

U.S. Air Force Research Lab Taps IBM to Build Brain-Inspired AI Supercomputing System

Equal to 64 million neurons, new neurosynaptic supercomputing system will power complex AI tasks at unprecedented speed and energy efficiency

ARMONK, N.Y. and ROME, N.Y., June 23, 2017 /PRNewswire/ -- IBM (NYSE:[IBM](#)) and the U.S. Air Force Research Laboratory (AFRL) today announced they are collaborating on a first-of-a-kind brain-inspired supercomputing system powered by a 64-chip array of the IBM TrueNorth Neurosynaptic System. The scalable platform IBM is building for AFRL will feature an end-to-end software ecosystem designed to enable deep neural-network learning and information discovery. The system's advanced pattern recognition and sensory processing power will be the equivalent of 64 million neurons and 16 billion synapses, while the processor component will consume the energy equivalent of a dim light bulb – a mere 10 watts to power.

IBM researchers believe the brain-inspired, neural network design of TrueNorth will be far more efficient for pattern recognition and integrated sensory processing than systems powered by conventional chips. AFRL is investigating applications of the system in embedded, mobile, autonomous settings where, today, size, weight and power (SWaP) are key limiting factors.

The IBM TrueNorth Neurosynaptic System can efficiently convert data (such as images, video, audio and text) from multiple, distributed sensors into symbols in real time. AFRL will combine this "right-brain" perception capability of the system with the "left-brain" symbol processing capabilities of conventional computer systems. The large scale of the system will enable both "data parallelism" where multiple data sources can be run in parallel against the same neural network and "model parallelism" where independent neural networks form an ensemble that can be run in parallel on the same data.

"AFRL was the earliest adopter of TrueNorth for converting data into decisions," said Daniel S. Goddard, director, information directorate, U.S. Air Force Research Lab. "The new neurosynaptic system will be used to enable new computing capabilities important to AFRL's mission to explore, prototype and demonstrate high-impact, game-changing technologies that enable the Air Force and the nation to maintain its superior technical advantage."

"The evolution of the IBM TrueNorth Neurosynaptic System is a solid proof point in our quest to lead the industry in AI hardware innovation," said Dharmendra S. Modha, IBM Fellow, chief scientist, brain-inspired computing, IBM Research - Almaden. "Over the last six years, IBM has expanded the number of neurons per system from 256 to more than 64 million – an 800 percent annual increase over six years."

The system fits in a 4U-high (7") space in a standard server rack and eight such systems will enable the unprecedented scale of 512 million neurons per rack. A single processor in the system consists of 5.4 billion transistors organized into 4,096 neural cores creating an array of 1 million digital neurons that communicate with one another via 256 million electrical synapses. For CIFAR-100 dataset, TrueNorth [achieves](#) near state-of-the-art accuracy, while running at >1,500 frames/s and using 200 mW (effectively >7,000 frames/s per Watt) – orders of magnitude lower speed and energy than a conventional computer running inference on the same neural network.

The IBM TrueNorth Neurosynaptic System was originally developed under the auspices of Defense Advanced Research Projects Agency's (DARPA) Systems of Neuromorphic Adaptive Plastic Scalable Electronics (SyNAPSE) program in collaboration with Cornell University. In 2016, the TrueNorth Team received the inaugural [Misha Mahowald Prize](#) for Neuromorphic Engineering and TrueNorth was [accepted](#) into the Computer History Museum. Research with TrueNorth is currently being performed by more than 40 universities, government labs, and industrial partners on five continents.

About IBM Research

For more than seven decades, IBM Research has defined the future of information technology with more than 3,000

researchers in 12 labs located across six continents. Scientists from IBM Research have produced six Nobel Laureates, 10 U.S. National Medals of Technology, five U.S. National Medals of Science, six Turing Awards, 19 inductees in the National Academy of Sciences and 20 inductees into the U.S. National Inventors Hall of Fame. For more information about IBM Research, visit www.ibm.com/research.

About Air Force Research Laboratory

With headquarters at Rome, NY, the Information Directorate (RI) research vector develops novel and affordable Command, Control, Communications, Computing, Cyber, and Intelligence (C4I) technologies. RI is recognized as a national asset and leader in C4I. Refining data into information and knowledge for decision makers to command and control forces is what we do. This knowledge gives our air, space, and cyberspace forces the competitive advantage needed to protect and defend this great nation. For more information about AFRL, <http://www.wpafb.af.mil/afrl/ri.aspx>.

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