Landscape and generalisation in deep learning

Assoc Prof Matthieu Wyart
EPFL

Abstract

Deep learning is very powerful at a variety of tasks, including self-driving cars and playing go beyond human level. Despite these engineering successes, why deep learning works remains unclear; a question with many facets.

I will discuss two of them: (i) Deep learning is a fitting procedure, achieved by defining a loss function which is high when data are poorly fitted. Learning corresponds to a descent in the loss landscape. Why isn’t it stuck in bad local minima, as occurs when cooling glassy systems in physics? What is the geometry of the loss landscape? (ii) in recent years it has been realised that deep learning works best in the over-parametrised regime, where the number of fitting parameters is much larger than the number of data to be fitted, contrarily to intuition and to usual views in statistics. I will propose a resolution of these two problems, based on both an analogy with the energy landscape of repulsive particles and an analysis of asymptotically wide nets.

Short Biography

Matthieu Wyart studied physics, mathematics and economics at the Ecole Polytechnique in Paris where he obtained in 2001 his degree in physics with Honors and, the following year, the Diploma of Advanced Studies in Theoretical Physics, with highest Honors at the Ecole Normale Superieure, Paris. In 2006 he obtained a doctoral degree in Theoretical Physics and Finance at the SPEC, CEA Saclay, Paris with a thesis on electronic markets. He then moved to the United States, to Harvard, Janelia farm, and Princeton before joining in 2010 New York University as Assistant Professor, where he was promoted Associate professor in 2014. In July 2015, he was appointed Associate Professor of Theoretical Physics in the School of Basic Sciences at EPFL.