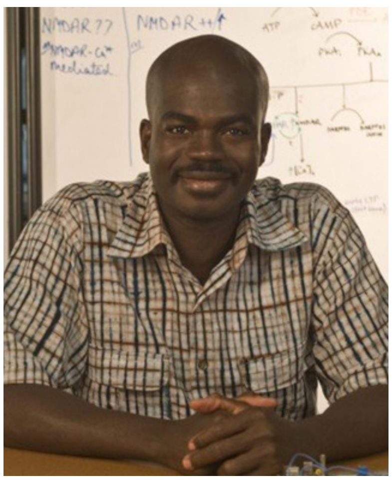
CARNEGIE MELLON UNIVERSITY
BME 2024 FALL SEMINAR SERIES

Scaling Knowledge Processing from 2D Chips to 3D Brains



PRESENTED BY

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SCHEDULE

Porter Hall (PH) 100

Thursday,
October 31, 2024
(9:30-10:30AM)

Artificial intelligence (AI) now advances by performing twice as many multiplications every two months, but the semiconductor industry tiles twice as many multipliers on a chip every two years. Moreover, the returns from tiling these multipliers ever more densely now diminish because signals must travel relatively farther and farther. This communication now consumes much more energy and generates much more heat than computation does. Although travel can be shortened by stacking multipliers tiled in two dimensions in the third dimension, such a solution acutely reduces the available surface area for dissipating heat. My recent reconception of the brain's fundamental unit of computation cuts communication by moving away from synaptocentric learning to dendrocentric learning. Synaptocentric learning weights input precisely across an entire arbor of dendrite to discriminate spatial patterns of activity. Current AI, by using dot-products to emulate synaptic weighting, realizes this 60-year-old conception but produces dense outputs. Dendrocentric learning orders inputs meticulously along a short stretch of dendrite to detect a particular spatiotemporal pattern of activity. I will illustrate how dendrocentric learning AI, by using a string of ferroelectric transistors to emulate a stretch of dendrite, could signal sparsely and thus enable knowledge processing to scale from 2D chips to 3D brains.

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