PROJECT REPORT - CARROM AGENT

Team Name - Avengers

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1 Objective
Implement an agent to play the game of Carrom. The agent must demonstrate proficiency both in 1-player mode (to clear the board using a minimal number of strikes) and when playing an adversary in 2-player mode.

2 The Abstract
This report describes architecture and algorithm used to develop agent to play carrom game for single player and two player modes. It also describes the steps taken for performance optimisation. We have also listed the area of improvements which can be done.

3 Architecture of Agent
Following are the main decisions to be made by the agent while playing in both single player and double modes.

- Which coin to pocket next
- When to pocket the queen.
- Where to place the striker when the striker location (on the striker line) calculated by the agent coincides with a coin.
- Calculating force required

3.1 Calculating angle and determining position of the striker.
This has been done geometrically, as follows -
First we try to grab coin which is inline with striker and pocket, then we calculate the slope of coin with pocket and same with striker, upon doing that, we get position of striker on strikeline. If we unable to place striker on strikeline in range from (170,630) as x-coordinate, then we are placing striker at left corner of strikeline and target the intended coin with force 0.8 by calculating proper angle.

3.2 Calculating force required
The force required from various striker positions for pocketing coins in different quadrants has been hard coded in the code. The actual force has been finalised based on our observation while experimenting with the code.
Our motivation here is that, if the force is maximum, then we can pocket multiple coin in single shot, therefore we used constant force as 0.8 for all conditions.
3.3 Algo Description for single player

Description of the algorithm for agent to play carrom in single player mode.

- First we have collected all coins into the list named as coinloc
- Coins in the are ordered as follows - Queen, White Coins, Black Coins
- We considered the board as set of four quadrants
  - First quadrant is left half of the board below the stricker line.
  - Second quadrant is right half of the board below the stricker line.
  - Third quadrant is left half of the board above the stricker line.
  - Fourth quadrant is right half of the board above the stricker line
- Our strategy is to cover the queen as soon as possible, hence the queen has been placed first in the above list.
- We select the coins one by one from list; always select the first coin, and hit it into pocket in the quadrant in which selected coin lies.
- by calculating proper angle and by applying proper force.
- Continue these steps until board gets cleared.

3.4 Algo Description for two player

The logic we used for determining striker position and determining force is same as that in the single player mode (described above). The only significant changes in double player mode is in coin selection. We are adding only those coins to the list which belong to our team (either all black coins or all white coins, plus queen) and targeting to pocket the queen when two of ours coins are remaining.

Detailed description of the algorithm for agent to play two player carrom is as below.

- First we have collected our coins based on color returned by server into the list named as coinloc
- Which are ordered as follows - White Coins or Black Coins, Queen.
- We consider the board as set of four quadrants
  - First quadrant is left half of the board below the stricker line.
  - Second quadrant is right half of the board below the stricker line.
  - Third quadrant is left half of the board above the stricker line.
  - Fourth quadrant is right half of the board above the stricker line
• Our strategy to cover the queen is, cover it when we are left with two more coin of ours.

• We are picking coin one by one from list and hitting it into pocket corresponding to that of coin by calculating proper angle and by applying proper force.

• Continue these steps until our coins get cleared.

4 Performance Optimisation

Cut shots has been implemented to improve the performance of the agent as shown in image below. (source - Taken from internet).

![Image showing cut shot](image)

Figure 1: Image showing cut shot

5 Areas of Improvement

Below are the points which could have been improved.

1. As the agent always pick the first coin from the list, independently of its location on the carrom board, the agent might sometimes lose the opportunity to pick some other coins which could be pocketed more easily.
2. For single player, if queen is present on the carrom board, agent will always target the queen first. As the queen also requires a cover, the agent sometimes gets stuck pocketing the queen. Although, our observation is that, this situation does not arise very frequently.

3. While targeting a coin in two player mode, the agent does look at the coins of the opposite team along the path. Therefore it may end up pocketing coins of the opposite team.

6 Other thought process

6.1 Using Neural Network

We thought of using neural network, by passing the coin position as input and striker position, angle and force as output. As we could not figure it out how to train the model, in absence of train data. So we have not implemented it.

7 Conclusion

We got best results using geometric algorithms as presented above. We tried some other complex strategies as well.

8 References

The image presented in the report is taken from internet.