Practical PHI toolbox for integrated information analysis

Jun Kitazono and Masafumi Oizumi (Araya Inc.)

Email: oizumi@araya.org

Last update: June 9th, 2017

This toolbox provides MATLAB codes for computing practical measures of integrated information, Φ^*, proposed in (Oizumi et al., 2016, PLoS Comp), and Φ_G, proposed in (Oizumi et al., 2016, PNAS) under the assumption that the probability distribution of data is a Gaussian distribution. Integrated information quantifies the amount of information that is integrated within a system. Please refer to the following papers for the technical details of Φ^* and Φ_G.

Oizumi, M., Amari, S, Yanagawa, T., Fujii, N., & Tsuchiya, N. (2016). Measuring integrated information from the decoding perspective. PLoS Comput Biol, 12(1), e1004654. http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1004654

Oizumi, M., Tsuchiya, N., & Amari, S. (2016). Unified framework for information integration based on information geometry. Proceedings of the National Academy of Sciences, 113(51), 14817-14822. http://www.pnas.org/content/113/51/14817.short

You can freely use this toolbox at your own risk. Please cite the papers above and this toolbox (doi:10.6084/m9.figshare.3203326) when the toolbox is used for your publication.

The core function for computing Φ^* is "phi_star_Gauss.m" and the core function for computing Φ_G is "phi_G_Gauss". Please first look at "phi_demo.m", which is a simple demonstration code, to see how the core functions should be used.

The toolbox contains "minFunc" written by Mark Schmidt, which is needed for solving unconstrained optimization. Please refer to the original webpage for the details.
http://www.cs.ubc.ca/~schmidtm/Software/minFunc.html

We are planning to add more functions to this toolbox in the near future such as finding Minimum Information Partition (MIP) and complex, which are important concepts in Integrated Information Theory (see Tononi, 2008, Biol Bull for example). Comments, bug reports, and proposed improvements are always welcome.