

Plenary Talk PV I Tue 9:00 PVa
Physics-Informed AI for Image Reconstruction in PET —
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The powerful capabilities of artificial intelligence (AI) have led to an exciting paradigm shift in methodology for many fields in medicine and physics, including inverse problems and image reconstruction. This presentation reviews the application and great promise of AI for image reconstruction in positron emission tomography (PET). Medical imaging with PET provides important information for disease diagnosis and research, but its full potential is constrained by noisy data, and limited spatial resolution. Recently, AI has led to new methodologies for PET image reconstruction, which help tackle these limitations. Starting

with direct AI methods, new hybrid reconstruction algorithms which combine the AI paradigm with imaging physics and statistical models for PET are then reviewed. These physics-informed AI methods unfold existing iterative reconstruction methods in order to include deep-learned neural networks within them. They use deep learning for the components which we do not confidently know (such as how exactly to remove noise and enhance spatial resolution), while preserving decades of research progress in image reconstruction for the components that we do know (the imaging physics and noise distribution). Physics-informed AI holds great promise not only for next-generation PET image reconstruction, but also for inverse problems in general throughout medicine and physics.