Automatic Play Gaming With Deep Learning

Miguel Antonio Rodriguez Delgado
Electronic Engineering
Hamm-Lippstadt University of Applied Sciences
Dortmund, Germany
miguel-antonio.rodriguez-delgado@stud.hshl.de

Abstract—Deep learning techniques are growing in all fields, and game playing in not an exception. With this paper we review how different deep learning methods to understand how the can be used in gaming environments. Along this paper we will show how deep learning can be applied for a real world example, focusing in the development of the well known Tic-tac-toe game. We also share the results of the comparison using deep learning techniques against coding the the same game in a classical way.

Index Terms—Deep learning, Automatic Play Gaming, Tic-tac-toe, Minimax, Neural-networks.

I. INTRODUCTION

Video games industry is becoming an important part on people's life, not only by offering entertainment, but also by offering sense of belonging and interconnecting people [1]. Reports of the Entertainment Software Association (ESA) on 2020 showed that nowadays, and boosted by the corona-virus lockdown not only young males, but also women, adults and even retired people is attracted by this industry [1].

Deep learning algorithms and Artificial Intelligence (AI) have been used in may fields, including the video game industry since 1971, starting with Computer Space and Pong on the Atari 2600 [2].

Artificial Intelligence is defined the study of "Intelligent Agents", as any device that can perceive its environment and based on it attempt to take actions to succeed in a goal by maximizing its chances of success [3]. Machine learning and deep learning algorithms are the tools used to generate these so called intelligent agents [3].

II. ARTIFICIAL INTELLIGENCE ON GAMES

As described on I, AI has been present in games since the earlies seventies, [6]. However, in the 1957 a team at Carnegie Mellon University predicted that in 1967 a computer would have been capable of defeating a chess world champion [4], but they did not anticipate the hight complexity to predict the correct order of movements required for this task. But at the end of the decade of seventies, a computer defeated for the first time a world champion level chess player [5].

In the same way, Artificial Intelligence has been used to defeat humans in other games, such as Mahjong and Go [6]. These kind of games required a lot of computation and learning algorithm, but they have the possibility to take the time to perform all the necessary calculations. But more advance games, such as Sony's Gran Turismo, have an increased difficulty to master the correct algorithm to drive a race car since many decisions have to be made in real time [6].

III. RACING GAMES

Gran Turismo, a racing simulation video game, made its debut in 1997 and has sold over 80 million units. According to Sony, it took about 20 PlayStations running simultaneously during 12 days to train Sophy, the Gran Turismo artificial intelligence

IV. DRAWBACKS

The introduction of artificial intelligence and deep learning algorithms do not only offer advantages in the different fields that we have talk about in the previous sections, but it also brings different risks. Since the focus of study of this paper is gaming, an example on how AI can represent a risk in the development of a chess software that can identify unique styles of playing and it is able to point out with no previous information, who it is playing with, what represent a serious privacy risk [9].

V. CASE OF STUDY - TIC-TACK-TOE

Neural networks, genetic programming, computer vision, heuristic search, knowledge representation and reasoning, Bayes networks, planning, and language understanding are each revealed through the growing capabilities of these agents.

REFERENCES

[1] Lugris, M. (2020, July 25). New ESA Report Shows Gaming Is No Longer A Niche Market. TheGamer. https://www.thegamer.com/esa-gaming-niche-popular-die-mad-gamers/
[2] Skinner, G., & Walmsley, T. (2019, February). Artificial intelligence and deep learning in video games a brief review. In 2019 IEEE 4th International Conference on Computer and Communication Systems (ICCCS) (pp. 404-408). IEEE.
[3] Ongsulee, P. (2017, November). Artificial intelligence, machine learning and deep learning. In 2017 15th international conference on ICT and knowledge engineering (ICT&KE) (pp. 1-6). IEEE.
[4] A. Newell and H. Simon, "Heuristic Problem-Solving: The Next Advance in Operation Research," Operations Research, Vol. 6, No. 6, 1958.
[5] Hapgood, Fred. "Computer chess bad-human chess worse". New Scientist. pp. 827–830. (23–30 December 1982) Retrieved 22 January 2015.
[6] Mukherjee, S. (2022, February 9). Sony's new AI beats humans in Gran Turismo racing game. Reuters. https://www.reuters.com/technology/sonys-new-ai-beats-humans-gran-turismo-racing-game-2022-02-09/
[7] Hutter, F., Kotthoff, L., & Vanschoren, J. (2019). Automated machine learning: methods, systems, challenges (p. 219). Springer Nature.
[8] Stadelmann, T., Amirian, M., Arabaci, I., Arnold, M., Duivesteijn, G. F., Elezi, I., & Tuggener, L. (2018, September). Deep learning in the wild. In IAPR Workshop on Artificial Neural Networks in Pattern Recognition (pp. 17-38). Springer, Cham.
[9] Hutson, M. (2022). Artificial intelligence unmasks anonymous chess players. Science, 129, 129.