M2 Research Internship: Quantitative aesthetics, color & complexity

Laboratory name : CFM chair of Econophysics & Complex Systems, LadHyX
CNRS identification code : UMR CNRS 7646
Internship location : Ecole polytechnique, Palaiseau
Thesis possibility after internship : YES
Funding : NO

Supervision : Michael Benzaquen (Ecole polytechnique) and Alexandre Darmon (Art in Research)

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Subject

We recently revisited the long-standing question of the relation between image appreciation and its statistical properties [2]. We generated two different sets of random grayscale images well distributed along three measures of entropic complexity, and ran a large-scale survey in which people are asked to sort the images by preference. This revealed maximum appreciation at intermediate entropic complexity (see Fig. 1). 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, thereby suggesting there exists some universal quantitative criteria for aesthetic judgment.

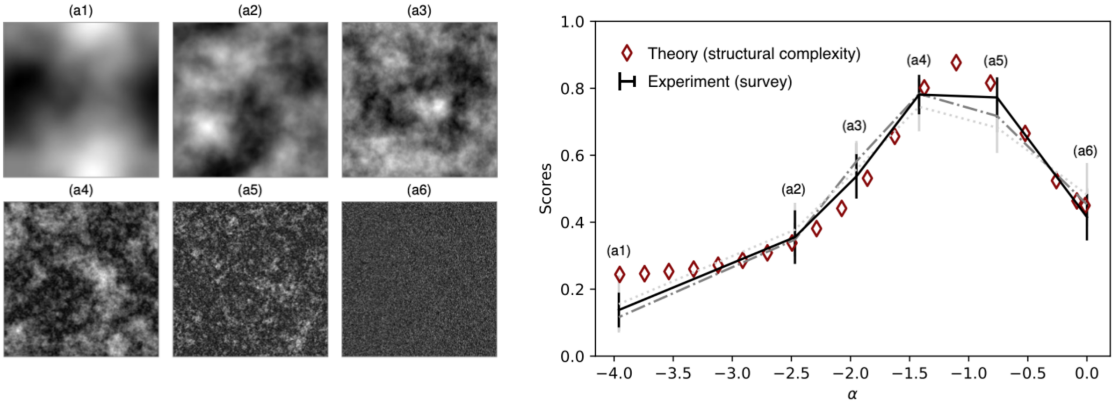

Figure 1: Structural Complexity and image appreciation (right) of the gray-scale random images of increasing entropic complexity (left), from [2]

The goal of this internship is to address the question of colour appreciation. By generalizing the above procedure with generic color images (see Fig. 2) we aim at establishing universal preferences, if any, on colour distributions. Are there optimal colour spatial distributions? If so, do they match that of natural images? We shall confront different color space representations (RGB, CIELAB, HSL, HSV) to assess which maximise preference gradients [3]. For inspiration, see the recent work on the analysis of Monet paintings [1], in which the authors find strong logarithmic correlation.

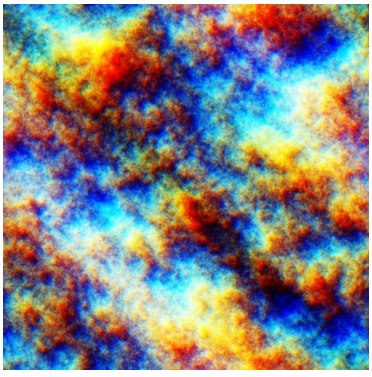

Figure 2: Artificially generated fractal surface, where each RGB channel results from the lagged propagation of random wave modes.

The internship will be held within the CFM Chair of Econophysics and Complex Systems at Ecole polytechnique (www.econophysix.com) in collaboration with Alexandre Darmon (www.artinresearch.com). A reasonable background in statistical physics, data analysis and Python is advised.

References

[1] Jaron Kent-Dobias. Log-correlated color in Monet's paintings. September 2022.

[2] Samy Lakhal, Alexandre Darmon, Jean-Philippe Bouchaud, and Michael Benzaquen. Beauty and structural complexity. *Physical Review Research*, 2(2):022058, June 2020. Publisher: American Physical Society.

[3] O. Lezoray, A. Elmoataz, and C. Meurie. Mathematical Morphology in Any Color Space. In *14th International Conference of Image Analysis and Processing - Workshops (ICIAPW 2007)*, pages 183–187, September 2007.