Title	Supervised and Reinforcement Learning for Fighting Game AIs using Deep Convolutional Neural Network [課題研究報告書]
Author(s)	Nguyen, Duc Tang Tri
Citation	
Issue Date	2017-03
Type	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/14205
Rights	
Description	Supervisor:池田　心，情報科学研究科，修士

Abstract

AI has become important for human life since its application can help human in problem-solving. Imaging a world, when workers in dangerous environment are replaced by Robot, oldsters are taken care by automated and comfortable services, self-driving cars reduce the number of accidents etc. That wonderful world is a big dream but not impossible. Step by step, human improve AI and achieve many positive signals.

One of the early successes of human is creating AI that can defeat human player in some simple games. This success is meaningful because from the beginning of mankind history, game has been selected as a testbed of intelligence. For example in Japan, strong board game players are respected as intelligent people, about tens percent people may think "Habu Yoshiharu" is one of the most intelligent men in Japan. Furthermore, game is simple and easy to understand. In game, rules are clearly defined so we can evaluate human player or AI easily by matches. Therefore, when an AI can defeat human player, even in a very simple game, we can confirm this AI is quite "smart".

In 2016, Google has acquired DeepMind and tried to attack the hardest problem in board games: the Game of Go. Finally, an AI named AlphaGo was created based on Deep Q-network, self-playing method which allowed AlphaGo to improve itself, and Monte Carlo tree search. This powerful AI, which combined two cores of AI for games: tree search and machine learning, defeated human champion Lee Sedol in March 2016, opens a new era for Deep Learning.

Deep Learning has become most popular research topic because of its ability to learn from a huge amount of data. In recent research such as Atari 2600 games, they show that Deep Convolutional Neural Network (Deep CNN) can learn abstract information from pixel 2D data. After that, in VizDoom, we can also see the effect of pixel 3D data in learning to play games. But in all the cases above, the games are perfect-information games, and these images are available. For imperfect-information games, we do not have such bit-map and moreover, if we want to optimize our model by using only important features, then will Deep CNN still work?

In this report, a method has been described to successfully incorporate Deep CNN with optimized non-visual information. We investigated the allocation of features are important and valuable for improving its performance. By intentionally arranging features as an 2D grid, with some duplication of features and well-considered allocation, Deep CNN achieves 54.24% accuracy when predicting the next moves of AIs in the experiment. Meanwhile, the normal neural network can only reach 25.38% accuracy. With the promising result, we can expect Deep CNN to be applied in even more type of problems where visual or similar information is not available.

The network structure above was used as a policy of our agent in Fighting ICE environment. Thereby, our agent could get an average point 200 in matches against the AI champion of 2015. By applying reinforcement learning method to improve this policy, our agent could get an average point 250-300. By modifying the design of reward function, we increased the point to 350-400. This result was not enough to defeat the AI champion

of 2015 ,since an agent can win when achieving 500 points, but it helped us have more knowledge about delay-reward in reinforcement learning.