

Project Proposal

Team Members:

1. Anway Shirgaonkar
2. Neeraj Sahasrabudhe

Problem Statement:

This project aims to develop an AI (Artificial Intelligence) agent that can efficiently play the trick-taking multi-player card game called ***Mendikot***. The AI agent will act as one or more players in the game and try and win the game by making strategic decisions based on the predefined rules. Mendikot is played in teams of 2. Here we will try to incorporate both the co-operative and competitive AI agents, namely, an AI agent would play with another AI agent as a teammate (co-operation) or as the opponent (competition).

Game Description:

The game of *Mendikot* can be played amongst an even number of players starting from 4. Players form a team of 2 and sit in a circle. The players in a team sit opposite each other.

1) Objective:

Every player strategically plays a card (MAX or MIN) once in a “trick” that can increase their team’s chances of winning the game. A team aims to win the maximum number of tricks.

2) Dealing:

The dealer shuffles the deck and deals the entire deck of cards equally among the players.

3) Playing the Game:

- The player sitting next to the dealer in the circle starts the game by playing a card. The term playing a card means to lay one of the cards dealt to you in front of all the players. This is the start of a “trick”
- The suite of the first card played in a trick is the leading suite, and all the players are required to play cards from the leading suite only.
- Each player plays one card each and the card with the highest face value wins the trick.
- The trump suit is selected at random the first time a player does not have a leading suite card in their hand. This trump suit remains constant for the entire duration of game. (13 tricks for 4 players)
- Any card from the trump suit has a higher weightage over other cards from other suits.

- If a player neither has a card in the trump or the leading suite, he is forced to play any card present in his hand. This card holds no weight, and the trump suite/leading suite always wins

Winning:

The game ends when all the cards in hand are played. The team with the highest number of 10s (present in the tricks) wins the game.

Proposed Work:

We plan on implementing an AI agent that will efficiently play the game of *Mendikot*. While implementing and testing our algorithms we plan on using two approaches. Later, we plan on zeroing down on an approach that proves to be more logical and presentable. Two approaches:

- a) 2 AI agents would form a team and would compete against humans. (2 agents, 2 humans). The input for the human team would be taken from the command prompt or GUI.
- b) 4 AI agents would simulate a game of *Mendikot*. The game will be simulated multiple times, and the selected actions will be used for analysis. The analysis will provide a metric for evaluating our work.

Algorithms:

We plan on exploring various approaches and algorithms to solve the problem. If an approach seems redundant and time-consuming, we plan on sticking with the approach that seems more logical and convenient.

Following are the 3 approaches we plan on implementing:

1) Heuristic-Based AI:

Pros: Simplicity and interpretability

Cons: Limited adaptability and might struggle in more complex scenarios.

2) Monte Carlo Tree Search (MCTS):

Pros: Adaptive and can handle complex decision trees.

Cons: Requires computational resources; might not be necessary for simpler games.

3) Reinforcement Learning (RL):

Pros: Can learn optimal strategies from experience; adaptable to various scenarios.

Cons: Requires significant computational resources and training time.

Results:

The goal is to pair the AI agent with a human/another AI agent to play the game of Mendikot. The results of our project will include

- CLI (Command Line Interface) on which humans can play the game against the AI agent.
- For the reinforcement learning approach, we will include the plots for the learning curves, average performance of the agent over many games and any metrics that quantify the agent's performance.
- An empirical study which compares the performance of AI agents trained to play Mendikot using three approaches mentioned above.
- While our aim is to develop AI agents with the algorithms mentioned above, it is possible that all of them do not work. In this case, we will boil down the approach only to one or two algorithms and explain analytically why other algorithms are not feasible/workable.

Project Timeline:

Week	Work
1	Defining the problem and setting up the Mendikot environment in Python which contains the interface to setup and play the game manually.
2	Exploring the 3 mentioned approaches. Theoretically determining the best approach moving ahead.
3	Implementing a basic multi-player reward-maximizing card game using the designed Environment
4	Setting up the transition function incorporating all the required rules of <i>Mendikot</i>
5	Implementation of Algorithms
6	Implementation of Algorithms
7	Implementation of Algorithms
8	Testing the results using appropriate testing strategies. Capturing important comparison metrics.
9	Presentation and Demonstration Prep