

Asymptotic Analysis of Higher-order Scattering Transform of Gaussian Processes

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Abstract

In this talk, we would like to talk about the scattering transform with the quadratic nonlinearity (STQN) of Gaussian processes. STQN is a nonlinear transform that involves a sequential interlacing convolution and nonlinear operators, which is motivated to model the deep convolutional neural network. We prove that with a proper normalization, the output of STQN converges to a chi-square process with one degree of freedom in the finite dimensional distribution sense, and we provide a total variation distance control of this convergence at each time that converges to zero at an exponential rate. To show these, we derive a recursive formula to represent the intricate nonlinearity of STQN by a linear combination of Wiener chaos, and then apply the Malliavin calculus and Stein's method to achieve the goal. This work is collaborated with Prof. Yuan-Chung Sheu and Prof. Hau-Tieng Wu.