RESEARCH ARTICLE

Artificial Intelligence Driven Judgment Card Game

Pranay Parmar[1], Chirag Rathod[2], Romal Thakkar[3], Rashmi Chawla[4]

Department of Information Technology, MCT's Rajiv Gandhi Institute of Technology, University of
Mumbai, Mumbai, Maharashtra, India

[1] pranayparmar101@gmail.com; [2] chiragcool119@gmail.com; [3] romal_rockz@hotmail.com;
[4] rashmi.chawla.be@gmail.com

Abstract— Since the last decade there has been a large amount of research into artificial intelligence driven computer based card games. The interest in this field is primarily due to the fact that creating an artificial intelligence for these card games is very challenging. The main focus here is the usage of heuristics to find the good cards in the least possible time. But there is another important aspect with respect to heuristics. Heuristics can be implemented to give these card games a human feeling when the user plays the game. In this paper, we examine a pure strategy based, non-deterministic, artificial intelligence driven card game known as Judgment. Judgment is a trick-taking card game where you have to aim to make the number of hands that you had predicted at the start of every round. A trump card is chosen prior to the game which can ace any other card. It is a multiplayer four person card game that is easy to play. This card game offers various research challenges that are not seen in common artificial intelligence test beds.

Keywords— Artificial Intelligence, Heuristic, Non-Deterministic, Card Game-Play, Non-Player Character

I. INTRODUCTION

In the Judgment card game one has to judge how many hands can be won based only on the cards provided to them. Once a judgment is made, the player has to try and win as many hands as he had judged prior to the round. A trump card is chosen prior to the game which can ace any other card. If a player achieves his goal, he gets points respective to the number of hands he won. The player wins if he has the most number of points at the end of all the rounds.

Most current techniques for General card Game Playing involve finding heuristics for evaluating the value of the game state after making a possible next move. A heuristic is a method which helps in solving a problem. It is a technique that often rapidly provides a solution that is usually close to the best possible solution if not the exact. Heuristics are nothing but educated guesses, spontaneous judgments or simply common sense providing better computational performance at the cost of exactness. A popular method for finding these heuristics is to use machine learning. However, we decided to avoid this as it can often be very difficult to understand the reasoning of the player's decisions at game time.

The game will require high end Artificial Intelligence programming and will need moderate levels of computer graphics. Game Artificial intelligence provides techniques to produce the illusion of intelligence in the

behaviour of non-player characters (NPCs). The emphasis of game artificial intelligence is on developing rational agents to match or exceed human performance.

II. LITERATURE SURVEY

We have analysed a variety of research papers as well as existing systems providing detailed information like randomness, card game language, design of the user-interface, random card generator and distributor and various game play algorithms. We have drawn the following conclusions

- Card Game Language (CGL) is a language that can be used for compiling card games which make use of a standard 52-card deck. Thus it will allow one to easily transform card games to a digital form rather than using languages such as Java or C.
- Card generation and distribution should not only be random but also the protocol used for shuffling the deck should be low in latency and computational costs.
- The user-interface should be simple and easy to understand. It should include a tutorial as well as appropriate methods to display the score at any point of time.
- Behaviour of the non-player characters should be similar to a human as much as possible. Various levels of difficulty can also be introduced to make the game play more challenging.
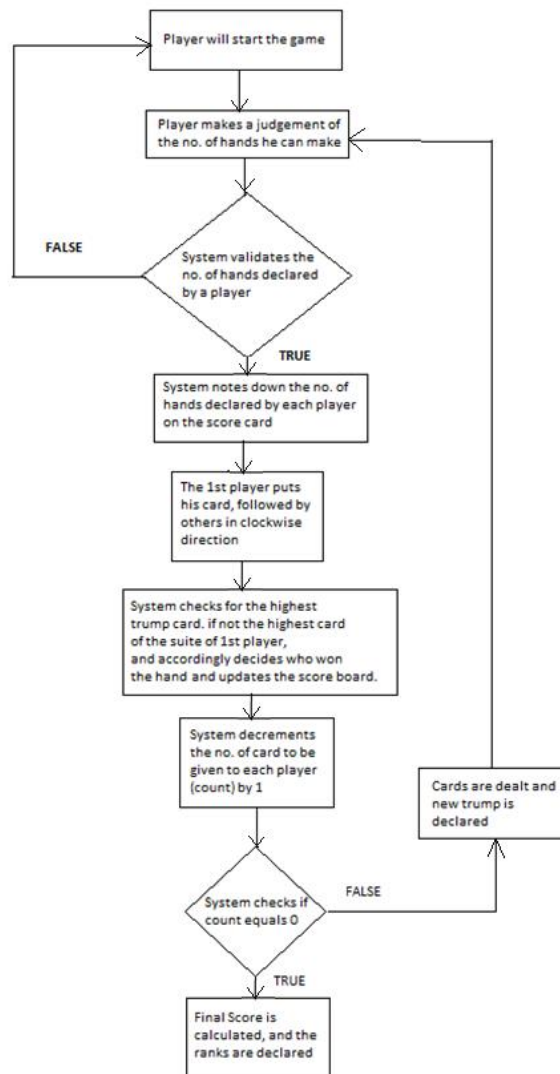

