Opening of two postdoctoral positions on

Statistical Physics of Machine Learning

Scope of the project: Nowadays, deep learning is revolutionizing both science and technology. As attractive and performant as this is, however, it is largely an empirical field that still lacks a theoretical understanding of its capacity and limitations. Learning algorithms explore high-dimensional loss functions and their behaviour is akin to dynamics of disordered systems with the training data playing the role of the disorder. In this project we pursue this analogy and use advanced methods of disordered systems such to develop a statistical mechanics approach to deep neural networks. The goal is to bring theoretical understanding of the principles behind the empirical success of deep neural networks. On the way to our main goal of building theory of deep learning we encounter many fascinating problems of current statistics, machine learning, data and network science to which our approach contributes. Our group is well represented at he main machine learning venues such as NeurIPS, ICML, MSML etc. Current focus of the project related to understanding how the role of data structure influence tractability of learning, analysis of the gradient-descent based algorithms and the role of stochasticity in the training, exploration of how the architecture of the neural networks interplays with the algorithms and the data structure leading to efficient learning.

We are looking for **candidates with one of the following backgrounds** (or a combination of the two):

(1) PhD in theoretical physics. Experience with either statistical physics of disordered systems and the associated analytical and numerical techniques, or with applications of current machine learning in sciences.

(2) PhD in fields related to machine learning, information theory, signal processing, data processing, computer science, statistics, computational mathematics with a strong interest in theory and numerical experiments designed to advance foundational understanding, and interest in methods from physics.

We offer a two-year postdoctoral contract with the **Statistical Physics of Computation Laboratory (SPOC) led by Lenka Zdeborová.** SPOC is affiliated with the Institute of Physics in the School of Basic Sciences and with the School of Computer and Communication Sciences in EPFL. This offers us a unique combination to connect the various disciplines needed in order to advance the theory and foundations of modern machine learning. The postdoc fellow will be in contact and is invited to collaborate with colleagues and students in physics, computer science, mathematics and engineering. The position will **start in 2021** (precise starting date is flexible).

EPFL, with its main campus located in Lausanne, Switzerland, on the shores of lake Geneva, is a dynamically growing and well-funded institution fostering excellence and diversity. It has a highly international campus with world-class infrastructure. As a technical university covering the entire spectrum of science and engineering, EPFL offers a fertile environment for research cooperation between different disciplines. The EPFL environment is multilingual and multi-cultural, with English serving as a common interface. Internationally competitive salaries and benefits are offered.

Interested applicants are invited to send their questions, CV and a statement of motivation and interest in the project to the PI Lenka Zdeborová. Candidates are expected to have read some of my recent publications. Applications should be send by **November 30, 2020.**

Contact: Lenka Zdeborová (lenka.zdeborova@epfl.ch).