

Title: On Optimal Distributed Sampling and Detection of Poisson Processes

Abstract:

We study the problem of distributed sampling and detection of remote point processes. A remote source, modelled as a homogeneous Poisson counting process (PCP) and with one of two possible intensity values, is observed at multiple remote observers in noise. The observers have a ‘sampling’ constraint which limits them from forwarding the entirety of their observations to a centralized fusion center, or ‘detector’. More precisely, the observers or samplers can remain active or ON for a fixed fraction of time over a fixed, known and finite time window. The detector seeks to design the sampler ON times for the distributed samplers jointly so as to optimize the overall accuracy of its detection procedure. We seek to understand this design of sampling-cum-detection strategies jointly. Our problem finds application in settings where the distributed agents communicating with a centralized fusion center are energy constrained or limited via finite capacity connecting links thereby limiting communication capability.

Our main contribution is the complete characterization of optimal strategies for joint sampling and detection of the remote source. We first present optimal strategies for the two-sampler configuration, and then extend the characterization for the K-sampler, $K > 2$, case. Our results reveal a fundamental tension in the design of distributed sampling strategies between (i) *overlapped distributed sampling for better noise rejection* to obtain concurrent but independently corrupted source observations at multiple samplers, and (ii) *disjointed distributed sampling for better source discovery*. Our results also reveal an interesting fact that two simultaneously active samplers are necessary and sufficient for complete noise-rejection.

This is joint work with Vanlalruata Ralte (IIT Kharagpur), Stefano Rini (NYCU Taiwan).

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Speaker: Amitalok J. Budkuley (IIT Kharagpur)

Bio:

Amitalok J. Budkuley is an assistant professor in the Dept. of Electronics and Electrical Communication Engineering at the Indian Institute of Technology Kharagpur since 2019. He received his B. Engg. degree in Electronics and Telecommunications Engineering from Goa University, in 2007, and his M. Tech. and Ph. D. degree in Electrical Engineering from the Indian Institute of Technology Bombay, Mumbai, India in 2009 and 2017 respectively. In between, he spent some time in industry working with Cisco Systems Inc.. From 2016 to 2019, he was at the Dept. of Information Engineering, The Chinese University of Hong Kong (CUHK) as a research assistant and then as a post-doctoral fellow.

His research interests include information theory, security and cryptography, signal processing for communication and control, and wireless communications.