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NN-QFT Correspondence

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From a path integral perspective, the backbone of perturbative quantum field theory is a close-to-Gaussian distribution on function space that allows for the computation of correlators via expansion of the non-Gaussianities. Incidentally, many neural network (NN) architectures induce function space distributions with similar properties, allowing for direct import of techniques from QFT into the study of neural networks. In this talk, I will provide a new theoretical understanding of NNs in terms of Wilsonian effective field theory, complete with matches to experiment and renormalization. One insight gained is a duality between parameter space and function space treatments of NNs: as parameter complexity increases, Wilsonian RG flow and 1/N-corrections decrease the complexity of the function space distribution. This has the flavor of strong-weak dualities we are accustomed to in physics.

Presenter: Prof. HALVERSON, Jim (Northeastern University)