Speeding up drug research through ‘visionary’ cryptographic crowdsourcing

A new cryptographic system could allow pharmaceutical companies and academic labs to work together to develop new medications more quickly — without revealing any confidential data to their competitors.

The centerpiece of this computing system is an artificial intelligence program known as a neural network. The AI studies information about which drugs interact with various proteins in the human body to predict new drug-protein interactions.

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In the new AI-training system, data pooled from research groups get divvied up among multiple servers, and the owner of each server sees what appear to be only random numbers. “That’s where the crypto-magic happens,” says computer scientist David Wu of the University of Virginia in Charlottesville, who wasn’t involved in the work. Although no individual participant can see the millions of drug-protein interactions that compose the training set, the servers can collectively use that information to teach a neural network to predict the interactivity of previously unseen drug-protein combinations.

“This work is visionary,” says [computer scientist] Jian Peng.

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[T]he AI identified an interaction between estrogen receptor proteins and a drug developed to treat breast cancer called droloxifene. The neural network also found a never-before-seen interaction between the leukemia medication imatinib and the protein ErbB4, which is thought to be involved in different types of cancer. The researchers confirmed this interaction with lab experiments.
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