SAPE: Spatially-Adaptive Progressive Encoding for Neural Optimization

Abstract:

Multilayer-perceptrons (MLP) are known to struggle with learning functions of high-frequencies, and in particular cases with wide frequency bands. We present a spatially adaptive progressive encoding (SAPE) scheme for input signals of MLP networks, which enables them to better fit a wide range of frequencies without sacrificing training stability or requiring any domain specific preprocessing. SAPE gradually unmask signal components with increasing frequencies as a function of time and space. The progressive exposure of frequencies is monitored by a feedback loop throughout the neural optimization process, allowing changes to propagate at different rates among local spatial portions of the signal space. We demonstrate the advantage of SAPE on a variety of domains and applications, including regression of low dimensional signals and images, representation learning of occupancy networks, and a geometric task of mesh transfer between 3D shapes. Project page: https://amirhertz.github.io/sape/