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Curious AI learns by exploring game worlds and making mistakes

By **Matt Reynolds**

CURIOUS algorithms are teaching themselves to solve problems they haven't encountered before.

Faced with level one of *Super Mario Bros*, a curiosity-driven AI learned how to explore, avoid pits, and dodge and kill enemies. This might not sound impressive – algorithms have been beating humans at video games for a few years now – but this AI's skills were learned thanks to an inbuilt desire to discover more about the game's world.

Conventional AI algorithms learn through positive reinforcement. They are rewarded for achieving external goals, like increasing the score in a video game by one point. This encourages them to perform actions that increase their score – such as jumping on enemies in the case of *Mario* – and discourages them from performing actions that don't, like falling into a pit.

But humans learn through curiosity, says Deepak Pathak at the University of California, Berkeley. He set out to give his own reinforcement learning algorithm a sense of curiosity to see if it would do the same. The algorithm experienced a reward when it increased its understanding of its environment. So, rather than looking for a score-based reward in the game world, the algorithm was rewarded for mastering skills that led to it discovering more about that world.

This type of approach can speed up learning times and improve the efficiency of algorithms, says Max Jaderberg at Google's AI company DeepMind. The company used a similar technique last year to teach an AI to explore a virtual maze.

Imbued with a sense of curiosity, Pathak's own AI learned to stomp on enemies and jump over pits in *Mario*, and also learned to explore faraway rooms and walk down hallways in another game. It could apply its new skills to further levels of *Mario* despite not seeing them before – but it did struggle to make it past some relatively simple obstacles (arxiv.org/abs/1705.05363).

“Imbued with curiosity, the AI learned to stomp on enemies and jump over pits in *Super Mario Bros*”

Pathak now wants to see if robotic arms can learn through curiosity to grasp unfamiliar objects. He also plans to see whether a similar algorithm could be used in household robots like the Roomba vacuum cleaner.

This article appeared in print under the headline “Curiosity saves the computer from death”

Want more? Read the extended version of this article.

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