Machine Learning for Molecular Sensing

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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.