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CS4620

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Hanabi Log Analysis

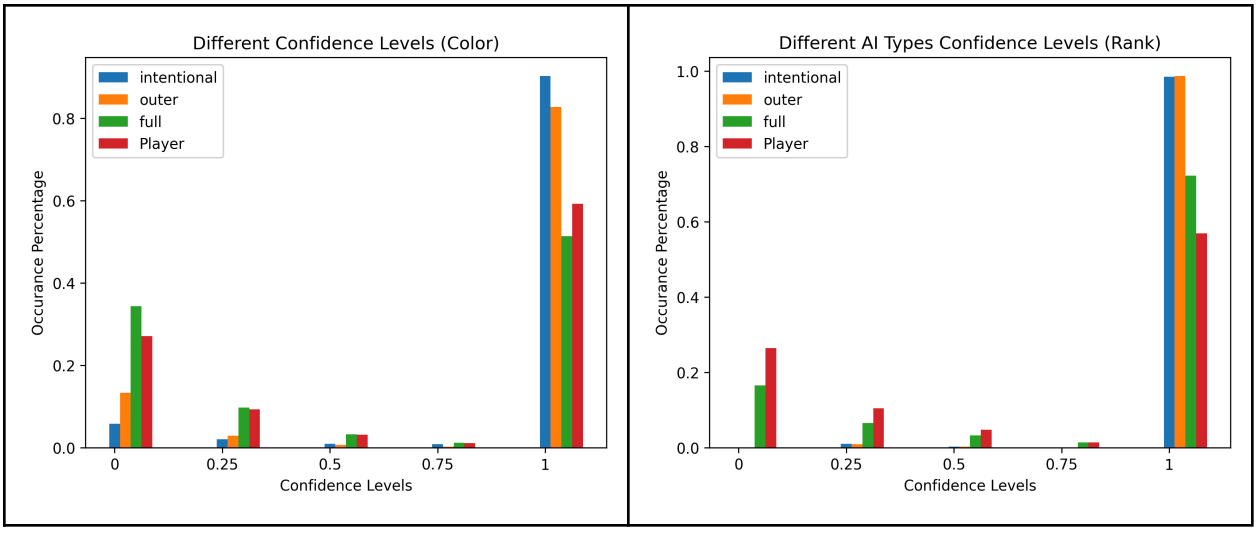
Hanabi is a two player game, where both players must work together as a team in order to succeed. The game consists of a deck of 50 cards that have a color and number on it. The colors are as follows: red, yellow, green, blue, or white. There are 10 cards for each color. These 10 cards also have the ranks 1, 1, 2, 2, 3, 3, 4, 4, 5, 5. The objective of this game is to have cards placed in number order from 1 - 5 for each color. Although this may seem simple on the surface, a player cannot look at his/her own cards, which is where the second player comes into play. Both players have the choice to play a card, discard a card, or give hints to the other players.

Both players have a total of 8 hint tokens, which can be used to help out the other player determine if a card in their hand should be played or not. Using one of these hint tokens allows a player to point out characteristics about the other player's cards , but the hints are limited to being a hint about rank, or a hint about color. Also, if a player hints the other player about either the color or rank of a card, he/she needs to point out all the cards of the other player's hand that are that rank/color. For example, a turn could be one player hinting at the location of all the other player's blue cards. After a hint, a token is discarded. However, a hint token can be gained after cards 1 - 5 are placed for a specific color.

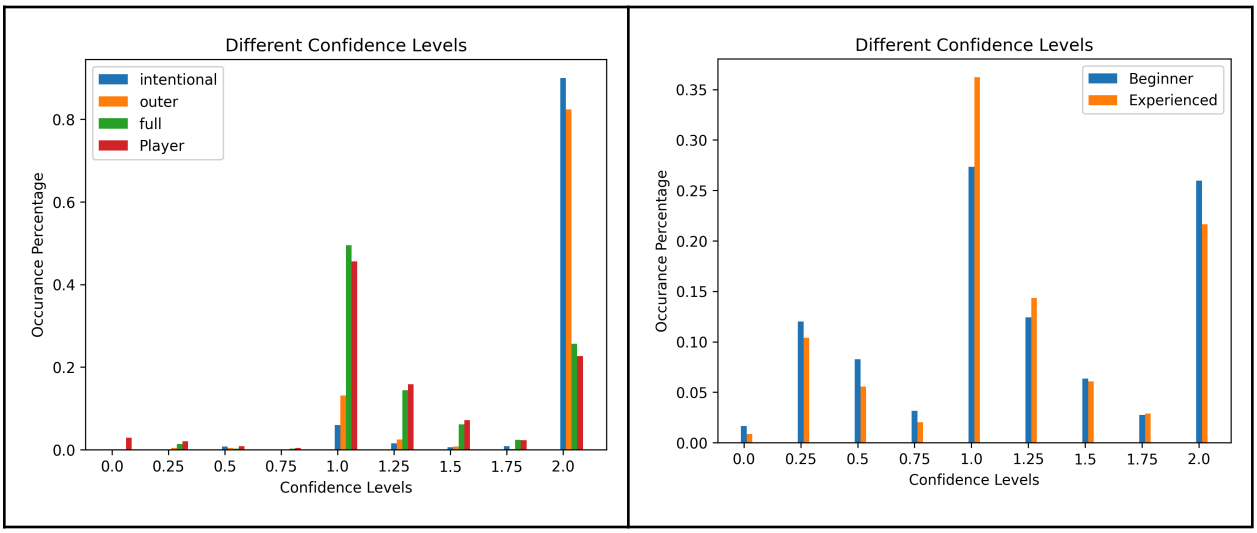
Moving forward, as mentioned before, a player obviously has the option to play a card. Before a player plays a card, it is important to keep in mind that a game will have a total of 3

