Week 3

1. Keep reading the book of Reinforcement Learning: An Introduction by Sutton. I have finished two chapters.
2. Finish the homework of Machine Learning class.
3. I have read a paper intensively "Evolving Mario Levels in the Latent Space of a Deep Convolutional Generative Adversarial Network" and read a paper roughly "Generating Diverse Opponents with Multiobjective Evolution".

Evolving Mario Levels in the Latent Space of a Deep Convolutional Generative Adversarial Network

[1] Outline the value of this article: This paper had won the best paper of GECCO 2018 and reported by Nature, so we can judge this is a good paper worth reading. Many researchers are engaged into training an AI agent to play game well, this paper shows us that the AI agent can also generate game levels. The authors use GAN network designing evolving Mario levels and latent variable evolution to increase difficulty.

Firstly, how to make the game recognized by computers? We use Video Game Level Corpus(VGLC) to generate the whole system. Because many games are made up of pixels, so we can divide every frame into many pixel blocks. And then we use some symbols like a/b/c to represent each different block.

Secondly, it's the GAN part. We have two input data, one is some real game samples and the other one is network generated samples, discriminator compare the last one with the first one to judge whether it is fake or real. The train method is WGAN algorithm. And in the end we can get many real levels generated by this generative adversarial network.

Finally, this paper uses CMA-ES and latent vector method to evolve the trained generator in order to generate more and more difficult levels.

The problem or the disadvantage of this paper is that the author did not set any restrict in the whole process, so the GAN generate some unrealistic elements.

There are many improvements I can do. On the one hand, in this paper, the author combine the goal and time these two goals as a single optimization function, I can add some new optimization goal and compose a multi-objective problem. On the other hand, the original GAN uses only level itself to fight and use a separate simulation to play, I want to redesign the network to achieve a fight between the level and agent playing. It is easy to recurrent or do some new work because The author had made their code public.

References

[1] Vanessa Volz, Jacob Schrum, Jialin Liu, Simon M Lucas, Adam Smith, and Sebastian Risi. Evolving mario levels in the latent space of a deep convolutional generative adversarial network. In *Proceedings of the Genetic and Evolutionary Computation Conference*, pages 221–228. ACM, 2018.