

**INTELLIGENZA ARTIFICIALE: PROGETTO**  
**PROFF. A. MARCELLI, A. DELLA CIOPPA**  
NATURAL COMPUTATION LAB - DIEM, UNIVERSITY OF SALERNO

# INTELLIGENZA ARTIFICIALE

1

PURAMENTE  
REATTIVA

2

MEMORIA  
LIMITATA

3

TEORIA DELLA  
MENTE

4

AUTO-  
CONSAPEVOLE

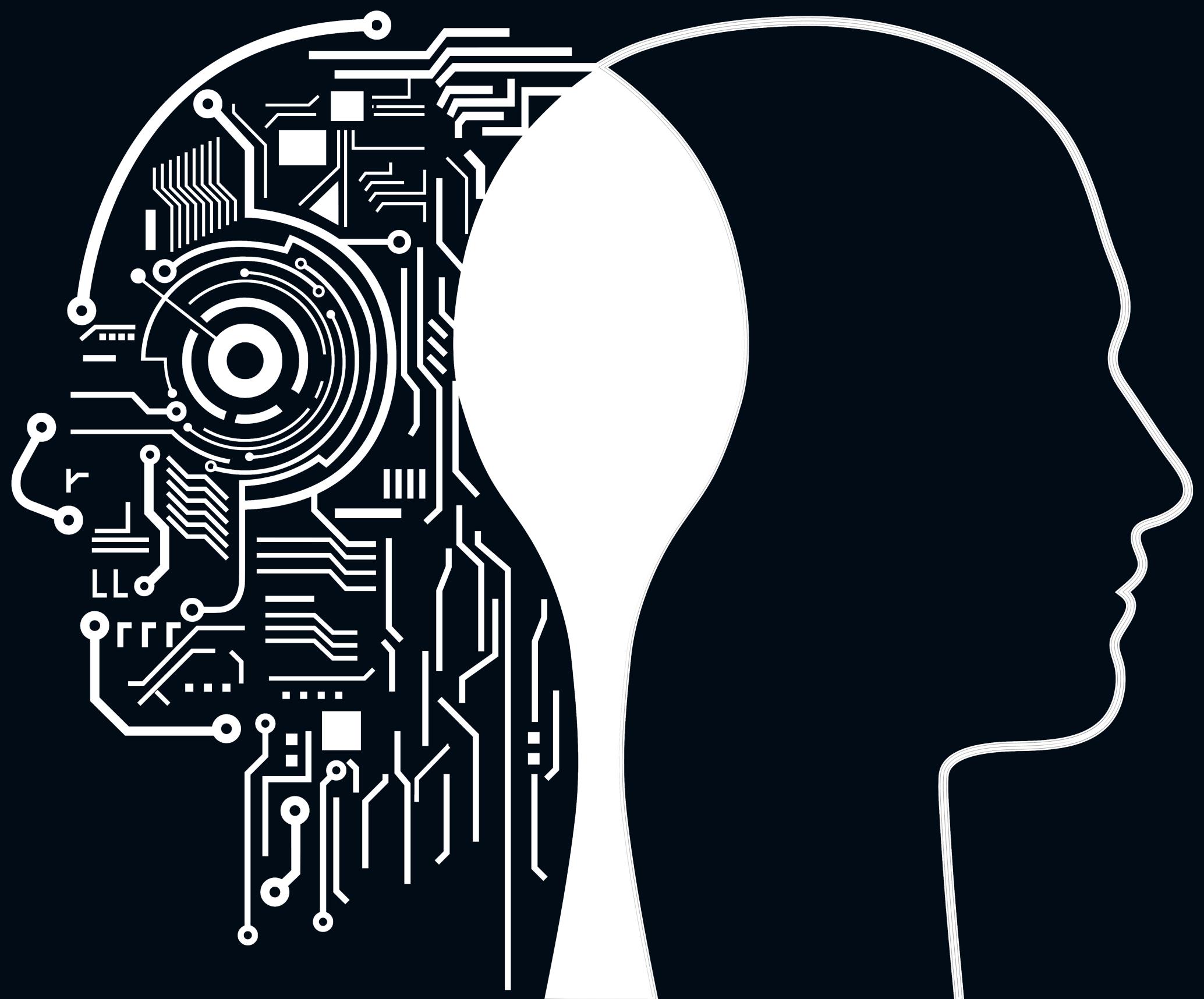
# INTELLIGENZA ARTIFICIALE TIPO I

PURAMENTE REATTIVA

## Tipo I: puramente reattivo

---

- L'agente percepisce l'ambiente e gli eventi che si verificano direttamente.
- Non ha cognizione di ciò che si trova al di fuori del proprio ambiente.
- Non ha memoria e non può imparare dall'esperienza.





