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B.Sc. IT (Hons.)
Artificial Intelligence

Comparative Performance Analysis of AI Algorithms in Competitive Pokémon Showdown Battles

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INTRODUCTION

This study delves into artificial intelligence's (AI) role in games featuring randomness and imperfect information, contrasting with deterministic games like Chess[1] and Go[2]. Our focus is Pokémon, the world's highest-grossing franchise[3][4], with over 70 games since its 1995 inception, yielding over $90 billion revenue.

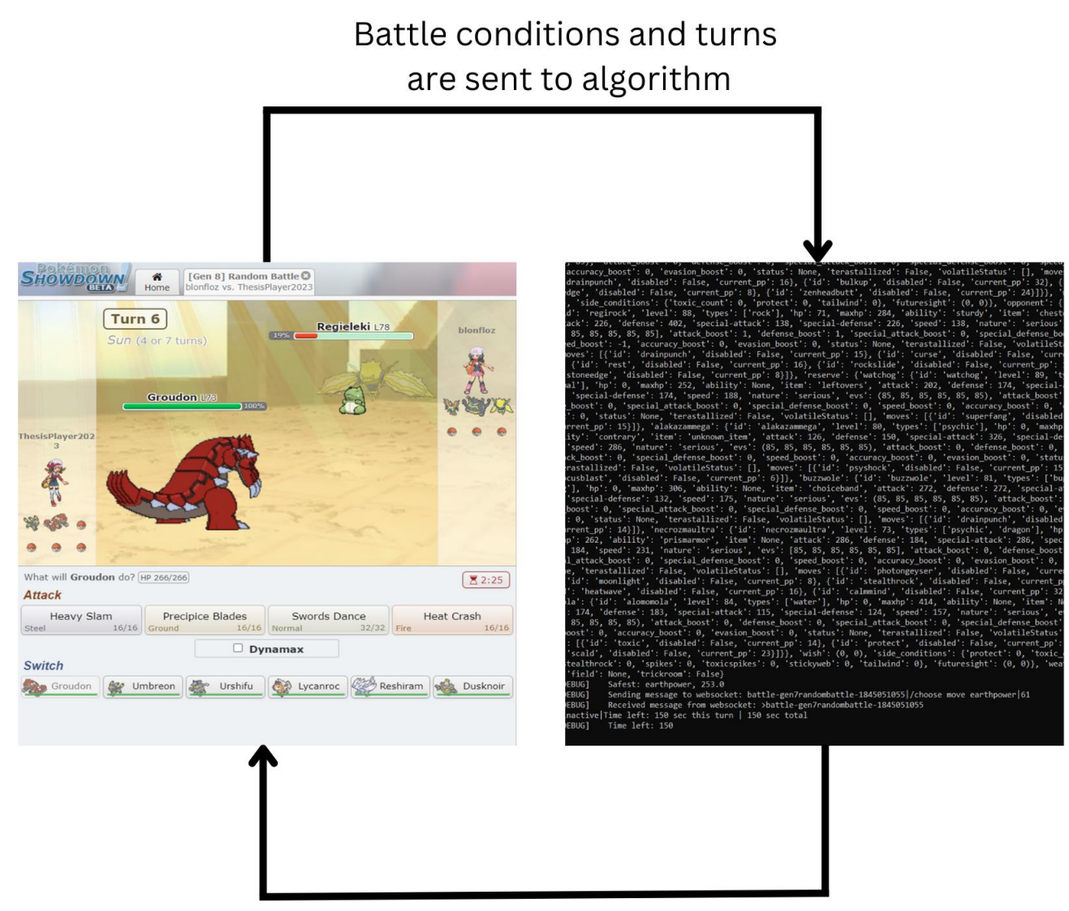
The research primarily targets the franchise's core series, emphasising competitive single battles. We aim to develop astute AI agents capable of efficiently competing in Pokémon battles, an intricate blend of randomness and imperfect information.

AIM

The ultimate goal of the project was to contribute to the ongoing conversation around AI in gaming, highlighting the potential of sophisticated algorithms in games that incorporate both strategic decision-making and elements of chance. Through meticulous observation and rigorous analysis, we aspired to draw meaningful conclusions that could guide future research and contribute to the development of even more competitive and adaptable AI for Pokémon Showdown and similar gaming environments.

By comparing these varied approaches to AI, the project aimed to shed light on the trade-offs and balances in complexity, adaptability, and performance in the fascinating arena of artificial intelligence in gaming.

ARCHITECTURE DESIGN



METHODOLOGY

Each algorithm has an account assigned to them in order to track their results and Elo rating.

Using WebSocket APIs, the algorithm in use connects to the Pokémon Showdown platform and participates in 100 battles.

After each battle the Elo rating difference is noted down in order to collect data.,

After each algorithm participates in 100 battles, the results are compared to determine which algorithm performs best in this environment.

RESULTS

Our project examined AI bots in 100 Pokémon Showdown battles each. A search algorithm bot, Minimax, performed well, but struggled against high Elo opponents and with the game's Dynamax mechanic, despite implementing measures to manage this complexity. A reinforcement learning bot, Q-Learning, had difficulty adapting to the complexity of the game and learning from past experiences.

Two simpler bots were also tested. One made random moves and another always chose the move with the highest base damage, both achieving lower Elo ratings. Surprisingly, the high-damage bot had some success, illustrating the potential effectiveness of deterministic strategies within Pokémon battles.

Overall, search algorithms, specifically Minimax, performed better in high-level Pokémon gameplay than reinforcement learning algorithms, such as Q-Learning. These findings provide valuable insights for the application of AI in competitive and complex gaming environments.

CONCLUSIONS AND FUTURE WORK

In our final year project, we explored AI in Pokémon Showdown battles, focusing on Minimax and Q-Learning AI bots, benchmarked against simpler algorithms. Using Pokémon Showdown's matchmaking system, we assessed performance through Elo ratings and percentiles. The Minimax bot outperformed its Q-Learning counterpart, demonstrating superior game comprehension. However, the Q-Learning bot struggled with the game's unpredictability and vast state space. Our findings pave the way for future research, suggesting enhancements to the Minimax algorithm, exploration of hybrid approaches, and investigation of techniques like Monte Carlo Tree Search. Despite challenges, our study contributes to ongoing AI advancements in Pokémon battles.

REFERENCES

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