Human and GAN collaboration to create *haute couture* dress

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Abstract

Here we present our process to create *haute couture* dresses by a collaboration between human dress designer, Ema Rie, and generative adversarial network (GAN). When we trained the GAN with the designer's past works only, the generations by the GAN were not inspirational enough for the designer, but when we added motifs in nature, the designer was quite inspired by the generations. The resulted dresses were presented at the Tokyo Fashion Week 2019 Autumn/Winter.

1 Introduction

We created *haute couture* dresses for the Tokyo Fashion Week by a collaboration between human dress designer and GAN. We chose collaborative setting rather than AI only creation by 2 reasons. The first is that the dress is design in not only 3D, but in 4D, the designer even considers how it moves when a model with the dress walk throughout the runway, and designing in 4D is too difficult for current GANs. The second reason is that we believe seeking possible collaboration between human and AI is important for our future.

2 Materials and Methods

First, we collected photographs of dresses from designer's past works. In total, approximate 500 photographs were used to train GAN. Wasserstein GAN with gradient penalty [1] was used because of its stability in learning. Images of dress were generated by trained GAN from 96 different seeds, and presented to the designer. The designer successfully created 6 dresses from GAN's outputs, but was not inspired enough. For GAN, the biggest limitation was the total number of training data. To overcome this limitation, we decided to add a motif in nature, spiral sea shells, because motifs in nature have been always the designer's source of inspiration, and there were commonality in shape with the designer's dresses in past. We photographed about 1000 spiral sea shells at the Rikuzentakata City Museum, Iwate, Japan, which has one of the largest sea shell collections. Together with designer's past works, the photographs were fed to GAN without labeling whether it is a dress or

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Figure 1: Images generated by GAN (most left) and dresses created based on GAN's output.

a sea shell. This time, GAN's outputs have more diversity while maintaining the designer's style. Some of the outputs inspired the designer, and 5 dresses were created (Figure 1).

3 Results

Using this process, we created 11 *haute couture* dresses in total. Six were created from Ema's past creations only, and 5 were based on the combination of past creations and spiral sea shells. The dresses were presented at the Tokyo Fashion Week 2019 Autumn/Winter, on March 20, 2019. The show was broadcasted by the organizer as `https://www.youtube.com/watch?v=QPpTlV_Lm6c`.

4 Discussion and Conclusion

Throughout this process, we found an interesting fact. If a designer is highly creative, total number of creations in her/his lifetime is too small to be learned by AI. In the *haute couture* dress field, number of dresses created by a designer a year is quite limited. To overcome this limitation in the size of training data, we borrowed a motif from nature, and resulted more inspirational generation by GAN. Since a dress is 3D object and even movement is considered in its design, current generative neural network is not sufficient to design entire process. However, in collaborative setting, GAN is able to learn the designer's past works and generate a seed of inspiration with the style of the designer. We think collaboration between human and AI might be a key to ensure the ethicalness of the final output of creation.

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References

[1] Ishaan Gulrajani, Faruk Ahmed, Martin Arjovsky, Vincent Dumoulin, & Aaron C Courville. (2017) Improved training of wasserstein gans. *In Advances in Neural Information Processing Systems*, pp. 5767—5777.