



Efficient coding and processing and its consequences on signal evolution

Neuroscience, Computer Vision & Evolutionary Biology

POST-DOCTORAL POSITION IN MONTPELLIER (FRANCE)

We are looking for a post-doctoral researcher to work on the role of efficient neural coding and processing in the evolution of communication signals. The visual system has many adaptations to efficiently code and process environmental visual stimuli, but it is unclear how these adaptations in turn contribute to shape the design of communication signals. In this highly promising project, which lies at the interface between neuroscience, computer vision, evolutionary biology and the humanities, we will use various approaches for modelling efficient coding and processing (e.g., sparse coding, efficient categorization, predictive coding and other models of visual attention) to analyse whether and how these adaptations can explain both visual preference biases in Humans and some of the universal properties that characterise sexual signals as well as artworks. The post-doctoral researcher will also be able to extend her/his findings to non-human animals by contributing to a NSF-funded project on the role of efficient coding in the evolution of male colouration in fishes conducted at the University of Maryland.

This project offers an opportunity to a young researcher to develop a unique and promising research area having ground-breaking consequences for evolutionary biology –by exploring the predictive power of the models of sensory bias in signal evolution; for the humanities –by offering a functional model to the fluency theory of aesthetics; and for vision sciences – by understanding how environmental stimuli shape vision.

Skills needed – The candidate should have a PhD in vision neuroscience with strong skills in computing, or in computer vision with a strong interest in biological models of vision. A good knowledge in modelling visual attention (e.g., saliency maps), in Bayesian modelling, in sparse coding and in cognitive models of vision (e.g., HMAX) would be appreciated. The candidate should also have an interest in evolutionary biology, especially sexual selection, and ideally for experimental aesthetics.

Eligibility – Following the LabExs requirements, the candidate shall not have carried out her/his thesis in one of the three LabExes Agro, CeMEB and NUMEV. The candidate must have obtained her/his PhD in a 6-year period preceding her/his application, and should not have spent more than a year of post-doc in France over the past 3 years.

Administrative information

Source of funding – The three Laboratories of Excellence (LabEx) Agro-CeMEB and NUMEV

Location – Laboratory Charles Coulomb (L2C - UMR5221) and Centre of Evolutionary and Functional Ecology (CEFE - UMR5175), both in Montpellier, France.

Duration – 18 months, starting from summer 2017

Application deadline – June 15th, 2017

Contacts

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Key words

Theory of information, efficient coding, sparseness, cognitive models of vision, convolutional neural networks, HMAX, visual attention, communication, sexual selection, fluency theory of aesthetics, artworks

Relevant literature



- Enquist, M., & Arak, A. (1993). Selection of exaggerated male traits by female aesthetic senses. *Nature*, 361(6411), 446.
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- Olshausen, B. A., & Field, D. J. (1996). Emergence of simple-cell receptive field properties by learning a sparse code for natural images. *Nature*, 381(6583), 607.
- Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and social psychology review*, 8(4), 364-382.
- Renoult, J. P., Bovet, J., & Raymond, M. (2016). Beauty is in the efficient coding of the beholder. *Royal Society Open Science*, 3(3), 160027.

