Post-Doctoral Project: Energy-efficient physical-layer algorithms and channel coding for IoT

Work Package 4, task 4.1

Advisors: Vítor H. Nascimento and Rodrigo C. de Lamare

Abstract

This project proposes the study of physical-layer and channel coding schemes that are suitable for IoT networks, considering their design and decoding complexity, compared to their performance. The channel capacity, transmit and receive processing tasks, and code design when using coarse quantization will also be considered.

1 Fellowship Requirements

Post-Doctoral fellowship is aimed at distinguished researchers with a recent doctorate degree and a successful research track record. More information about FAPESP requirements are available at `http://www.fapesp.br/en/postdoc`.

The fellow will be located at Escola Politécnica da Universidade de São Paulo.

2 Goals

Coding schemes and physical-layer algorithms used in IoT networks must take into account the need for low power consumption, and be flexible to allow for the different requirements in latency and rate that will appear in different applications. This project proposes the investigation of the reliability-complexity tradeoff of three families of error-correcting codes (LDPC, polar and BCH), and compare their performance under a restriction on the number of operations along with associated physical-layer algorithms associated with transmit and receive processing tasks. These results will be used to determine the most promising pairs considering coding and decoding and transmit and receive processing under different conditions of use (node-to-node, node-to-control center). Finally, the designs of the best pairs will be analyzed and adapted for IoT networks.

3 Methods

The researcher will initially perform a literature review in the subjects of physical-layer algorithms including transmit and receive processing functions, coding and the particularities of IoT networks (including the use of coarse quantization). This task will be completed during the first year of work. In the second year the researcher will start comparing the reliability-complexity tradeoffs of the three error-correcting code families. In the third and fourth years, the researcher will work on determining the best pairs and adjusting them to each other, on proposing code designs suitable for IoT networks, and on testing the proposed code designs. We expect that the research will result in three to six conference and three to four journal papers.