Master Matchmaker of Nervous System Sparks Computer Science Breakthrough

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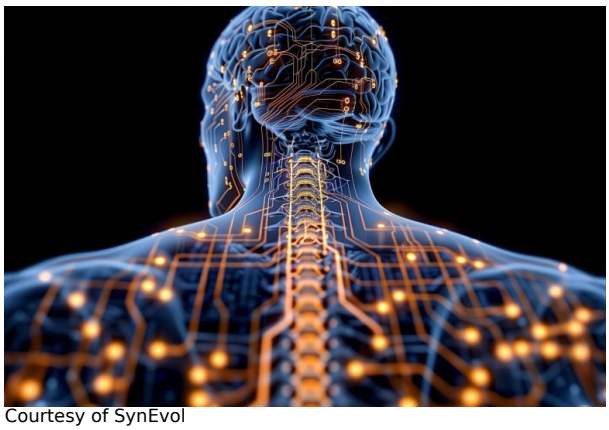

Courtesy of SynEvol

A ridesharing app's computers start to search for a car when you ask it to. They are aware of your want to get there as soon as possible. They are aware that there are other users in need of a ride. They also understand that drivers want to pick up someone nearby in order to reduce idle time. According to Saket Navlakha, an associate professor at Cold Spring Harbor Laboratory, the computer's duty is to match drivers and riders in a way that maximizes everyone's enjoyment.

Navlakha and other computer scientists refer to this as bipartite matching. Systems match organ donors with recipients of transplants, medical students with residency programs, and advertising with ad slots all perform the same function. It is hence the focus of much research.

According to Navlakha, "this is probably among the top ten most well-known problems in computer science."

Courtesy of SynEvol
Credit: Navlakha lab/ Cold Spring Laboratory

Currently, he's discovered an improved method by applying biological principles. Navlakha identified a bipartite matching issue in the nervous system's wiring. In mature animals, the movement of every muscle fiber in the body is regulated by a single neuron. Nonetheless, several neurons target each fiber in the early stages of life. An animal needs to have extra connections trimmed in order to move efficiently. Which contests are therefore meant to last?

The nervous system offers a productive remedy. According to Navlakha, neurons that were initially attached to the same muscle fiber engage in competition with one another in order to keep their match, employing neurotransmitters as "bidding" resources. In this biological auction, neurons that are unsuccessful can bid on other fibers using their neurotransmitters. In this manner, all of the neurons and fibers ultimately find a partner.

Navlakha came up with a method for using this matching technique outside of the nervous system. He states, "It's a simple algorithm." There are just two equations. The first involves rivalry among neurons linked to the same fiber, and the second involves resource reallocation.

The neuroscience-inspired approach outperforms the best bipartite matching systems available in tests. Fewer parties remain unpaired and nearly ideal pairings are produced. In practical terms, this might imply fewer hospitals lacking medical residents and reduced wait times for rideshare customers.

Navlakha highlights an additional benefit. Privacy is maintained by the new algorithm. For the majority of bipartite matching systems to function, relevant data must be sent to a central server. However, a distributed approach might be better in many situations, such as online auctions and donor organ matching. With so many possible uses, Navlakha is hoping that other people would use the new algorithm to create their own tools.

He continues, "It's an excellent illustration of how researching neural circuits can uncover novel algorithms for significant AI issues."