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IAPME Seminar

Machine Learning for Molecular Sensing

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Date: 18 April 2024; Time: 14:30 – 15:30; Venue: N23-4018

Abstract:

Olfaction, an ancient sensory system, provides intricate information about the environment. In emulation of this biological process, neuromorphic devices in conjunction with machine learning algorithms, endeavor to replicate and digitize the olfactory capabilities. This presentation focuses on the gas discrimination and identification capabilities of neuromorphic nanosensors. These nanosensors, constructed with functionalized nano materials, were integrated into multi-channel gas sensor devices, and their sensing signals were recorded upon exposure to diverse gases. To unravel the temporal characteristics embedded in the sensing signals, we employ machine learning algorithms to extract meaningful patterns and discern specific gases. The integration of machine learning significantly enhances the electronic olfaction system's gas identification performance across a wide spectrum of gases. This innovative platform not only downsizes electronic noses but also digitizes olfactory information, enabling the precise detection and identification of various gases and volatile organic compounds (VOCs). By leveraging machine learning, our electronic olfaction system demonstrates exceptional capabilities applicable to diverse fields such as pathogen detection, environmental monitoring, and disease diagnosis. The fusion of neuromorphic nanosensors and machine learning algorithms creates a powerful synergy, paving the way for advanced molecular sensing technologies with broad-ranging applications.

Professor Gianaurelio Cuniberti holds the Chair of Materials Science and Nanotechnology at the Technische Universität Dresden (TU Dresden) and the Max Bergmann Center of Biomaterials in Dresden, Germany since 2007. He obtained his Ph.D. in 1997 at the age of 27 in a collaboration between the University of Genoa and the University of Hamburg, Germany. His research activity is internationally recognized in more than 400 scientific journal papers to date. He serves as a referee for numerous high-impact journals, and for several funding research institutions including among others the EU, the German Science Foundation (DFG), the USA National Science Foundation (NSF), the German Israeli Foundation (GIF), and the Alexander von Humboldt Foundation. Prof. Cuniberti is an elected member of the European Academy of Sciences, of the Academia Europaea and of the Germany National Academy of Science and Engineering (acatech).

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