D, which are both multilayer perceptrons. We train G to generate synthetic samples from noise while training D to maximize the probability of assigning the correct label to examples from real data distribution and synthetic samples from G.

We will separately analyze effects of GANs, WGAN, CGAN and DCGAN as well as go through the empirical analysis on the dataset Mnist. Our project will focus on the comparison and realization of these GANs.