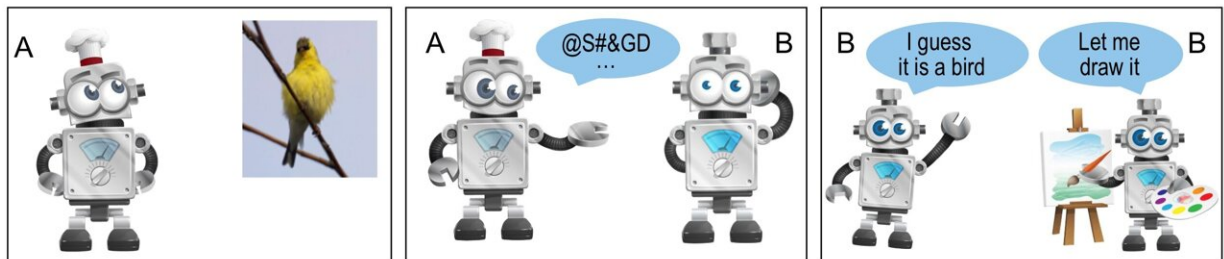


# Emergence of machine language: Towards symbolic intelligence with neural networks

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From left to right: Agent A sees a random image; A tries to use his own language (to be learned) to tell a friend B what he saw; B needs to understand the language and guess what A is talking about and meanwhile draw the image according to the description of generated through cooperation. Credit: Science China Press

Led by a team from the Institute of Automation, Chinese Academy of Sciences, a new study explores a novel frontier in machine learning. With the rise of large language models, AI is evolving from perceptual intelligence to cognitive intelligence, and human language has become a pivotal component of visual understanding. This study questions whether machines can spontaneously learn a machine language as a visual representation, without relying on human language.

The work is [published](#) in the journal *National Science Review*.

Inspired by the strengths of [human language](#), the researchers began by

simulating the emergence of language in the most basic scenario of a two-agent game. Their aim was to generate a language through the interactions of these agents. Using the "speak, guess, and draw" game as a platform, the researchers demonstrate the capabilities of neural networks in generating variable-length, discrete, and semantic representations.

The team also validated its potential advantage by comparing discrete language with continuous features from three perspectives: interpretability, generalization, and robustness across diverse datasets.

The study of machine language represents an exciting and valuable direction in artificial intelligence research. Imagine a future where AI development is no longer limited to fixed programs and predefined rules, but allows intelligent agents to freely evolve in a specific environment, communicating and collaborating through spontaneous language.

**More information:** Yuqi Wang et al, Emergence of machine language: towards symbolic intelligence with neural networks, *National Science Review* (2024). [DOI: 10.1093/nsr/nwad317](https://doi.org/10.1093/nsr/nwad317)

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