Fig. 1 Basic flow-chart of judgment card game

III. EXISTING SYSTEMS

Presently, this system does not exist. But, systems with intersecting logic do exist. Their names are Internet Spades and Hearts. These systems have some similar modules, but also have some pitfalls which are not present in the proposed system.

If we consider the game of Hearts, its basic purpose is to collect the least number of cards of the suite-hearts. The similarity in the two systems is that the shuffling module is needed for random card generator. Also, one has to judge what cards are left and what cards the opponents may play and then play accordingly.

The pitfalls of this system compared to the proposed systems are that the player is not allowed to choose the number of opponents and also, it is not as challenging to play since there is no limit or target for the number of hands a player must make, to win.

The game of Internet spades also overcomes these pitfalls and hence helps us in understanding how they can be overcome. In this game, one has to judge the number of hands one can make, and then try to achieve that target. But the pitfalls are that the game has only team mode. This is a fault since one does not always have multiple people to play with, simultaneously. Also, one cannot select the number of opponents to play with. Along with the fact that one plays in teams, making the game easier, it only has one round, that is, the number of cards remain the same every time, the player plays. Moreover, the trump card is always spades, whereas in the proposed system, the trump card changes in each round.

IV. PROPOSED SYSTEM

To predict the actions of the opponent, we examine a minimal-score playing strategy for the opponent, namely, the opponent always chooses the strategy that will minimize the situation score of the player among all possible strategies.
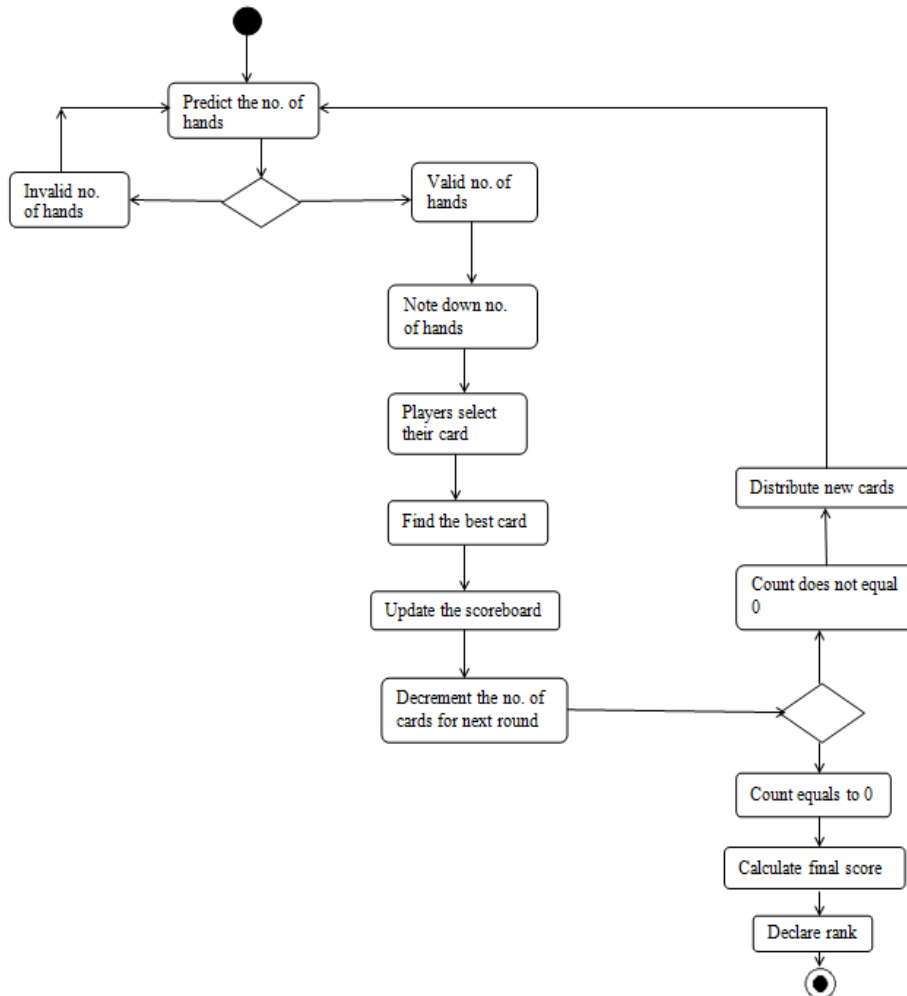

