A Survey of Deep Reinforcement Learning in Video Games

Submitted by Neelu Verma(MP19AI002)

Contribution: This is a review paper in which authors review achievements of deep reinforcement learning methods in video games, survey the progress of DRL methods and introduced different new methods and their application.
This paper shows that DRL plays an important role in game in AI and also shows the progress of these methods,including policy gradient, value-based, and model-based algorithms, and compare their main techniques and properties.
The main contributions include the comprehensive and their techniques, properties, detailed comparisons of various DRL methods, and the impressive and diverse performances in video games.

Novalites: This apprach is novel in sense that with the development of DRL(DL+RL) , agents are able to play various games end-to-end.
There are several methods in Deep learning like CNN,RNN,LSTM but DRL includes Deep Learning(DL) method with parallel distributed computing resources and reinforcement learning(RL) gives **state-of-the-art** performance. These DRL methods, include value-based methods, policy gradient methods, and model-based methods.
These methods used to deal with some problem of game AI for example the state space problem solved using large-scale state space with deep neural networks method,the difficulties of learning proper policies to make decisions in dynamic unknown environment is solved using supervised learning and reinforcement learning, the problem of transfering the AI's ability among different games is solved using taking decisions in high-dimensional state space in an end-to-end framework, and improves the generalization and scalability of traditional RL algorithms dramatically.

Implementation Details:

challenges of DRL in video games, such as trade-off between exploitation and exploration, dilemma in generalization and overfiting, low sample efficiency, muti-agent learning, incomplete information and delayed sparse rewards can be solved by some new technique for example Demonstration is a proper technique to improve sample efficiency improves by **Demonstration,** in the training process **Parametric noise and randomized value functions** can help exploration to a large extend, combining exploration with deep neural networks can help to learn much faster, **communication protocols** i.e Reinforced Inter-Agent Learning (RIAL) and Differentiable Inter-Agent Learning (DIAL) use DRL is important to share information to solve end-to-end multi-agent tasks.

Analysis: This paper is a detailed analysis which shows that in addition to above achievements, there are still some major problems when applying DRL methods to this field, especially when we talk about 3D imperfect information multi-agent video game. So author suggest that A high-level game AI requires to explore more robust and efficient DRL techniques, and suggest that in complex environment it needs a novel frameworks to be implemented which can be researched in future.