

BREAKING DOWN POKER AI

The new generation of AI-driven poker bots can now play as well strategically as tactically, resulting in better teaching tools and more immersive experiences for the mobile generation, as **Rob Gallo** of Neo Poker Bot explains.

Poker is an intricate, complex puzzle, steeped in statistical probabilities. A poker deck has 52 cards, so 2,598,960 five-card hands are possible. That number comes from a simple statistical formula of factorials; it is $(52 \times 51 \times 50 \times 49 \times 48) / (5 \times 4 \times 3 \times 2 \times 1)$. The most popular form being Texas Hold'Em further complicates matters, because you use the best of seven cards (133,784,560 potential combinations) to develop your five-card hand.

This makes the game not only very fun to play, but also very appealing to physicists and mathematicians as the testing grounds for Artificial Intelligence (AI) research. The AI of a poker bot is like the brain of a human player: it takes inputs from the game, processes it, and outputs a decision. While making bots that are able to play poker, scientists encounter interesting and complicated problems such as: imperfect information, enormous game tree for more than three opponents, substantial complexity with finding equilibrium strategies and possible deception from opponents.

In the beginning, AIs were extremely straightforward and with exact guidelines on how to play pre-flop, or when they should check-raise. The AI consisted of rules such as "if you have a hand with more than 90% equity, raise". These days, there are much, much more complicated AIs, which can't be expressed in such broad rules.

Enter Game Theory, a field of mathematics pioneered by John Nash, which proves that poker, like every game has an "optimal" strategy for every player. That is, there is some set of strategies (the equilibrium), one strategy for each player, such that no player can improve his expected value by switching to another strategy. In other words, these strategies are unexploitable. The bot can safely play this strategy and expect not to lose in the long run. Equilibrium strategy is however not the

most profitable and due to the game size it is best equipped to handle highly simplified situations, where players are perfectly rational. In the real world, if you want to make a winning bot in poker, you need to adjust to your opponents: these are called exploitative strategies.

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Alexander Lee is one of the world's top artificial intelligence (AI) experts. As head of technology for Neo Poker Labs, he has built bots that have decisively won in two different categories at the both the 2012 and 2013 ACPC (Annual Computer Poker Championship), held at the University of Alberta, Canada. The competition is motivated by scientific research, and there is an emphasis on ensuring that all of the results are statistically significant by running millions of hands of poker to eliminate the luck factor.

Lee explained that the most common way a bot can implement an exploitative strategy is to have several pre-computed strategies, and use some tree-search algorithm in combination with opponent models to select the strategy deemed best against the current opponent. In the case that expert rules fail to provide this estimation, the AI then employs neural networks trained on historical data. A model contains a set of parameters that are created for each opponent based on his previous actions.

Lee added that the goal of Neo Poker Lab

developing poker-playing bots is twofold. The primary purpose is to allow the player to have a fun and enjoyable experience battling poker bots in a soon-to-be-released mobile app. The secondary purpose, subordinate to the first, is to provide a poker game with reasonable and entertaining bot opponents that are beatable at various levels. The bots will tend to play strong hands, they will occasionally bluff, they won't scare easy if their hand is good, and they will abandon weak hands

when raised, and they will stick around on a reasonable chance of a flush or straight draw, making for entertaining and realistic game play. These bots are good as teachers because they play well both strategically and tactically. They are available to teach the beginner the ropes of a game, to increase the player's confidence, and provide the experienced player with a professional sparring partner. In addition, he says, it's perfect for a generation that likes to lose itself in mobile games: "If you prefer not to socialize with people or you have a few minutes to kill, you can play this game the same way you would play Candy Crush or Angry Birds."



Rob Gallo is Chairman/CEO of Neo Poker Lab Corp. Rob is considered to be one of the founding members of the online gaming industry. Prior to founding Neo Poker Lab Corp, Rob launched and managed both OmniCasino.com in 1997 and Sunpoker.com in 2001, and sold both in 2010. Additionally, Rob offers consulting services as an Internet gaming expert to both land based and online gaming companies across the globe.