

CE811: Assignment 2

Game Artificial Intelligence

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ABSTRACT

Hanabi's a card game where two or more players or a team can showcase their cards to other without looking at their own card and plan to make a set of firework cards or try to get the winning combination for their own by taking the assistance of other player and by trying to deal with flaw data given by the player so to overcome that we have work on distinct strategies by building rule base so we get the best possible solution and we have done this by genetic algorithm and by doing that we will gain knowledge and make a successful decision with the defined rules.

INTRODUCTION

Hanabi is a mutual understanding game where at least a minimum of 2 players or a maximum of 5 people can play and should be on the same table. The deck contains 5 different color cards (White, Red, Blue, yellow, and Green) the game is having 8 obtainable tokens with 3 fuse tokens at the start of the game only players are given 5 cards before starting the game every single player have to reveal their own card to the other player who has more number of their own cards after the game is commenced and can give clues to other and when your deck turn arrives you can do 3 things which are played, discard or you can give information to other players at the start of the game there will be eight clocks on the desk because each and every player can give clue to other to make his

move. But, there will be a certain rule to follow while giving clues thus clues can be color or number on the card and can only reveal one thing at a time, and once the token which has been kept in the desk is empty. You are not permitted to give any hints, so you have to reject the card to get another different token. when you discard, you will not get that card again if you want to win so it's a gamble to throw away the important card or you will get mismatched cards and not get another chance to continue the game.

HANABI

Firstly, we know that Hanabi is a game where a maximum of 5 and a minimum of 2 players are playing together and each player will get 4 cards beginning of the game. Each card will have a different rank and color every time when the player gets it to turn he can do 3 things give hint or discard or play the card.



Figure: - 1

The following rules and proceeding we can play are: -

Hints:- When the player's turn comes, the player is able to give hints to another fellow player but he will have certain restrictions where he can only give him the suggestion about the color or rank of the card, as stated in the introduction.

Discard:-When playing the game if the token is not available for the player then the player can't give any kind of hint to another player unless he is willing to discard one card from his hand and the disadvantage of that is the player will not get that card again.

Plays:- When the player's turn comes he can play the deck and it is only possible if the card is next to sequence only to the color played.

Game over:-When the team collects five pairs of cards means three playings will be losing the game. Otherwise, if any one player takes the final card left from the deck from every other player that has picked from their last turn. This way there are a lot of ways for the team members to cooperate and under the players to win the game.

- **Communication Between Players:-**

Giving hints that the other player can understand and also receiving hints from them and understanding them is very necessary to plan a strategy with your team and win the game.

- **Important Information: -**

It's important to know and recognize the information of the players who have some sequence of color and number

- **Play cards in order: -**

Playing the right color and the number beginning of the game will be beneficial to win

- **Number order:-**

Tracking the player's card number, which has been taken, which has been played, and when and which is being placed in the game is necessary.

- **Order and information on throw-away cards: -**

It's important to keep track of all the thrown-away cards to see the player's next move.

- **Right order at right time: -**

Keep changing the methods and ways as the game continues to get the new information to win.

- **Practice:-**

Hanabi game depends on two players understanding and playing together to give hints each can understand. If the game is played enough time to understand each other's hints, then practice do make it perfect.

These are the general rules, methods, and strategy for playing hr game Hanabi.

BACKGROUND/TECHNIQUE IMPLEMENTED

The game can be played with a certain set of rules defined, a few rules implement a different set of actions, and executing each rule in a set of scenarios will bring out the best score in winning games. This can be achieved by many methods either by MCTS, Machine Learning, or Genetic algorithm.

Genetic Algorithm as the name suggests is a genetic process where a random chromosome is defined and the score is taken to improve the chromosomes to get the best score after the game ends up winning

What is Genetic Algorithm?

