

Probabilistic sampling for physics: finding needles in a field of high-dimensional haystacks

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Multiscale Interaction Models of Physical Energies and Deep Networks - Stéphane Mallat (ENS Paris)

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Building probabilistic models and sampling complex physical fields is an outstanding issue, despite remarkable numerical results of deep networks. Relying on the renormalization group approach, we show that the curse of dimensionality can be avoided by separating variables at multiple scales in wavelet bases. The main difficulty is to model interactions across scales. We show that these interactions are often spatially local, with a probability distribution which is nearly log concave. They can thus be estimated and sampled with faster score matching algorithms. Models of multiscale interactions are introduced for cosmological and turbulence fields. Relations with deep neural networks are explained.

Classification de Session: Colloquium