Fig. 1 Activity Diagram

The system can comprise of the following modules. The first module can comprise of random card-generator and card-distributor. This is required so that in each round, random cards are given, avoiding repetition of

patterns and also to control the number of cards given in each round, since we need to keep reducing the number of cards distributed in each round.

The second module can be for judging. This will require a deeper understanding into the logic one uses to judge the number of hands one can win. This is an essential module of the system since the game-play module completely depends on the working of this module. It does not require any code related to computer graphics. Also, the decision will be affected by the suite of the current trump card and also the number of cards being distributed in that particular round.

The third module can be for the entire game-play, that is, reading the trump card, the current cards played, seeing the number of cards kept out of the round, and then selecting which card to be played at each turn. This will require the inputs from the judging module, a record of cards that have been played, and also a complete understanding of the logic used to select the card so that it seems that an experienced human user has made that decision. The final module needed can keep track of the scores of all the rounds and also to calculate the total score so that a winner can be declared.

V. CONCLUSION

We have studied and examined artificial intelligence driven judgment card game. Although Judgment was introduced several years ago, it has never been fully investigated or analyzed. We expect this paper will grab the attention of a much wider body of AI researchers and that it will inspire others to study this fascinating game.

In the future, we will be completing the algorithms for the judging and Game Play. After which, the coding of all modules will be done. This will be followed by the integration of all modules, and implementation of the User Interface. This will be followed by verification, Quality Assurance, testing, final refinement and deployment. If feasible, we will also be implementing multiplayer Game Play mode over LAN.

REFERENCES

[1]   Ronald D Fricker Jr., "A look at randomness in Microsoft windows solitaire or using electronic games of chance for statistics projects", NPS Education, Volume 20, November 20, 1998

[2]   Kevin Henrick, Ryan Jones, Mark Micchelli and Hebo Yang, Card Game Language (CGL), Columbia University

[3]   Muxin Wang, Liangfei Zhu , "Designing and implementing an online card game based on Android 2D graphics" IEEE (ICALIP), pp. 817–821, July 2014

[4]   L.F. Teofilo, L.P. Reis, and H. Lopes Cardoso, "Computing card probabilities in Texas Hold'em," Information Systems and Technologies (CISTI), Iberian Conference, August 2013, pp. 1-6B.

[5]   Arneson, R. B. Hayward, and P. Henderson, "Monte Carlo tree search in Hex," IEEE Transactions on Computational Intelligence and AI in Games, vol. 2, no. 4, pp. 251–257, 2010.