Subject:
Implementation of AI techniques in wireless communicating sensor networks: applications to healthcare

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Abstract:
The aim of the thesis will be to develop a node of a wireless sensor network. This device will have the role of collecting physiological or environmental data and will integrate functions for sorting and analyzing data from deep learning methods, which will reduce the total energy consumption of the system thanks to intelligent selection of the data to be transmit while increasing the relevance of the data reported.

Skills:
Embedded electronics, informatic

Keywords:
AI, IOT, Ehealth, neural network
Currently, AI and neural networks are the subject of numerous developments both in large industrial groups (Google, Intel, Microsoft) and in laboratories. Several choices are explored, mainly at the server or large infrastructure level, which can assume neural networks with very large number of layers. Among this development choices are solutions based on FPGA (path chosen by Microsoft) or specialized ASIC chips (Google), these supported solutions are advancing rapidly and making it possible to process and analyze data in an increasingly efficient manner.

In the context of low cost and large deployment wireless sensor networks, it is advantageous to use these neural networks in order to better manage the data at the source and thus minimize the transmission of irrelevant data. By bringing the neural analysis closer to the sensors, they should reduce their need for very expensive wireless transmission, both energetically and in bandwidth terms. Indeed, in certain fields it has been shown that this approach could increase the lifetime of the network by 60% [1] and in other cases decrease the number of measurements by 30% [2] for the same precision.

The use of ASICs and FPGA neural network solutions, no longer only at the level of the data server, but also at the level of the communicating sensor node will therefore be explored within the framework of this thesis work. The objective will be to assess their relevance both in the total energy balance of the system but also on the analysis performance of the complete system since the databases of such sensor networks should prove to be more relevant for analyzes and deep learning treatment. As has already been shown in another context, this analysis should make it possible to detect warning signals more precisely [3].

This analysis will be carried out in the context of physiological data from biomedical sensors which have the relevant characteristics to demonstrate the validity of the approach: large amount of data and complex analysis.
References:


How to candidate?
Contact the supervisor and Co-advisor