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How many are we? Using mobile phones to estimate population size and density

Abstract

Is it possible to estimate the size of a population by making an opportunistic usage of data collected on bluetooth phones? If these phones are equipped with GPS devices, can we also estimate the population density? We conduct an experiment where 10 attendees of an open-air music festival are acting as sampling agents sending and collecting Bluetooth probes. We then construct a parametric statistical model on the contact patterns to estimate the total number of visible Bluetooth phones in the festival area. By comparing the estimate obtained from the model, with ground truth information provided by probes at the entrances of the festival, we find that the total population can be estimated with a surprisingly low error (1.26% in our experiment), given the small number of agents compared to the area of the festival, to the population size and to the fact that they are regular attendees who move randomly (and not to maximize coverage). We then extend the model to jointly estimate population size and density (joint work with Farid M. Naini (EPFL), Olivier Dousse (Nokia) and Martin Vetterli (EPFL)).

Biographical Sketch

Patrick Thiran is a Professor at EPFL. He received the electrical engineering degree from Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium, in 1989, the M.S. degree in electrical engineering from the University of California at Berkeley, USA, in 1990, and the Ph.D. degree from EPFL, Lausanne, Switzerland, in 1996. He held visiting positions with Sprint Advanced Technology Labs, Burlingame, CA and Nokia, Helsinki, Finland.

His research interests include communication networks, performance analysis, dynamical systems, and stochastic models. He is currently active in the analysis and design of wireless and PLC networks, in network monitoring, and in data-driven network science.

He served/s on the editorial boards of the IEEE Transactions on Circuits and Systems (1997-99), of the IEEE/ACM Transactions on Networking (2006-10) and of the IEEE Journal on Selected Areas in Communication (2013-). He was/is on the program committee of different conferences in networking, including ACM Sigcomm, Sigmetrics, IMC, CoNext and IEEE Infocom. He was TPC chair of AMC IMC 2011 and CoNext 2012. He was the recipient of the 1996 EPFL Ph.D. award and of the 2008 Crédit Suisse Teaching Award.