Computer chess: how the ancient game revolutionised AI

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Chess-playing computers were designed to entertain people who could not find an opponent. In the end, they transformed computing as we know it

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Early origins

Chess lends itself well to computer programming. Where other games can depend more on gut instinct or physical skill, chess is a game of strict binary rules – a move is either correct or it isn't.

It's a game where multiple permutations, strategies and responses to moves and gambits could all be pre-programmed. Teaching a computer how to select the best option from those available to counter a problem, though, was the tricky part, and that's where machine learning came in.

Given the close relationship between chess, logic and programming it's no surprise that the driving forces of early computerised incarnations of chess were academics whose love of the game dovetailed with their desire to push the boundaries of the burgeoning field of computer science.

One of those academics was Alan Turing. He may have made his name breaking Nazi ciphers at Bletchley Park, but he also helped lay the early groundwork for computerised chess too. In 1947, while working at the University of Manchester, Turing developed the first simple algorithm that was capable of analysing an opponent's move one step ahead. Four years later, his academic colleague DG Prinz wrote a program that could solve particular moves, but not play a game.

Competitive games

The 1960s saw computer chess start to come into its own. In 1967, MacHack VI, a program written by MIT student Richard Greenblatt, was able to draw a game in a US Chess Federation tournament, losing four. But this was just the start and its results began to improve.

New York City hosted the first US computer championship in 1970; it was won by Chess 3.0, a program put together by a team from Northwestern University.

And in 1988, HiTech, a computer developed at Carnegie Mellon University, defeated grandmaster Arnold Denker, in a match. In the same year, another Carnegie Mellon program, Deep Thought, defeated top-notch grandmaster Bent Larsen in a tournament game.

Humans strike back

Deep Thought's defeat of Larsen was a huge moment for early AI. But this success was short-lived – the program was easily bested later that year by Garry Kasparov.

This setback prompted the team behind Deep Thought to push further and further to refine their model. In their view, Kasparov's success was simply check – but it wasn't check mate. The team's success caught the eye of US computer giant IBM, which brought them aboard as part of a dedicated chess programming group tasked with devising a way to beat Kasparov and they developed a successor to Deep Thought called Deep Blue. It incorporated a sophisticated new multiprocessing system that enabled it to consider as many as 50bn positions in three minutes, about a thousand times faster than Deep Thought's system.

Garry Kasparov takes on Deep Blue in 1997. Photograph: Sipa/Shutterstock

Kasparov vs Deep Blue

Deep Blue made its professional chess-playing debut in a six-game match with Kasparov in Philadelphia in

February 1996. A bumper $500,000 prize and IBM covering the match on its website – the web was still in its infancy back then – helped draw huge media attention.

Deep Blue won the first game, but Kasparov adapted his tactics to win three and draw two of the remaining games to win the match 4–2.

But in a six-game rematch held in May 1997 in New York City, an upgraded Deep Blue was able to consider an average of 200m positions a second, twice its previous speed. Its algorithm was also improved with input from human grandmasters.

Kasparov played smart though, he was conservative with his moves which threw Deep Blue off balance – it hadn't expected it. But after resigning the second game even though it was drawable, the Russian said he never recovered mentally. With the match tied at one win, one loss, and three draws, Deep Blue won the decisive final game in 19 moves.

Influence on AI

The lessons learned from the desire to create a program that could beat a human chess champion enhanced AI.

Murray Campbell, one of IBM's top AI experts, originally worked on the Deep Thought and Deep Blue projects. He now works on artificial neural networks and credits the quest to master chess programs with helping his team understand the importance of identifying the differences between how humans and machines think, but also in how they're similar.

Efforts to master chess, though, still continue to drive the development of AI. One of the criticisms of Deep Blue and subsequent machines is that they relied on the "brute force" application of their superior memory skills – they could remember more permutations than a human. They could out-calculate, rather than out-think.

AI company DeepMind's algorithm AlphaZero set out to change that. It could teach itself how to play chess and learn from its own mistakes. Not only that, it was able to play with intuition and finesse, destroying the reigning artificial chess champion Stockfish during a match in 2017. It played like a human and at times appeared to even toy with its opponent before delivering a killer blow.

Even now, the desire for the perfect tech-mate is continuing to push the boundaries of AI.

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