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AI Meets Quantum Mechanics to Unravel Molecular Fingerprints of Brain Function and Diseases

Abstract:

Scientific research requires powerful tools for elucidating the secrets of nature. Today, understanding the brain — how it works and what goes wrong when it is injured or diseased, is considered one of the last frontiers in science, and it has posed significant challenges for scientists and engineers to develop effective tools to meet this objective. This talk will discuss a new AI-enabled magnetic resonance (MR) spectroscopic imaging technology, known as SPICE, for ultrafast, high-resolution, labeled-free molecular imaging of the brain. SPICE uses a machine learning framework to effectively integrate quantum simulation, rapid scanning, sparse sampling, and constrained image processing to provide an unprecedented capability for simultaneous mapping of brain structures, function and metabolism using tissue intrinsic MR spectroscopic signals from multiple molecules. In this talk, I'll will give an overview of SPICE, show some "SPICY" experimental results, and discuss future opportunities of AI-enabled brain mapping.