iRobot®

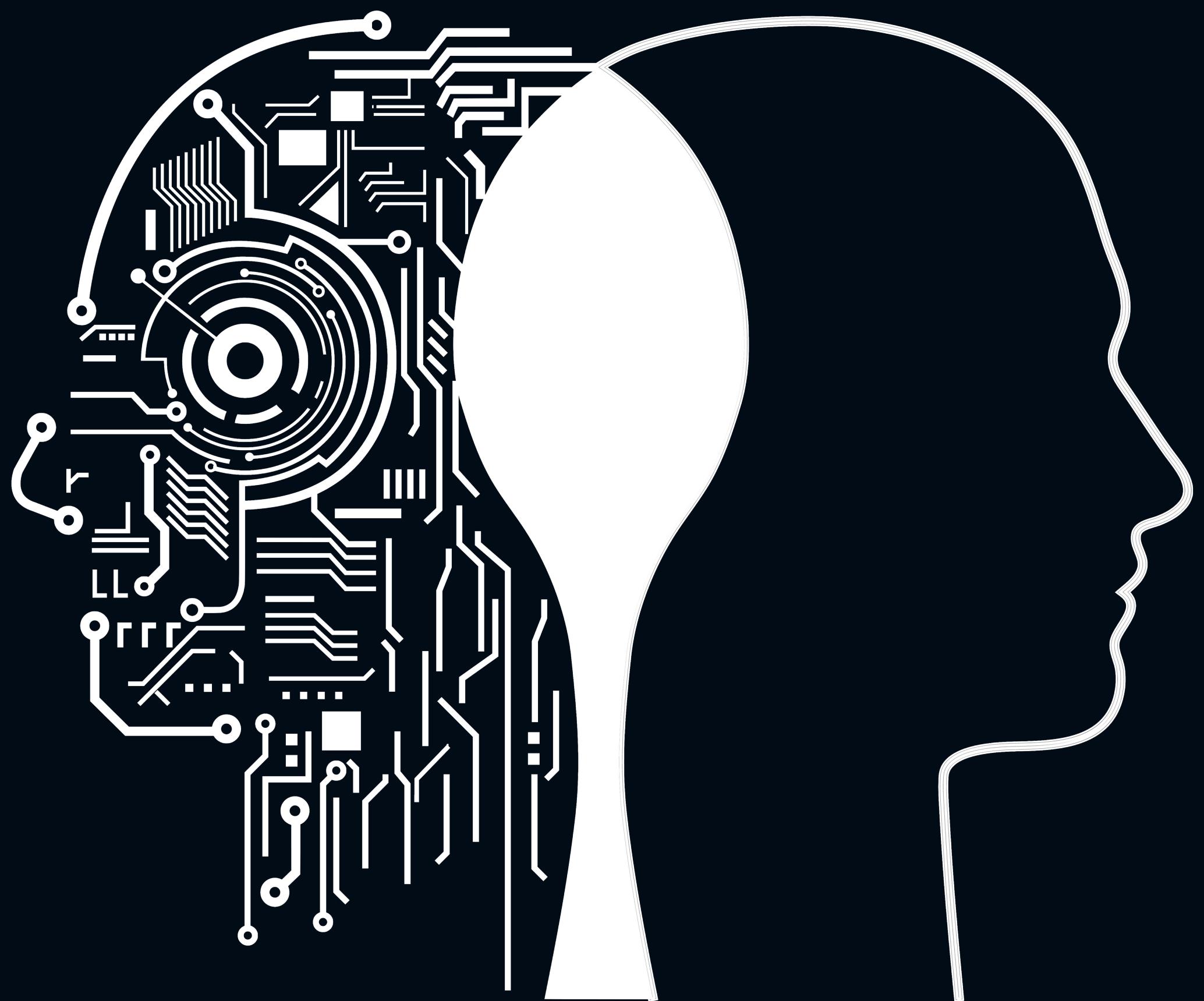
# INTELLIGENZA ARTIFICIALE TIPO II

MEMORIA LIMITATA

## Tipo II: a memoria limitata

---

- L’agente considera l’informazione passata e la inserisce nella sua rappresentazione del mondo:  
**apprende!**
- Ha abbastanza memoria o esperienza per prendere decisioni corrette ed eseguire azioni appropriate.



