SEMPARIS – Séminaires en région parisienne

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Forum de Physique Statistique @ ENS

Mercredi 13 Avril 2022, 14 :30
LPENS, Salle Djebar (29 rue d'Ulm)(please ask xiangyu.cao@ens.fr for a zoom link.)
Domaines : cond-mat.stat-mech

Titre : *Relevant operators and symmetries through the lens of lossy compression theory*

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Résumé : *Identifying the relevant degrees of freedom is key to developing an effective theory. RG provides a framework for this, but its practical execution in unfamiliar systems is difficult. Machine learning (ML) approaches, on the other hand, though promising, lack formal interpretability : it is often unclear what relation the discovered, architecture-dependent, "relevant" features bear to objects of physical theory. I will present results addressing both issues. We develop a fast algorithm, the RSMI-NE, employing recent results in ML-based estimation of information-theoretic quantities to identify the most relevant field theory operators in a statistical system. Information about the phase diagram, correlations and symmetries (also emergent) can be obtained, which we validate on the example of the interacting dimer model. I will also discuss formal results underlying the algorithm : we establish an equivalence between the information- theoretic relevance defined in the Information Bottleneck (IB) approach of compression theory, and the field-theoretic relevance of the RG. We show analytically that for statistical physical systems the "relevant" degrees of freedom found using IB (and RSMI-NE) indeed correspond to operators with the lowest scaling dimensions, providing a dictionary connecting two distinct theoretical toolboxes, and paving the way to automated theory building in more complex settings.*