*4th Inverse Problems, Design and Optimization Symposium* (IPDO-2013)
*Albi, France, June 26-28, 2013*

# Locating the Source of Diffusion in Large-Scale Networks

**Pedro Pinto, Patrick Thiran and Martin Vetterli**
[a] *School of Computer and Communication Sciences, Station 14, EPFL, CH-1015 Lausanne, Switzerland.*

## EXTENDED ABSTRACT

We will survey some recent results on the localization of the source of diffusion in a network. There has been significant effort in studying the dynamics of epidemic propagations on networks, and more particularly on the forward problem of epidemics: understanding the diffusion process and its dependence on the rates of infection and cure. We address here on the inverse problem of inferring the original source of diffusion, given the infection data gathered at some of the nodes in the networks. Indeed, because of the tremendous size of many real networks, such as the Internet or human social graphs, the state of all nodes in a network cannot in general be observed. We show that it is fundamentally possible to estimate the location of the source from measurements collected by sparsely placed observers. We present a strategy that is optimal for arbitrary trees, achieving maximum probability of correct localization. We describe efficient implementations with complexity O(N^a), where a=1 for arbitrary trees and a=3 for arbitrary graphs. In the context of several case studies, we determine how localization accuracy is affected by various system parameters, including the structure of the network, the density of observers, and the number of observed cascades. This work has been published in [1].

## REFERENCE

1. P. C. Pinto, P. Thiran and M. Vetterli, "Locating the Source of Diffusion in Large-Scale Networks', *Phys. Rev. Letters*, **109**, 68702, (2012).