Invited Talk

Information Geometry and Neural Networks

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Information geometry is a new method of approach to statistical and stochastic phenomena. It elucidates invariant geometrical structures of a family of probability distributions, by introducing Riemannian metric and a pair of dual affine connections. It has been developed as a basic theory of statistical inference, but it can be applied to other information sciences successfully. Behaviors of neurons and neural networks are stochastic so that it can be applied to neural networks.

In the present talk, we consider three related subjects. One is to extract pairwise correlations, intrinsic triple correlations and more higher order correlations from joint activities of a number of neurons. It is possible to decompose correlations of firing of an ensemble of neurons into a sum of various order of correlations invariantly. Another topic deals with a manifold consisting of multilayer neural networks. We elucidate topological and metrical structures of this manifold, from which we derive a new learning algorithm based on Riemannian gradient. This method is promising to overcome slow convergence of backpropagation. The third topic is Independent Component Analysis, which decomposes correlated multivariate data into some of independent components in a way quite different from conventional Principal Component Analysis.

It is my pleasure if these ideas have some connection with genome information processing.