Ph.D. Project: Distributed Learning for IoT Networks

Work Package 3, task 3.2

Advisors: Cássio G. Lopes and Rodrigo de Lamare

Abstract

This project proposes the development of distributed learning algorithms that are resilient to outages, and operate with short-wordlength data. The algorithms will use novel techniques for distributed learning that allow a network to operate at the optimum level, even when the topology is unknown and time-variant, and when the quality of the data (signal-to-noise ratio) at each node varies. The algorithms will be designed taking into consideration constraints imposed by the network, such as bandwidth constraints, latency, quantization, sampling rate and topology.

1 Scholarship Requirements

The fellowship will be granted to a student of PPGEE/EPUSP (Graduate Program in Electrical Engineering (PPGEE) - Escola Politécnica da Universidade de São Paulo). Information about the application process for PPGEE is available at `http://ppgee.poli.usp.br/?page_id=1914`.

Notice the application period is 02/05/2019 to 17/05/2019.

The Direct Doctorate scholarship is intended for students who are regularly enrolled in stricto sensu post-graduate programs of public or private higher education institutions in the State of São Paulo, without the title of master, for the development of a research project that results in thesis. The analysis of direct doctoral scholarship applications prioritizes a candidate who has just graduated, within the normal term of his / her term with an excellent academic record and, preferably, a successful scientific initiation stage. More information at: `http://www.fapesp.br/bolsas/dd`

2 Goals

One of the exciting possibilities of IoT devices is the possibility of fusing information gathered by nearby devices, thus creating up-to-date models of the environment in which the devices are immersed. In order to fully take advantage of this possibility, distributed learning algorithms that are optimized for IoT networks are fundamental.

3 Methods

The student will initially perform a literature review in the subjects of adaptive filtering and online estimation, with emphasis on low-complexity and energy-efficient algorithms, and algorithms designed especially for IoT applications. During the initial phase, the student will also take courses on stochastic processes, statistical signal processing, sensor networks, adaptive filtering and hardware design. These two tasks will be completed during the first year of work. At the beginning of the second year the student will take the qualifying exam, and start the research in earnest, first implementing known algorithms in simulations that takes into account the particularities of the IoT environment. At the end of the second year, the student should propose the first new algorithms for energy-efficient estimation, trying to derive methods that allow using smaller wordlengths in coefficients and in the input A/D conversion, while sacrificing as little of the performance as possible. In the third and fourth years, the student will work on developing theoretical models for the designed algorithms, on using these models to devise improved algorithms, and on writing papers and the dissertation. We expect that the research will result in two or three conference and two journal papers.