IBM DEEP BLUE VS G.  
KASPAROV  
11 MAGGIO 1997





# GOOGLE ALPHAGO VS LEE SEDOL

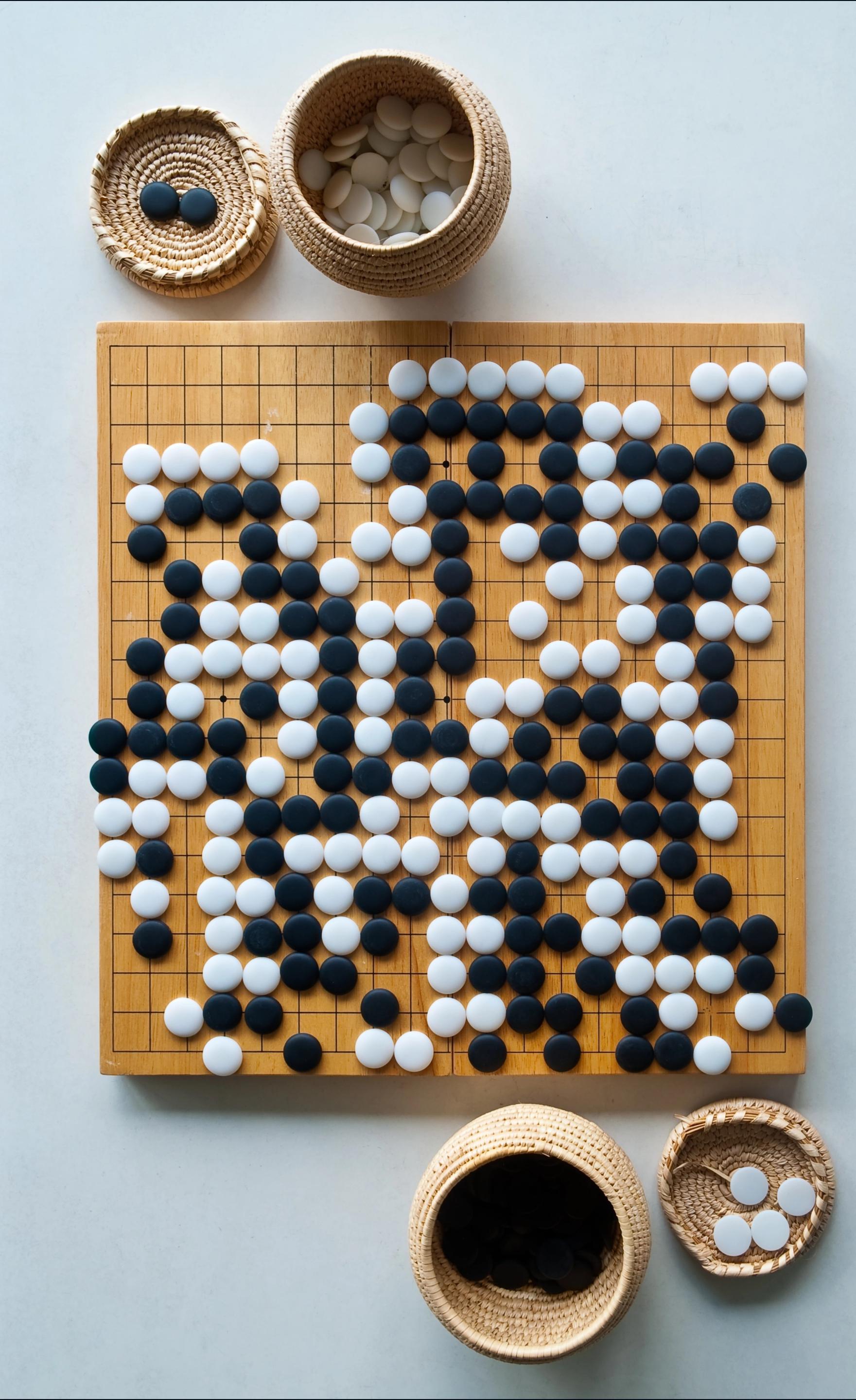


柯洁 KE JIE  
00:46:57

# GO

---

- GO is hard to face
- The exact number of  $L(19,19)$  was obtained in 2016
  - state-space complexity  $\approx 10^{170}$
  - game-tree complexity  $\approx 10^{360}$
- [https://en.wikipedia.org/wiki/  
Game\\_complexity](https://en.wikipedia.org/wiki/Game_complexity)



