A primary goal of modern cosmology is to map complex large-scale observations to simple theories. This contrast of scale between theory and data inevitably necessitates a computational approach. This may involve a compressive analysis of observational data, massive simulations, or a search for rare events. In this talk, I will argue that recent advances in machine learning and in particular deep learning can significantly change the current practice in “all” of these fronts. I will review several of our past and ongoing collaborations and identify exciting opportunities for interdisciplinary research.