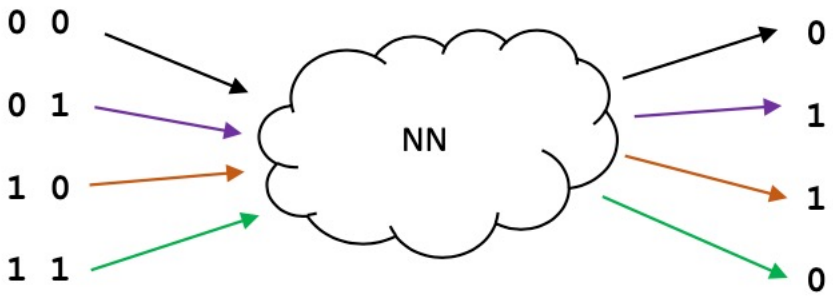
Pattern Recognition

Michael Wollowski

1

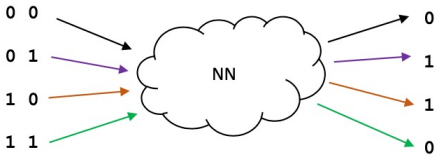
Simple Pattern Recognition (XOR)



2

Pattern Recognition: Rules vs. NN

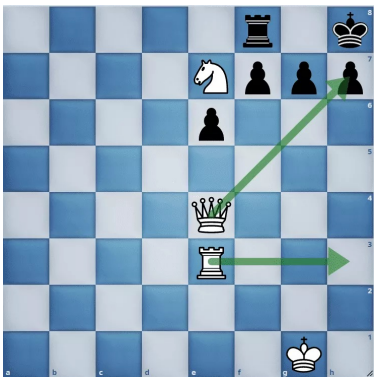
- `If (x1 or x2 and not(x1 and x2)) return true else return false`



3

Pattern Recognition: Rules vs. NN

The knight goes to e7 where it controls g8 and g6; the queen is sacrificed on h7 to open the h-file, and a rook makes use of the newly opened h-file to deliver checkmate.



Source: https://www.chessable.com/blog/chess-pattern-recognition/#:~:text=Chess%20pattern%20recognition%20allows%20you%20to%20use%20Lolli's%20Mate%20on,is%20b7%20instead%20of%20g7.

4

Pattern recognition in Chess

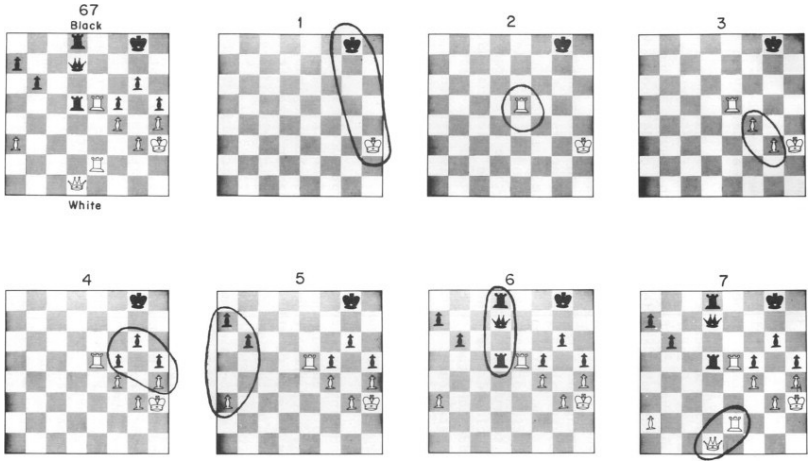
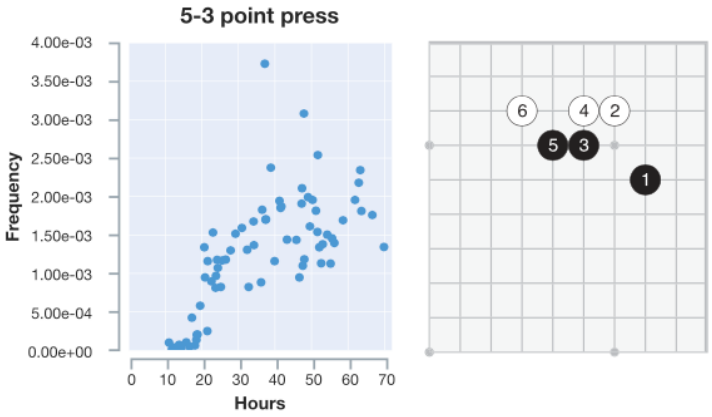