# GOMOKU

---

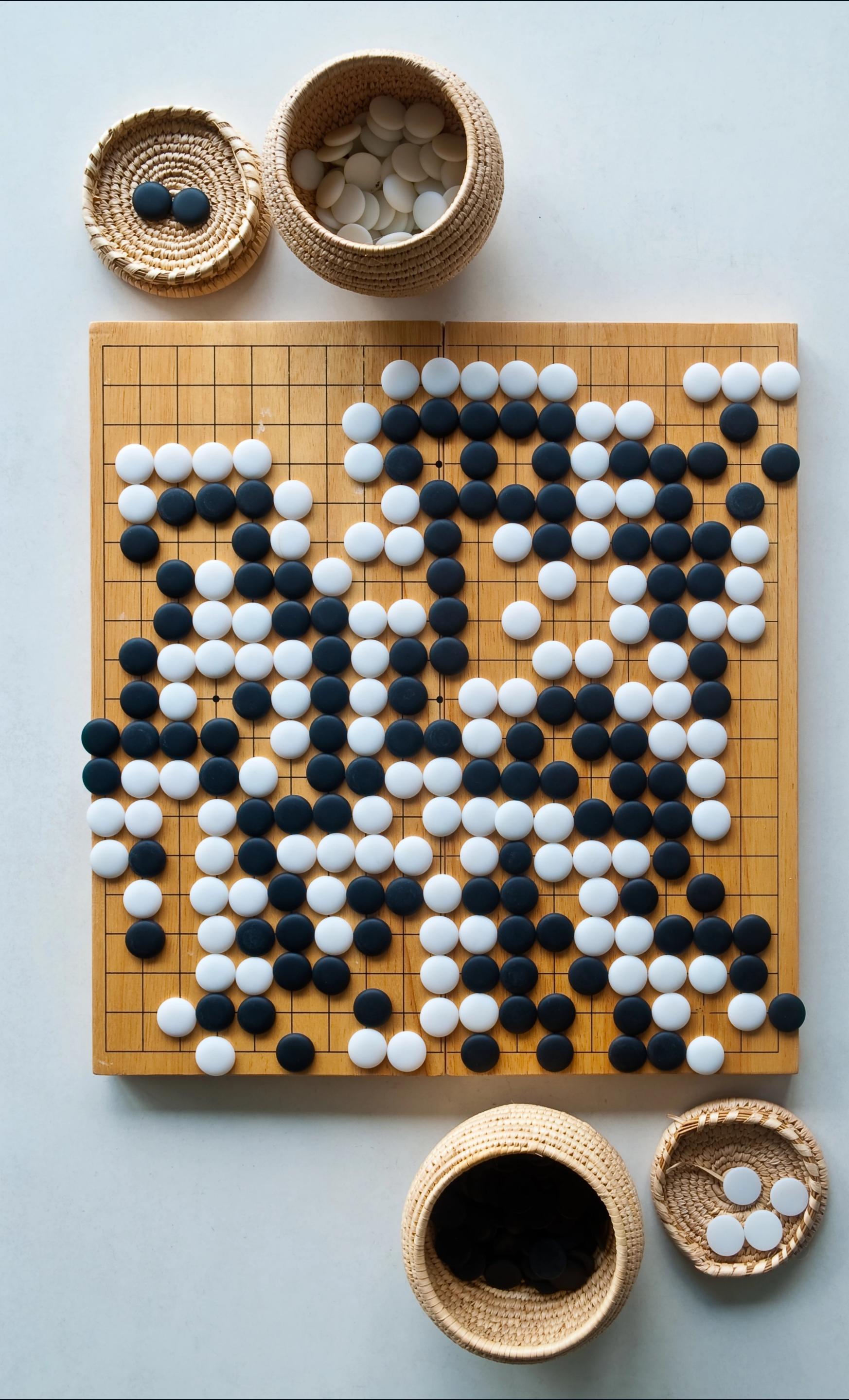
- GOMOKU is simpler
  - state-space complexity  $\approx 10^{105}$
  - game-tree complexity  $\approx 10^{70}$
  - no need to consider too many future steps
- Adversarial search
  - Min-Max and Alpha-Beta pruning algorithms



