

Final Project Proposal

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Overview

No-limit Texas hold'em is one of the most popular versions of poker played around the world today. The game begins with every player being dealt two cards (unlike other popular variants where players are dealt 4 or 5 cards), and after several rounds of betting, the winner is the player who can make the best five card hand using the two cards that were dealt to them, and five cards that are "community" cards (via the flop, turn, and river). The game is highly strategic, as everyone's cards are hidden from each other. Unlike a game like chess, poker is not a game of perfect information (this is the primary source of uncertainty). With most of the cards on the table being hidden (all of the opponent cards), one must make the best decisions they can make under high degrees of uncertainty.

In Texas hold'em (and in general, in poker), there are two ways to win a hand: to showdown the best two hole cards, or to get every other player to fold. The last key aspect of this game is that there are several betting rounds, in which players essentially force other players to pay to play their hand. If one doesn't like their hand, they can fold, while if they like their hand, they can bet (or raise). This causes pots to build, and the winner of the hand takes down the pot. The point at the beginning of this paragraph has one distinct corollary -- in poker, a bet serves one of two purposes. To get a worse hand to call (often called "getting value"), or to get a better hand to fold (often called bluffing). Understanding when to get value versus when to bluff is extremely complicated, and while GTO (game-theory optimal) solutions exist, it is impossible to understand every spot that one may be put in (there are simply too many different combinations).

Points of Interest

In this project, I hope to primarily look into building a solver (a program that understands the best decision making) / bot for a subvariant of Texas hold'em called heads-up Texas hold'em, which is simply Texas hold'em played between two players. This subvariant has a substantially different dynamic than six (most commonly played online) or nine (most commonly played in-person) player hold'em because instead of having to beat five or eight other people, you only have to beat one other person. If you get that other person to fold, you win the hand, and vice-versa. What makes it so challenging is that unlike full-ring (six or nine player) hold'em, the range of starting cards that one can play is much wider (instead of only playing the top X% of hands where X is often less than 10-20, you can really play the top 60+% of your hands). As such, it can be much more challenging to put an opponent directly on a hand.