1163-60-317 **Konstantinos Spiliopoulos*** (kspiliop@bu.edu). *Mean field analysis of neural networks: typical events and fluctuations.*

Machine learning has revolutionized fields such as image, text, and speech recognition. Important real-world applications are driven by neural networks, e.g. in finance, engineering, robotics, and medicine. Despite their immense success in practice, there is limited mathematical understanding of neural networks. Our work shows how neural networks can be studied via stochastic analysis, and develops approaches for addressing some of the technical challenges which arise. We analyze neural networks in the asymptotic regime of simultaneously (A) large network sizes and (B) large numbers of stochastic gradient descent training iterations. We establish the limiting behavior of the neural network and we show that, under suitable assumptions on the activation functions and the behavior for large times, the limit neural network recovers a global minimum (with zero loss for the objective function). We rigorously prove a central limit theorem, which describes the neural network's fluctuations around its mean-field limit. The fluctuations have a Gaussian distribution and satisfy a stochastic partial differential equation. We demonstrate the theoretical results in the study of the evolution of parameters in the well known MNIST and CIFAR10 data sets. This is joint work with Justin Sirignano, (Received September 02, 2020)