1154-49-1969 **Rene Vidal*** (`rvidal@jhu.edu`), 302B Clark Hall, 3400 N Charles St, Baltimore, MD 21218.

Mathematics of Deep Learning.

The past few years have seen a dramatic increase in the performance of recognition systems thanks to the introduction of deep networks for representation learning. However, the mathematical reasons for this success remain elusive. For example, a key issue is that the neural network training problem is non-convex, hence optimization algorithms may not return a global minima. In addition, the regularization properties of algorithms such as dropout remain poorly understood. The first part of this talk will overview recent work on the theory of deep learning that aims to understand how to design the network architecture, how to regularize the network weights, and how to guarantee global optimality. The second part of this talk will present sufficient conditions to guarantee that local minima are globally optimal and that a local descent strategy can reach a global minima from any initialization. Such conditions apply to problems in matrix factorization, tensor factorization, and deep learning. The third part of this talk will present an analysis of the optimization and regularization properties of dropout for matrix factorization. Examples from neuroscience and computer vision will also be presented. (Received September 16, 2019)