Enhancing Hearthstone deck building with a Generative Adversarial Network (GAN)

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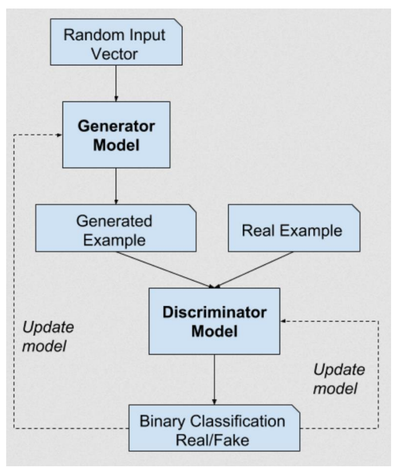
Introduction

The rising popularity of Hearthstone has attracted many new players to the card game, reaching over 100 million account in 2018 and climbing [1]. Because of the competitive nature of the game, players seek to obtain the highest rank possible: Legend. To achieve this rank, skilfully playing is not enough, the player must also build a deck with the most efficient cards, providing them the tools for success. Building such decks is a difficult process, players tend to copy decks off each other in hopes to increase their chances to win. This creates clusters of specific decks that are considered the "meta", meaning that these decks give the greater chances to achieve Legend rank. However there is no real way to know if there is a better version hidden behind these "meta" decks.

Project Aim

The aim of this project is to find alternative deck solutions to the staple ones, using an Artificial Intelligence fed by players decks to created a similar deck to the player built deck whilst respecting Hearthstone's game rules. Similarity is a major factor, AI the generated should resemble a user created deck.

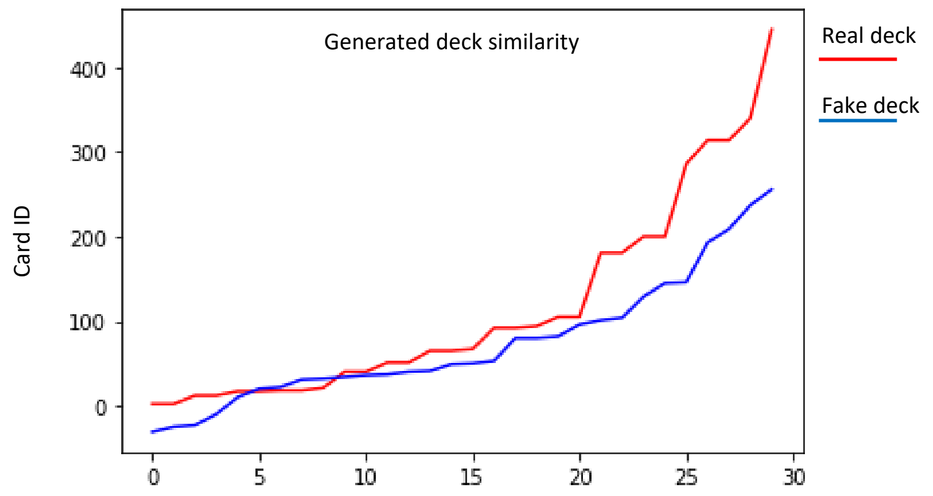
Methods

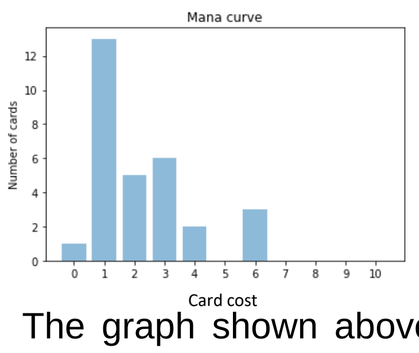


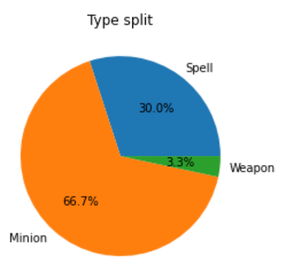
(Brownlee, 2021)

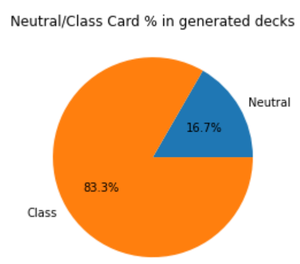
The Artificial Intelligence was implemented using a Generative Adversarial Network (GAN) which uses a generator to created random decks and then compares then with actual decks in the discriminator. The model is then updated based off the results of the discriminator.

