Physics 7653: Statistical Physics
http://www.physics.cornell.edu/sethna/teaching/653/
Material for Week 7
Exercises due Tuesday Oct 16
Last correction at October 2, 2018, 9:36 am

Pre-class Preparation

Thursday Oct 4

Read: http://www.lassp.cornell.edu/sethna/pubPDF/visualizing-probabilistic-models.pdf Visualizing probabalistic models: Intensive principal component analysis, Katherine N. Quinn, Colin B. Clement, Francesco De Bernardis, Michael D. Niemack, and James P. Sethna, *(The preprint uses PNAS macros, but is only now being submitted there).*
Note that the intensive model manifold for the Ising model shows nothing special at its critical point. Is this a surprise? Submit electronically by 8:30 Thursday morning.

Tuesday Oct 9

Have a great fall break.

Thursday Oct 11

Read: http://science.sciencemag.org/content/sci/342/6158/604.full.pdf Parameter Space Compression Underlies Emergent Theories and Predictive Models, Benjamin B. Machta, Ricky Chachra, Mark K. Transtrum, James P. Sethna, *Science* **342**, 604-607 (2013).
Note that the relevant variables T and H for the Ising model correspond to eigenvalues of the FIM that remain stable under coarse–graining. How do we reconcile this with the fact that they are both relevant (grow under the renormalization-group flow)? (Hint: The FIM is for the entire system. The system becomes smaller under coarse-graining.) *Can you explain why the two have the same behavior, given that $\frac{\mathrm{d}t}{\mathrm{d}\ell} = t/\nu = t$ and $\frac{\mathrm{d}h}{\mathrm{d}\ell} = \beta\delta h/\nu = 15/8h$ have different eigenvalues?* Submit electronically by 8:30 Thursday morning.

Tuesday Oct 16

Read: https://arxiv.org/abs/1710.05787 Information geometry and the renormalization group, Archishman Raju, Benjamin B. Machta, James P. Sethna.
Does this paper answer the question raised by the stability of the FIM eigenvalues in the 'Parameter compression' paper above? Submit electronically by 8:30 Tuesday morning.

Exercises

1.15: Fisher information and Cramér Rao

1.16: Distances in probability space