“storm tokens”. If a player places down a card that is out of order for its color, for example, a blue 5 being placed down onto a blue 2, then a storm token is discarded. If all storm tokens are discarded, the game is over, and we calculate the score of the game. This is done by summing up the ranks of the last card placed for each color. If a player does not think he has a playable card, he/she can choose to discard a card, which is followed by the player drawing a card from the deck.

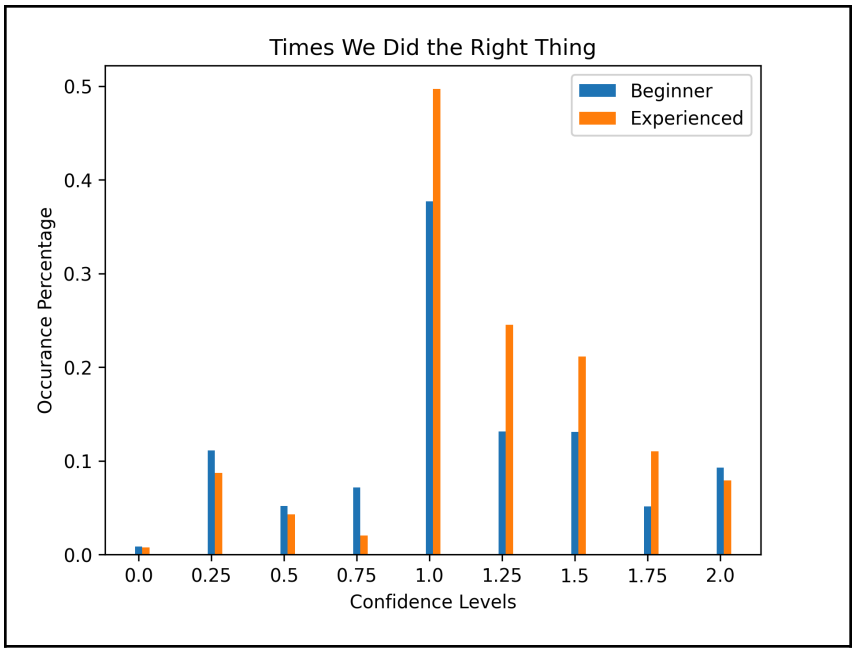
In this project, I created a program that observes the log files of games between a human player, and one of three AI types. To differentiate between these 3 AI’s playstyles, my program would produce bar graphs showcasing different information, such as how many hints, plays, or discards were performed in a game by the player and different AI’s. Another thing I checked for was what level of confidence a player had before playing a card. I made a statistic for how much we knew about the rank of a card, as well as how much we knew about the color of a card. I identified our knowledge as our “confidence level”, which scaled from 0 - 1.00; 0 means we do not know anything about the card, while 1.00 means we have eliminated 4 colors/ranks. On top of this, I also created a combined confidence level, which was the sum of our confidence level in rank and color. With that said, this confidence level scaled from 0 - 2.00.



Looking at these first two graphs reveals a few things about the AI and the player. First, the “full” AI acts the most similarly to the human player. Next, AI types outer and intentional both seem to play cards in their hand that have high confidence levels.



In these charts, we show combined confidence levels before playing a card. The player and full AI play cards they tend to know 50% about, while intentional and outer still prefer to play cards they are 100% confident in. In the second chart, we compare players that have played against an AI with the players being at a beginner level at hanabi, vs players that were experienced. Beginners tend to play cards they know 100% about out of fear that they will play a wrong card, while experienced players tend to play cards they know 50% about in order to maximize their score at the end of the game. Also, it makes sense that the statistic for playing a card a player knows nothing about is higher in beginners.



In this chart, I created a statistic for when players “did the right thing”. This means, how many times did a player play a card when he/she knew a certain amount of things about that card. For example, if a player played a card he/she knew 2.0 things about, that would give us a statistic of 100% or 1/1. However, if the player chooses to hint the AI rather than play the card he/she knew 2.0 things about that turn, he did not do the right thing, and the statistic will be lowered. For some reason, beginners along with experienced players chose to not play cards they were 100% confident in. Under some circumstance, players chose to hint the AI, or discard a card, rather than play a card they knew everything about. However, looking at the chart, we can see that players prefer to play a card at the moment they know 50% about it. Unfortunately, I did not spend much time debugging this part of my code as much as I had wanted, which might explain the stats that imply that the players were being illogical.