Figures and Results



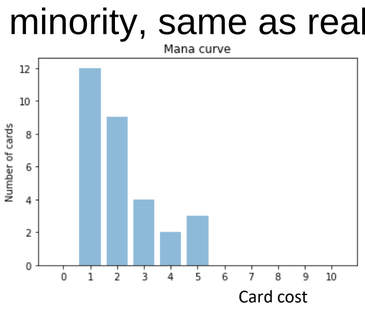


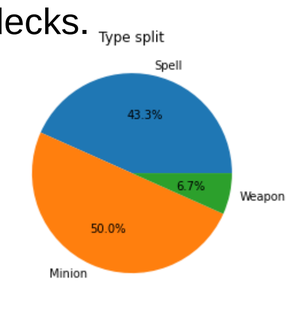


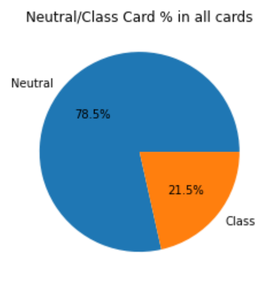


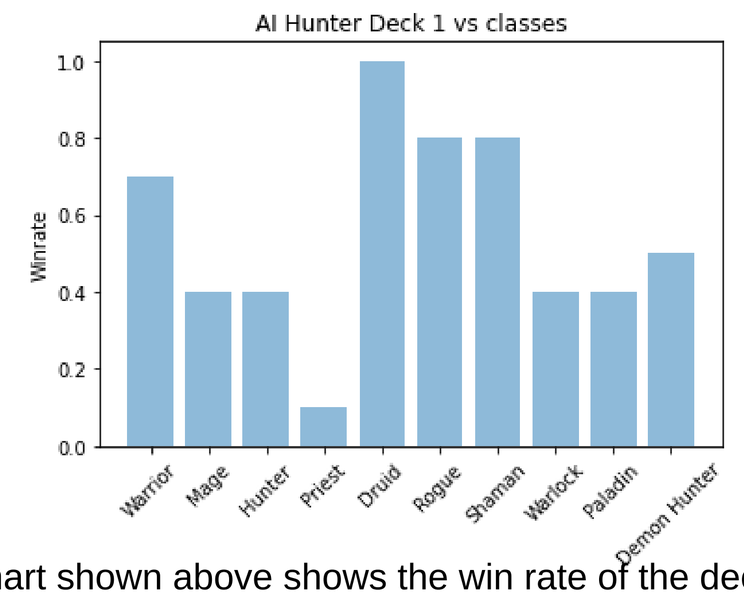
The graph shown above have been produced by the GAN, the deck created is that of the Hunter class, and after 10000 epochs of training the resulting similarity is close. By paying close attention there are similar patterns that form throughout the graph.

The figures above show the spread of the cards within the generated deck whereas the ones underneath show the spread within a real deck of the same class. The GAN was particularly successful in generating a believable deck, with the mana cost and type split proving so. Hearthstone's card collection has a majority of neutral cards (insert numbers), despite that the neutral percentage within decks is in the minority, same as real decks.



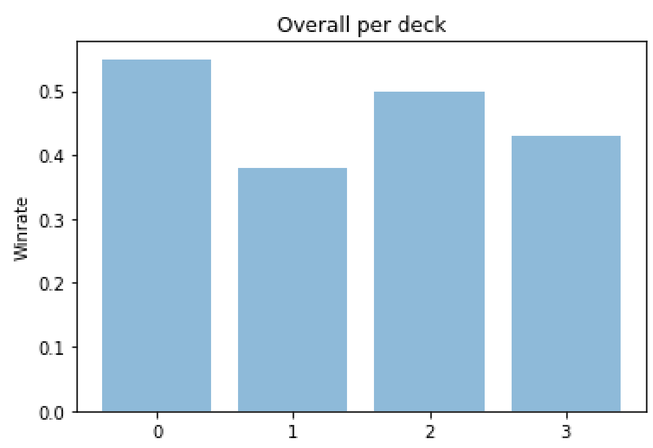






The chart shown above shows the win rate of the deck versus each class over 100 games. As expected the deck performs differently per class, Priest for example has a lot of board control, so for a cheap minion heavy Hunter deck that is a bad matchup, whereas against a spell heavy expensive Druid deck it has more success.

Conclusion



This project successfully proved that Generative Adversarial Networks can be used to build hearthstone decks which has never been done before. The decks created have attempted synergies, similar type spread and different enough from other decks in the dataset. The graph above shows the win rate of the AI's results, the deck that would have been suggested to the user would be the first one at 55% win rate, which is considered a strong deck in the Hearthstone community.

Further work could be by testing the created decks with a smarter game simulator to get more accurate results.

Acknowledgments

I would like to thank, in particular, my project supervisor Mark Bartlett, whose weekly meetings and wisdom were essential in giving me direction for this big project, the Hearthpwn team for giving me permission to collect and use their data, allowing me to complete the project, HearthSim for their simulator to run tests, all of the RGU lecturers who went beyond expectations in their support during this course despite these difficult times.

References

1) B. Entertainment, "Celebrating 100 million players!" 2018, [Accessed: 28/03/21]. [Online]. Available: https://playhearthstone.com/en-us/news/22636890

2) Brownlee, J., 2021. *A Gentle Introduction to Generative Adversarial Networks (GANs)*. [online] Machine Learning Mastery. Available at: https://machinelearningmastery.com/what-are-generative-adversarial-networks-gans/ [Accessed 29 March 2021].

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