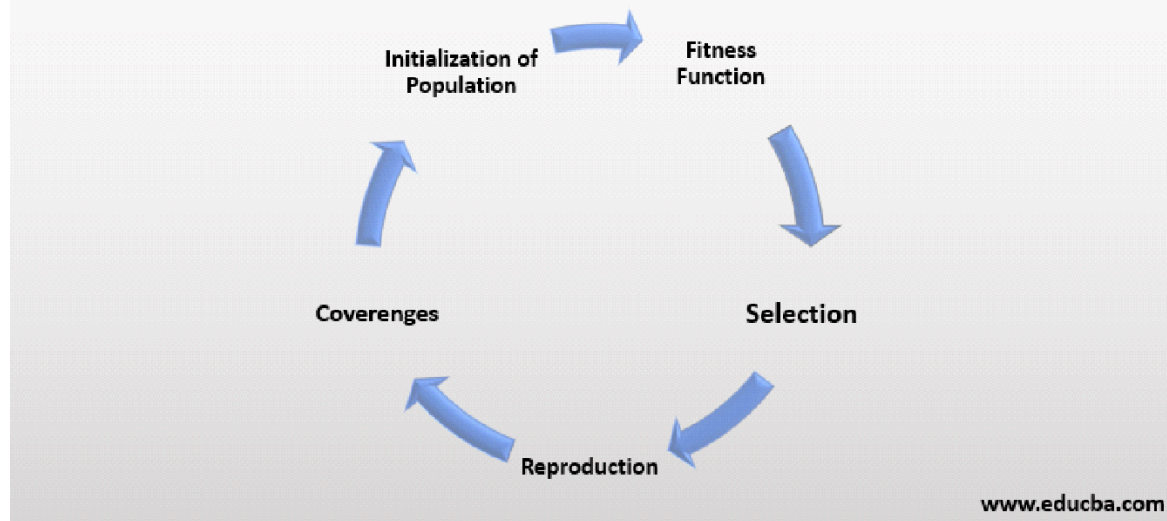


Figure: - 2
The life cycle of the Genetic Algorithm

The steps involved in Genetic Algorithm are: -

- Population
- Fitness Calculation
- Parent Selection
- Child Selection
- Mating Crossover method
- Offspring

Population: - Population is a set of an array of random good and bad chromosomes defines as an initial weight to implement the algorithm

Fitness Calculation: - Fitness for every chromosome generated randomly is calculated by playing the game and getting the score

Parent Selection: - Parent chromosomes are selected from the highest scores of the random population fitness

Child Selection: - Child chromosomes are the ones with the low population fitness score

Mating Crossover method: - Here the crossover of high score and good score chromosomes takes place to give the next chromosomes a better chance

Offspring: - The final chromosomes generated after crossover is used as input chromosomes for the game to get the fitness score again and the whole process repeats for n number of iteration until satisfactory chromosomes and score is obtained.

EXPERIMENTAL STUDY

When implemented the genetic algorithm the number of chromosomes, the number of iterations, and the number of weights were manually experimented with to get the good result, but as usual manual trial and error don't give the best result that is where machine learning comes where an average regression can be implemented for the generated chromosomes from genetic algorithm to determine the best parameters for the best score chromosomes. The experiment was not completed due to the complexity and the need for additional time to implement it successfully.

ANALYSIS

The manual selection of the number of chromosomes, number of iterations, and the number of weights resulted in an average above 15/16 agent score with the chromosomes generated by the genetic algorithm

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The Generation is:- 3
[[0 2 5 3 6]
 [0 2 5 3 6]
 [0 2 5 3 6]
 [0 2 5 3 5]]
The Generation is:- 4
[[0 2 5 3 6]
 [0 2 5 3 6]
 [0 2 5 3 6]
 [0 2 5 3 6]]
The Final Chromosome from GENETIC ALGORITHM IS :- [0 2 5 3 6] With Score:- 16

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Agent Tester Practice Mode. Your Hanabi agent scored an average of 15.0 points per game.

Part #	Outcome	
Class MyAgent is defined	Yes	✓
Agent Score (Practice Mode)	15.0/25	✓

Figure: - 3

CONCLUSION

The overall assignment is based on exploring the problem and developing Artificial intelligence (AI) for the collative card game where it was a challenging problem relative to the evaluation of the data till obtaining the perfect chromone and where we have to simulate it with the game so that the working of better rule-based baseline and implementation of more and more rules and parameters for smoothening the genetic algorithm will result in better agent score generation and after going through research journal and publication and personally having a hands-on implementation of the algorithm, I have concluded that, even though genetic algorithm generated good results, it is not always the good option as there are better ways to select the parameters like we manually did in genetic algorithm, rather we could perhaps try to implement a machine learning model to improve the agent score as it can go to a certain extent but it is good to go with deep learning methods if possible.

REFERENCE

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