UCLA College | Physical Sciences Chemistry & Biochemistry

PHYSICAL CHEMISTRY SEMINAR

Prof. Hirofumi Tanaka

Research Center for Neuromorphic AI Hardware, Kyushu Institute of Technology

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via Zoom

“Reservoir computing device composed by chemical dynamics”

In recent years, the superior computational power of deep learning based on software has been widely recognized, and the practical applications of artificial intelligence are rapidly expanding. On the other hand, the hardware for replacing such artificial intelligence (AI) algorithms is facing the physical limits of scaling in silicon CMOS technology, and performance improvement is expected to hit the ceiling. For this reason, there is a growing interest in hardware technologies that physically implement artificial neural networks (ANNs), neuromorphic or brainmorphic information processing systems, and the applications (hereafter referred to as AI systems in this paper) as well as new materials and devices. A critical difference between the presently required device functionality and that in conventional computational systems is the use of dynamics. By cleverly using nanomaterials' chemical dynamics and network structure, devices that spontaneously generate pulses, noise, and other physical phenomena are expected to be realized to utilize for the AI hardware. These devices will enable drastically lower power consumption and higher integration of AI systems. In the learning process of ANNs, it is necessary to constantly change and store the weights of the weighted sum part. In our research center, we have been working on materials that can complement CMOS for AI systems by using molecules and nanocarbon materials, and further, we are trying to apply them to autonomous AI robots. This presentation introduces these nanomaterials and networks' formation as devices, the key points of the devices' functionalization, application to robots, and other recent research results.

Please contact marla@chem.ucla.edu for additional information.