MANIFOLD LEARNING OF LATENT SPACE VECTORS IN GAN FOR IMAGE SYNTHESIS

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Abstract

Generative Adversarial Networks (GAN) have attained remarkable results in image augmentation and generation. GAN models consist of Latent space vectors. Latent space vectors are interpreted as inputs for the generator to generate images. Mathematically they are a hypersphere consisting of many dimensions, containing the learnt representation. However, various GAN variants use different techniques to model latent space vectors. This dissertation dissects the latent space vectors of state-of-the-arts GAN variants, for image synthesis. We also compare and contrast optimization methods of latent space vectors in existing literature. In this dissertation, we undertake a comparative analysis of latent space vectors and optimization methods of the popular image synthesizing GAN models.

Based on the analysis we were able to choose appropriate existing works to carry out the research. We choose the DCGAN as the model and ClusterGAN as the model optimization technique. Based on a review of mathematical methods we choose manifold learning techniques to cluster the latent space. The results of the clustering allowed us to determine the sparse and dense features of a Euclidean image distribution.

The research on the image augmentation techniques allowed the authors to make a deployable facial recognition system utilizing advanced image models. While there are other facial recognition models, they are not deployable in a business environment, they are procedural in nature. The authors had to review existing work on face recognition such as FaceNet model to make the system. The authors also used concurrent programming principles to optimize the model to train in reasonable amounts of time.

This will be useful with pandemics such as the COVID-19 as well. We need more robustness in non-invasive (touchless) authentication systems. Most authentication systems such as fingerprint recognition are touch-based, this is a risk during pandemics.

Keywords: Image Generative Model; Generative Adversarial Networks; Latent Space Vectors; Mathematical optimization; Model compression, Face recognition systems.