Competitive Deep Reinforcement Learning over a Pokémon Battling Simulator

David Simões
Institute of Electronics and Informatics Engineering of Aveiro
University of Aveiro
Aveiro, Portugal
david.simoes@ua.pt

Simão Reis
Artificial Intelligence and Computer Science Laboratory
University of Porto
Porto, Portugal
simao.reis@outlook.pt

Nuno Lau
Institute of Electronics and Informatics Engineering of Aveiro
University of Aveiro
Aveiro, Portugal
nunolau@ua.pt

Luís Paulo Reis
Artificial Intelligence and Computer Science Laboratory
University of Porto
Porto, Portugal
lpreis@fe.up.pt

***Abstract*—Pokémon is one of the most popular video games in the world, and recent interest has appeared in Pokémon battling as a testbed for AI challenges. This is due to Pokémon battling showing interesting properties which contrast with current AI challenges over other video games. To this end, we implement a Pokémon Battle Environment, which preserves many of the core elements of Pokémon battling, and allows researchers to test isolated learning objectives. Our approach focuses on type advantage in Pokémon battles and on the advantages of delayed rewards through switching, which is considered core strategies for any Pokémon battle. As a competitive multi-agent environment, it has a partially-observable, high-dimensional, and continuous state-space, adheres to the Gym *de facto* standard reinforcement learning interface, and is performance-oriented, achieving thousands of interactions per second in commodity hardware. We determine whether deep competitive reinforcement learning algorithms, WPLθ and GIGAθ, can learn successful policies in this environment. Both converge to rational and effective strategies, and GIGAθ shows faster convergence, obtaining a 100% win-rate in a disadvantageous test scenario.**

***Index Terms*—Deep Learning, Reinforcement Learning, Competitive Games, Multi-Agent Systems**

each one adding new mechanics to the Pokémon battles, but with unchanged core mechanics and goals. Some of the most notable changes of more recent Pokémon generations are the addition of passive abilities, held items that trigger under a certain game condition, restructuring of damage calculation or even the addition of new Pokémon types among others.

Games have been used as test-beds for artificial intelligence algorithms because they provide a controlled environment with widely different sets of rules and levels of complexity. They allow researchers to demonstrate properties of their algorithms in single-agent environments [24] (where a single agent competes to successfully finish the game) and in multi-agent systems (where a team of agents must coordinate to achieve a goal [27], [30], [29], or a group of enemies must compete for supremacy [32], [11], [26]). Pokémon battling falls under the latter category, a competitive 1v1 environment, where each agent (or trainer) controls a Pokémon, turn by turn, to attempt to defeat the enemy.