AI1001 - Assignment 2

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Go is an ancient Chinese board game. There is only one type of piece, and only one type of move. Both players place stones on a 19×19 grid and try to capture territory by surrounding it with stones. The player with more territory at the end wins. Go is an important part of South Korean culture. It was one of the four virtues learnt by literati, along with music, poetry and painting. People think that Go players are very smart and noble. The game has long been considered a difficult challenge in the field of artificial intelligence and is considerably more difficult to solve than chess.

AlphaGo is an artificial intelligence program made by Google DeepMind to play Go. It was trained on over 100,000 games of Go downloaded from the internet. AlphaGo uses deep neural networks, which mimic the human brain. Such networks were known for several decades, but only became viable recently due to increases in computing power.

Go is a game that requires a lot of intuition. Machine learning allows AlphaGo to 'learn' the game and play it in new ways that are not obvious to humans. For example, AlphaGo's goal is to maximize the probability of winning, not the margin by which it wins. So AlphaGo might play along 'slow' routes which do not provide any instantaneous advantage, but are helpful in the long run.

AlphaGo can be divided into three parts: the policy network which imitates games by top players, the value network which evaluates a board position and predicts the probability of winning, and the tree search, which looks through different possible moves and what they might lead to in the future. First, the policy network scans the board and finds interesting spots to play. Then, the value network tries to find the probability that the chosen tree of moves will lead to victory.

AlphaGo has two weaknesses. The first weakness is that the program always takes 60-90s to make a move, and if it plays along a slow route which can take a large number of moves to win, it might run out of time. The second weakness is the existence of rarely occurring positions where the model has not been trained adequately. When the model enters such a space, it starts playing the wrong moves.

The documentary also raises concerns about the future of AI development. We see that people have a tendency to anthropomorphize AI (such as by referring to it as 'he' or 'she'), which is a big obstacle in trying to understand it. Another concern is the possibility that AI will attain sentience and turn against humans. But AI is still a very nascent field, and we are nowhere near that level of sentience. There are already representatives from large players such as IBM and Microsoft who hold meetings about the impact of AI and what dangers it could pose, and ensure that AI is used ethically and responsibly.

The documentary covers AlphaGo's 5-game match against 9 **dan** (professional) Go player Lee Sedol. Lee had been playing Go since the age of 8 and had won 18 world championships. Lee was confident that he would win at least 4 out of the 5 games. In the first three games, AlphaGo used creative strategies such as **peeping** and **blocking**, forcing Lee into resigning each time. However, in the fourth game, Lee played a very non-obvious move (called a **divine move** by experts), and forced AlphaGo into a space where it had not been trained adequately. AlphaGo started playing wrong moves, leading to Lee winning the fourth game. Unfortunately, the fifth game ended in AlphaGo winning, and Lee lost the tournament 1-4 to AlphaGo.

Lee Sedol's tournament against AlphaGo was a major milestone in AI research. After the tournament, Lee remarked that AlphaGo taught a new way of seeing the game and that he had found the reason why he plays Go. The tournament led many new players to discover the game, and increased its popularity worldwide.

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