AI in Developing Game Strategies

Developing Strategies for the Bidding Card Game "Diamonds" with GenAI

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Abstract

In this modern era of genAI, we can leverage the power of AI to perform almost any task. This report explores the process of obtaining game strategies from AI by first training it with game rules, some previously played games and its outcomes. The game being played here in the cards game of "Diamonds".

1 Introduction

In the realm of card games, "Diamonds" stands out as a strategic and engaging bidding game that challenges players' decision-making abilities. The game involves bidding, collecting diamonds, and executing tactics to accumulate wealth. In this report, we explore the development of strategies for playing "Diamonds" with the assistance of artificial intelligence, specifically GenAI. By teaching GenAI the intricacies of the game and iterating upon its strategies, we aim to enhance our understanding of optimal gameplay and potentially discover novel tactics.

2 Problem Statement

The primary challenge in "Diamonds" lies in formulating effective bidding and gameplay strategies to maximize diamond collection while minimizing risks. Traditional approaches to strategy development often rely on human expertise and intuition. However, leveraging AI introduces the possibility of exploring vast decision spaces and uncovering optimal strategies that may elude human players. The objective is to teach GenAI the rules and nuances of "Diamonds" and enable it to autonomously develop and refine strategies through iterative learning.

3 Training Phase

The first step in harnessing GenAI's potential for "Diamonds" strategy development is to familiarize it with the game's rules and mechanics. This involves providing GenAI with a comprehensive understanding of the game's objectives, bidding process, diamond collection mechanisms, and scoring rules. By encoding this knowledge into its algorithm, GenAI can simulate and analyze various gameplay scenarios to make informed decisions.

Furthermore, training GenAI involves exposing it to a diverse range of gameplay situations through reinforcement learning or supervised learning techniques. By presenting GenAI with sample

games and their outcomes, it can learn from experience and gradually improve its decision-making abilities. Additionally, providing feedback on its performance allows GenAI to refine its strategies over time.

4 Iterating Upon Strategy

Once GenAI has grasped the fundamentals of "Diamonds," the iterative process of strategy development begins. GenAI explores different bidding strategies, weighing the risks and rewards associated with each bid. It adapts its approach based on the evolving game state, opponent actions, and its own assessment of the optimal path to victory.

In the process of obtaining the code attached below, genAI explored 2 main strategies for choosing the next card: first being the simple top of the deck strategy that simply plays the next card without any computation. The second strategy is a progressive strategy that aims to strike a balance between conserving strong cards for key rounds and strategically using lower-value cards in others. Here is a description of the strategy given by genAI:

Early Rounds (Rounds 1-3)

During the initial rounds, players tend to adopt a conservative approach. The key points of the strategy for these rounds are as follows:

- Players prefer to play cards of *moderate value* to assess the competition level without risking their high-value cards prematurely.
- The strategy involves selecting a card *close to the middle* of the player's hand. This tactic aims to preserve both high and low-value cards for strategic use in later rounds.

Mid Rounds (Rounds 4-7)

As the game progresses, the strategy adapts based on the player's current standing in the game:

- If trailing, players might start using *higher-value cards* to secure rounds. Conversely, if leading by a significant margin, the strategy might lean towards playing *lower-value cards* to maintain the advantage.
- The choice of card shifts towards the *higher end* of the remaining cards in the player's hand, incorporating variability to remain adaptable.

Late Rounds (Rounds 8-10)

The final rounds are crucial, and the strategy is highly dependent on the player's position and assessment of opponents' potential cards:

- Players will likely play their *strongest or weakest cards*, aiming to maximize their chances of winning more rounds and, consequently, more diamonds.

- The decision to play the strongest or weakest card is influenced by the player's need to win the current round or save cards for potential tie-breaker situations or subsequent rounds.

Overall, this strategy seeks to optimize the player's chances of winning rounds throughout the game by adapting to the current state of play and balancing risk and reward appropriately. By automatically selecting cards based on this strategy, players aim to accumulate diamonds strategically over the course of the game, ultimately leading to victory.

Few other strategies suggested were Aggressive Early Play, Conservative Play, Adaptive Play, Bluffing Strategy, Pattern Recognition and Risk Management.Each strategy presents a unique way to navigate the game, offering a variety of approaches depending on the player's preference for risk, observation of opponents, and adaptability to changing game dynamics.

Through continuous iteration and experimentation, GenAI fine-tunes its strategies, discarding less effective approaches and emphasizing those that yield better results. This iterative process may involve analyzing historical gameplay data, conducting simulated matches against human or AI opponents, and incorporating insights from strategic analysis.

5 Analysis and Conclusion

The analysis of GenAI's performance in "Diamonds" reveals intriguing insights into optimal bidding and gameplay strategies. GenAI demonstrates a remarkable ability to adapt to varying game conditions and exploit opportunities for diamond accumulation. Its decision-making process, rooted in statistical analysis and predictive modeling, often leads to strategic choices that outmaneuver human opponents.

Furthermore, the collaboration between human players and GenAI opens avenues for collaborative strategy development. Human insights into the game's nuances, coupled with GenAI's analytical prowess, create a synergy that pushes the boundaries of strategic exploration in "Diamonds."

In conclusion, developing strategies for the bidding card game "Diamonds" with GenAI showcases the potential of artificial intelligence to enhance gameplay experiences and deepen our understanding of strategic decision-making. By leveraging AI-driven approaches, players can unlock new levels of complexity and sophistication in their pursuit of victory. As technology continues to advance, the intersection of AI and traditional games like "Diamonds" promises an exciting frontier for strategic innovation.

6 Links

Link to transcript: GenAI Transcript
Link to code: Colab Link