M2 Research Internship: Statistical physics of image appreciation

October 18, 2019

Laboratory name: CFM Chair of Econophysics & Complex Systems, LadHyX
CNRS identification code: UMR CNRS 7646
Internship location: Ecole polytechnique, Palaiseau, and Capital Fund Management, Paris.
Thesis possibility after internship: YES
Funding: NO

Supervision: Michael Benzaquen (Ecole polytechnique)
Raphaël Benichou & Jean-Philippe Bouchaud (Capital Fund Management)
Alexandre Darmon (Art in Research)

Email: michael.benzaquen@polytechnique.edu

Subject

Our recent study [1] revisited the long-standing question of the relation between image appreciation and its statistical properties. In particular, a large scale survey on random gray-scale and B&W images revealed maximum appreciation at intermediate entropic complexity. We showed that the algorithmic complexity of the coarse-grained images, expected to capture *structural complexity* while abstracting from high frequency noise, is a good predictor of preferences, see Fig. 1.

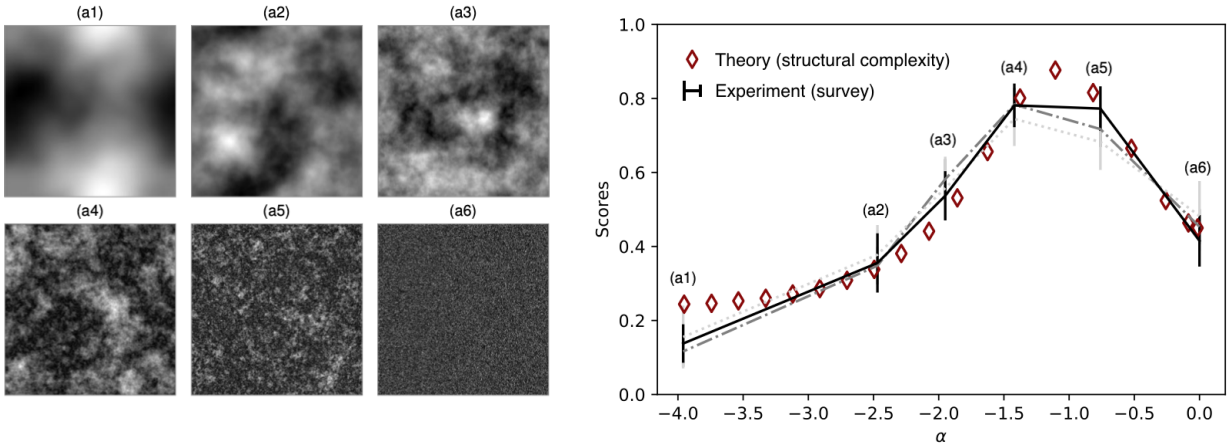

Figure 1: Structural Complexity and image appreciation (right) of the gray-scale random images of increasing entropic complexity (left), from [1].

This internship will be devoted to taking our understanding of image appreciation one step further, notably by determining optimal noise levels – or equivalently, temperatures – when reducing resolution and color palette, a question with numerous practical applications. Further, inspired by the analysis of Stephens *et al.* [2] and in the context of entropy design, we shall work at building a theoretical framework to address the question of colour images criticality using a 3D RGB Ising model.

The internship will be held within the CFM Chair of Econophysics and Complex Systems at Ecole polytechnique (visit `www.econophysix.com`) in close connection with Raphaël Benichou and Jean-Philippe Bouchaud (Capital Fund Management) and Alexandre Darmon (Art in Research, visit `www.artinresearch.com`). The internship will comprise theoretical, numerical and experimental components, with notably the design of large-scale human experiments to confront our theories and also explore whether already existing databases can be used to this purpose. A good background in statistical physics or information theory, and Python is advised.

[1] S. Lakhal, A. Darmon, J.-P. Bouchaud and M. Benzaquen, (2019) arXiv:1910.06088
[2] G. J. Stephens, T. Mora, G. Tkacik, and W. Bialek, PRL 110 (2013) 018701