

Project Members:

Justin Kieu, Louis Yang, Sheng-Hung Hung

Project Report 1**1. What is the topic of your project?**

The topic of our project is Self-Attention Generative Adversarial Networks (SAGAN). This technique of neural networks combines Generative Adversarial Networks (GAN) and Attention Mechanism together. Instead of traditional GAN models which usually use convolutional layers to analyse the features of images locally, the Self-Attention layer would consider the whole input images and take features which are located far away into account, and find out the dependencies across each region of image. By implementing this technique, we can improve the performances of both generator and discriminator, and finally generate higher quality images.

2. What algorithms are you planning to use?**a. Generative Adversarial Networks (GAN)**

Generally, the GAN model can be divided into two sections. The first part is a generator which will attempt to create some images from some noises to cheat the discriminator. The other part of it is a discriminator. This model would read both the real images and generated fake images, and try to figure out which ones are the real images. By training those models at the same time, they will fight against each other, and improve the learning results.

b. Self-Attention Mechanism

Attention Mechanism was originally used to enhance Recurrent Neural Network (RNN). The main principles of attention technique were first introduced by the Google Brain Team in the Transformer research. This technique mimics human's behavior of paying attention, and memorizes the features throughout the inputs.

c. Spectral Normalization

Spectral Normalization is a technique used to stabilize the discriminator in GAN. It mitigates the mode collapse problem while also dealing with the gradient problem. It is convenient as only one constant has to be tuned to change around the stabilization. This technique was introduced to be computationally easy and can be incorporated into already existing implementations.

3. What are the steps you need to take to finish the project?

- a. Learn and create Generative Adversarial Networks model, and set up it as the baseline of our research.
- b. Construct a Self-Attention model which can work independently.
- c. Implement Self-Attention unit into GAN, and add spectral normalization layer.
- d. Compare the baseline and models which implement Attention units in different layers.
- e. Analyse the results.

4. What are your plans for each week?

The plan for each week is to first read the different publications on GAN, Self-Attention Mechanism, and Spectral Normalization. We will spend the first 2 weeks setting up the Generative Adversarial Network model. We will spend the 3rd week setting up the Self-Attention model. In the 4th week, we will implement the Self-Attention model into the GAN and also implement the Spectral Normalization. In the 5th week, we will analyze the results.

5. Explain what parts each member will work on

We will all work together on setting up the Generative Adversarial Network model. Justin and Louis will work on constructing the Self-Attention model while Sheng-Hung will work on the Spectral Normalization. We will all come together to implement it into one model and analyze the results.

Citations

Zhang, H., Goodfellow, I., Metaxas, D., & Odena, A. (2019, June 14). *Self-attention generative adversarial networks*. arXiv.org. Retrieved October 22, 2021, from <https://arxiv.org/abs/1805.08318>.

Vaswani, Ashish, et al. "Attention Is All You Need." *ArXiv.org*, 6 Dec. 2017, <https://arxiv.org/abs/1706.03762>.

Goodfellow, Ian, et al. "Generative adversarial nets." *Advances in neural information processing systems* 27 (2014). <https://arxiv.org/abs/1406.2661>

<https://towardsdatascience.com/building-your-own-self-attention-gans-e8c9b9fe8e51>