Image from: The mind's eye in chess, by Chase and Simon

5

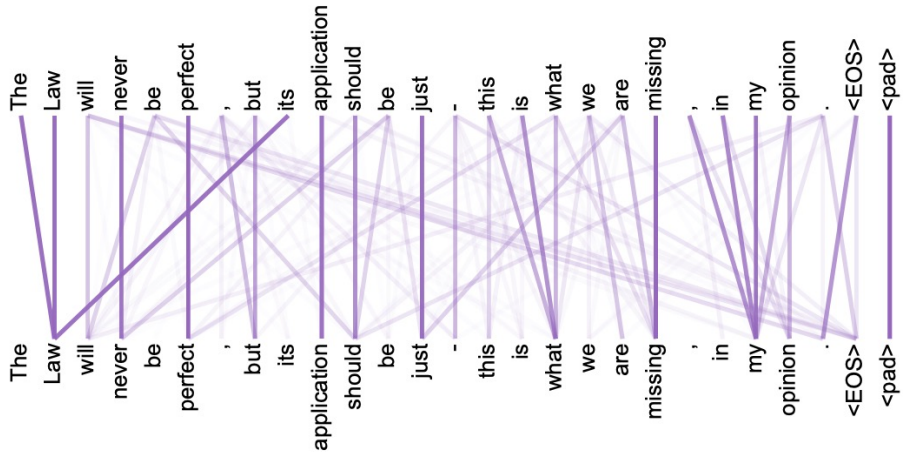
Pattern Recognition in AlphaGoZero

- The network learned common joseki patterns:



6

Sample Pattern in ChatGPT



7

ChatGPT on ChatGPT

> Tell me about yourself.

- "(...) My primary function is to assist and engage in natural language conversations with users.
- I don't have personal experiences, emotions, or consciousness.
- Instead, I generate responses based on patterns and information present in the data on which I was trained.
- I can help answer questions, provide information, assist with language-related tasks, and engage in a wide range of discussions. (...)"

8

NNs vs Rule-based Systems

- In the late 60's researchers knew that NNs were the better technology for AI.
- Selfridge: "The most important learning process of all is still untouched. No current program can generate test features on its own. The effectiveness of all of them is forever restricted by the ingenuity or arbitrariness of their programmers."[1)]
- Minsky, one of the most influential person in AI: "Today, machines solve problems mainly according to the principles we build into them. Before long, we may learn how to set them to work upon the very special problem of improving their own capacity to solve problems."[2)]

1) Oliver Selfridge and U. Neisser. Pattern Recognition by Machine. In: Computers and Thought. Feigenbaum, E. A. and Feldman, J. editors. McGraw-Hill. 1963.
2) Marvin Minsky. Machines are More Than They Seem. Science Journal 4(10). pages 3-43. October 1968.

9

Computing Power to Train ChatGPT

- GPT-3 required 3.14e23 flops of computing power for its initial training.
- Assuming GPT-4 is about 10 times bigger than GPT-3 with 175 billion parameters, it would require about 3.14e24 flops of computing power for its training.[1)]
- At least **10,000 high-end NVIDIA GPUs**
- ChatGPT-3 has **175 billion** parameters and requires 45 terabytes of data for training.[2)]

1) https://www.quora.com/How-much-computing-power-and-cost-is-involved-in-running-ChatGPT-4#:~:text=As%20you%20can%20see%2C%20you,or%20A%20series%20from%20Nvidia).&text=How%20much%20CPU%20power%20does,power%20for%20its%20initial%20training
2) https://www.linkedin.com/pulse/secrets-chatgpts-ai-training-look-high-tech-hardware-behind-kandel/

10

Computing Power of Apollo 11

- Around 40,000 instructions per second
- 15-bit word length + 1-bit parity
- 2048 words RAM (magnetic-core memory)
- 36,864 words ROM (core rope memory)

Source: https://en.wikipedia.org/wiki/Apollo_Guidance_Computer

11