Coffee@Beyond

Transdisciplinary explorations at the edge of knowledge...

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Free coffee will be provided

APRIL 11TH, 2016

3:00pm Biodesign AL1-10/14 (Lower Level)

"An Information Algorithmic Calculus for Reprogramming Life"

Abstract:

Techniques from graph theory, statistics, and entropy have been adapted and often successfully used in different disciplines for characterizing complex data in the language of networks. Techniques from statistical mechanics have also been useful to describe how different generative network models produce poisson, small-world, or scale-free networks. It has however proven difficult to find universal global measures of network complexity and to use those descriptions to causally intervene in networks in a predictive manner. However, recursive networks can be seen as unfolding computer programs. In this talk I will explain how a novel algorithmic calculus can be exploited to reprogram systems, in particular genetic regulatory networks, showing that Shannon's entropy, Kolmogorov-Chaitin's complexity and Solomonoff-Levin's algorithmic probability can quantify different properties of static and evolving (labelled and unlabelled) graphs. I will thus introduce concepts and tools at the intersection of algorithmic information theory, network biology and dynamical systems with powerful application to reprogramming and steering biological systems thereby potentially providing a better understanding into how nature itself programmed life in the first place.

Hector Zenil

Hector Zenil is interested in the algorithmic content of causal systems in connection to the problem of the observer, and in the potential of such tools to understand the underlying mechanisms of life to manipulate and reprogram biological systems. His work focuses in devising and translating these concepts from computability, complexity and information theory to areas of application such as molecular and structural biology, genetics and spatial computing. After a PhD in Theoretical Computer and in Philosophy of, he joined the Behavioural and Evolutionary Lab at the University of Sheffield as a Research Associate. Later he joined the SciLife Lab and the Unit of Computational Medicine at the Center for Molecular Medicine, Karolinska Institute in Stockholm as Assistant Professor and the Department of Computer Science at the University of Oxford as JTF Research Fellow. He is also the head of the Algorithmic Nature Group and has been before a visiting scholar/professor at MIT/NASA, Carnegie Mellon University and the National University of Singapore.

Biodesign

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