# GOMOKU: howto

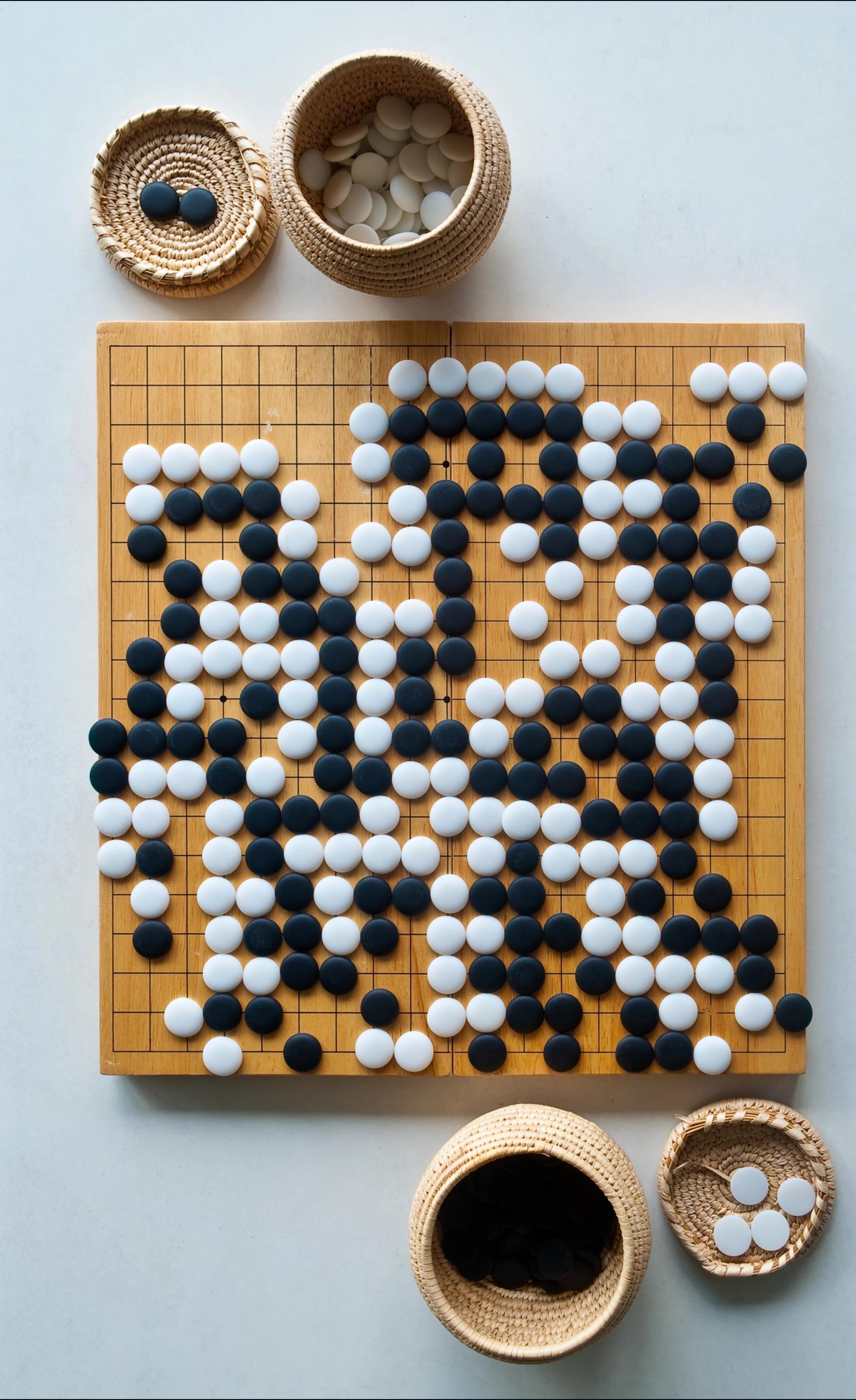
---

- GOMOKU game rules
  - Two players
  - Five-in-a-row, 6 or more stones do not matter
  - Vertical, horizontal, or diagonal direction
  - 19x19 board, 361 intersections
  - Black starts. Stones can be placed on the intersections
- <https://gomocup.org>
- <https://www.mathsisfun.com/games/gomoku.html>



# GOMOKU: howto

- GOMOKU has a strong advantage for the first player when unrestricted.
- Championships in Gomoku adopted the Swap2 opening protocol in 2009.
  - In Swap2, the first player places three stones, two black and one white, on the board.
  - The second player then selects one of three options:
    - play as black,
    - play as white and place another white stone,
    - or place two more stones, one white and one black, and let the first player choose the color.



# GOMOKU: howto

- Although GOMOKU was solved in 1992 and FREE RENJU was solved in 2001, GOMOKU and RENJU with modern opening rules such as Swap-2 (GOMOKU) and Soosorv-8 (RENJU) used in professional competitions are much more balanced and have not been solved.
- However, compared with computer chess, the development of computer GOMOKU/RENJU was slow.
- As of 2016, many gomoku/renju experts still believed that gomoku/renju programs could not compete at the human champion level.

