Interim Report

G53IDS

Project Title: Applying Evolutionary Algorithms to Pokémon Team Building

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1 Introduction

- Talk about aims and objectives
- Overall goal with the project
- Major steps to be taken
- Some of this can be adapted from the project proposal

2 Motivation

- Talk about other AI game playing and how they approach it
- Mention how these approaches assume things like pregame decisions
- Detail the problem
- Again some can be adapted from the project proposal

3 Related Work

- Discuss the Hearthstone deck building GA
- Investigate more works to talk about here (gaming and more general)

Many AI approaches to games tackle the aspect of playing the matches and the decision making process to choose the best action. Lots of research and development has happened in these areas with many effective techniques being discovered. One key reason the problem of prematch decision making hasn't been tackled is due to the lack of need for it with classical table top games ranging from Tic-Tac-Toe to Chess to Go requiring no preparation before the match begins.

As the field of AI game playing moves forward into more complex games these prematch decisions will need to be considered. As currently it would be rather simple to build and train an AI to play turn based strategy games, such as collectable card games or in this case Pokémon, but the deck/team building would require an expert to decide what the AI will be trained to use. This is often problematic as season rotation could add in new elements to the game or make certain elements no longer useable, or shifts in the metagame will mean that the AI is easily countered.

Team building is a form of optimisation problem as you are trying to bring the optimal team to the match so you have the best chance of winning. A variety of work has been conducted looking at optimisation via AI techniques, in particular I looked into techniques that tackled having a large, vast search space and where the correctness of a solution was hard to judge. Both of these issues were things that I saw as issues that I would have to tackle to solve the team building problem.

García-Sánchez et al. approached a very similar problem using a genetic algorithm, the problem in question was deck building[1]. The example they used was a popular collectable card game, Hearthstone, and they tried to create a viable deck through the genetic algorithm. This is of particular interest as several parts of their study directly relate to what I am trying to achieve, as well as several short comings that I would have to take into account.

An evolutionary algorithm was used as 'they commonly produce very effective combinations of elements', which a deck can be described as a combination of cards. This also allowed for competitive decks to be built

from scratch with no expert knowledge required. This was done by encoding the individuals as a vector of cards, in this case the 30 element vector became the deck.

In the deck building process it was possible to have a deck that would violate the rules of the game. To discourage the EA from creating decks that violate these rules a correctness metric was taking into account when calculating the fitness of each individual. If an individual was incorrect it wasn't evaluated further in the fitness calculation process and given the worse possible score.

4 Description of the Work

- Detail the output specifically
- Discuss building this solution from scratch (besides using relevant APIs outside of the main project), why this is beneficial
- Talk about both the EA and MA and how they will be linked

5 Methodology

5.1 Object Orientated Design and Python

- Easy adaptation
- Conversation from GA to MA
- Commonly used, lots of APIs

5.2 Evolutionary Algorithms

- Choice of GA and MA
- Why this over other AI techniques like ANN and Local Search

5.3 Software Engineering Tools

- Git
- Latex
- Atom
- Unit Tests
- How these tools work together and help with project management and speed up work

6 Design

- Genetic Algorithm
- High level Representation Explanation

7 Implementation

- Language and Platform choices
- Separation of settings
- Low level Representation Explanation
- Validation methods (if made by then)
- Use of the benchmark example

8 Progress

8.1 Project Management

- Discuss bringing Interim Report work forward
- Adding in of a benchmark function to test the GA Structure
- Review of individual tasks and how long they took
- Revised work plan, including changes to current progress and any prospective changes

8.2 Contributions and Reflections

- Difficulties due to unpredicted work loads in other areas
- How moving forward aspects and adding additional tasks helped and hindered
- Current achievements in the project
- Personal Reflections

9 Appendix

References

[1] Pablo García-Sánchez, Alberto Tonda, Giovanni Squillero, Antonio Mora, and Juan J Merelo. Evolutionary deckbuilding in hearthstone. In *Computational Intelligence and Games (CIG), 2016 IEEE Conference on*, pages 1–8. IEEE, 2016.

[2] Griffin McElroy. Becoming the very best: The pokemon world championships. `https://www.polygon.com/2013/7/20/4539528/becoming-the-very-best-the-pokemon-world-championships`, July 2013.