Riemannian Geometry of Neural Networks for Unsupervised Learning

Yasunori Nishimori

Neuroscience Research Institute
National Institute of Advanced Industrial Science and Technology (AIST),
AIST Tsukuba Central 2, 1-1-1, Umezono, Tsukuba, Ibaraki 305-8568, Japan
e-mail: y.nishimori@aist.go.jp

Most learning machines assume a fixed structure plus modifiable learning parameters. Information geometry deals with a geometric object arising from a set of learning machines with a fixed structure. For instance, a set of neural networks for unsupervised learning often forms a manifold such as the Stiefel, the Grassmann, or more general flag manifold. Thus learning with those neural networks is regarded as an optimization problem on such manifolds. To solve this, we present Riemannian optimization methods on $O(n)$-homogeneous spaces utilizing quasi-geodesics. Applications include minor component analysis, independent component analysis, and independent subspace analysis. This is joint work with Shotaro Akaho.