**CE811: Assignment 2**

**Game Artificial Intelligence**

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**ABSTRACT**

Hanabi is a collaborative card game where two or more players or a team can showcase their card to other without looking at their own card and plan to make set of fire work card 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 best possible solution and we have done this by genetic algorithm and by doing that we have gain knowledge and make a successful decision with rule baseline .

**INTRODUCTION**

Hanabi is one of the mutual understanding games where minimum of 2 player or at maximum of 5 people can play on the same table. The deck contains 5 different colour card (White, Red, Blue, yellow, Green) the game is having 8 obtainable token with 3 fuse token at the starting of the game only player are given 5 card before starting the game every single player have to revel their own card to the other player with having excess to their own cards after the game Is started and can reveal through clues to other and when your deck turn arrives you can do 3 thing which is play, discard or you can give information to other player at the start of the game there will be eight clock on the desk because each and every player can give clue to other to make his move. But, there will be certain rule to follow while giving clue thus clue can be colour or number on the card and can only reveal one thing at a time and ones the token which has been kept in the desk is empty. You are not permitted to give any hints so, for that you have to dispose of the card to get the token. when you discard, you will not get that card again if you want to win so its gamble to throw away the important card or you will get mismatching cards and not get other chance to continue the game.

**HANABI**

As we know that the hanabi is the game where maximum of 5 and minimum of 2 player are played together and each player will get 4 card at the start of the game. Each card will have different rank and colour every time when the player get it 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 turn come, the player is able to give hint to other fellow player but he will have certain restriction where he can only give him the suggestion about the colour or rank of card, as stated in the introduction.

**Discard**:-When playing the game if the token is not available for the player then the player cant give any kind of hint to other 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 turn comes he can play the deck and it is only possible if the card is next to sequence only to the colour played.

**Game over**:-The game will end when the game goes through different scenario, one way is if team is able to collect all the five stacks card with 3 player lost the game or if any one draw the last card from the deck where every player has already taken his last turn.

Thus as there are lot of fundamental strategies that team member can use to collabrative method, understanding with other player to win the game.

* **Communication effectively** :-

Telling and taking hints is crucial in Hanabi, so it's important to develop a clear and efficient communication strategy with your fellow players

* **Prioritize information: -**

It's necessary to focus on the most important information first. For example, if a player already has a 4 of a certain color,

* **Play cards in order: -**

It's important to play cards in the correct order as soon as possible to avoid.

* **Be mindfully of number**:-

Try to make a track of card played or got taken down from the game and play carefully when placing the card.

* **Keep the track of throw away card: -**

So that you will have information of what card are there in the game to play and what move to make.

* **Be flexible and use to the situation: -**

So we can change the strategy as game progress and new information get available

* **Practise:-**

More you play more will you be able to understand about what are the things we have to do and what move we have to play.

Thus, this are all the general guideline and some of the best strategy on certain situation

**BACKGROUND/TECHNIQUE IMPLEMENTED**

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

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



**Figure: - 2**

**Life cycle of Genetic Algorithm**

Steps invlolved in Genetic Algorithm are: -

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

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

**Fitness Calculation: -** Fitness for every chromosomes 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 cross over 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 a input chromosomes for the game to get the fitness score again and the whole process repeats for n number of iteration untill satificatory chromosomes and score is obtained.

**EXPREMENTAL STUDY**

When implemented the genetic algorithm the number of chromosomes, number of iteration, the number of weights were manually experimented to get the good result, but as usuall manual trial and error doesn't give a 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 complexity and need additional time to implement it successfully.

**ANALYSIS**

The manual selection of the number of chromosomes, number of iteration, the number of weights resulted in Average of above 15/16 agent score with the chromosomes generated by the genetic algorithm





**Figure: - 3**

**CONCLUSION**

The overall assignment is based on explore the problem and developing Artificial intelligence (AI) for the collative card game where it was a challenging problem relative to evaluation of the data till obtaining the perfect chromone and where we have to simulated it with the game so that the working of better rule-based baseline and implementation of more and more rules and parameters for smoothining the genetic algorithm will result in better agent score generation and after going through research journal and publication and personally having hands on implementation of the algorithm, I have concluded that, even though genetic algorithm generated a 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 certain extent but it is good to go with deep learning methods if possible.

**REFERENCE**

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