

# Developing Strategies for the Bidding Card Game 'Diamonds' with GenAI

DIYA ANEM

26 March 2024

## 1 Introduction

The advent of generative artificial intelligence (GenAI) has opened up new frontiers in various domains, including game strategy development. GenAI models, trained on vast amounts of data, possess the ability to learn and reason in ways that can potentially surpass human capabilities. In this report, we explore the process of leveraging GenAI to develop strategies for the bidding card game "Diamonds."

## 2 Problem Statement

"Diamonds" is a bidding card game that requires players to strategically bid and acquire sets of cards with the highest possible diamond values. The game's complexity lies in the intricate interplay between the bidding process, card distributions, and opponent strategies. Developing effective strategies for "Diamonds" can be a daunting task, as it requires considering a multitude of factors, including card probabilities, bid valuations, and opponent behavior.

## 3 Teaching GenAI the Game

The first step in developing strategies with GenAI is to ensure that the model comprehends the game's rules and mechanics. This process involves providing the GenAI with a comprehensive rulebook and supplementing it with examples of gameplay scenarios. Additionally, it is crucial to clarify any ambiguities or edge cases to ensure that the model has a thorough understanding of the game dynamics.

One approach to teaching GenAI the game is through interactive gameplay sessions. By engaging the model in simulated games and providing feedback on its decisions, we can reinforce its understanding and allow it to refine its strategies iteratively.

## 4 Iterating upon Strategy

Once the GenAI has a solid grasp of the game, the next phase involves iterating upon strategy development. This process can be divided into several steps:

### 4.1 Initial Strategy Generation

The GenAI model can be prompted to propose initial strategies based on its understanding of the game rules and principles of strategic decision-making.

### 4.2 Simulation and Evaluation

The proposed strategies can then be evaluated through simulated games against various opponent strategies, including those employed by experienced human players. This step allows for the identification of strengths, weaknesses, and potential areas for improvement in the GenAI's strategies.

### 4.3 Strategy Refinement

Based on the evaluation results, the GenAI can be prompted to refine its strategies, taking into account the observed patterns, opponent behavior, and game outcomes. This iterative process of strategy generation, evaluation, and refinement can be repeated multiple times until a satisfactory level of performance is achieved.

### 4.4 Incorporating Human Expertise

To further enhance the strategy development process, input from experienced "Diamonds" players can be solicited and incorporated into the GenAI's training data. This collaboration between human expertise and GenAI capabilities can lead to the development of more nuanced and robust strategies.

## 5 Analysis and Conclusion

The process of developing strategies for "Diamonds" with GenAI presents several advantages and challenges. On the advantages side, GenAI models possess the ability to process and analyze vast amounts of data, allowing for the consideration of numerous factors and scenarios that might be challenging for humans to comprehend. Additionally, GenAI can quickly iterate and refine strategies based on simulated gameplay and feedback, potentially leading to the discovery of novel and effective approaches.

However, there are also challenges to consider. Firstly, ensuring that the GenAI model has a comprehensive understanding of the game rules and mechanics is crucial. Any misunderstandings or gaps in knowledge can lead to flawed strategy development. Secondly, the quality of the strategies generated

by GenAI is heavily dependent on the quality and diversity of the training data and simulated gameplay scenarios provided.

Despite these challenges, the potential benefits of leveraging GenAI for strategy development in games like "Diamonds" are significant. By combining the strengths of GenAI models with human expertise and iterative refinement, it is possible to develop strategies that push the boundaries of what is achievable through traditional human analysis alone.

In conclusion, the process of developing strategies for the bidding card game "Diamonds" with GenAI offers an exciting opportunity to explore the synergy between artificial intelligence and human expertise in the realm of game strategy development. While challenges exist, the potential rewards of uncovering novel and effective strategies make this endeavor a promising avenue for further exploration and research.