PHD THESIS SUBJECT PROPOSAL #27-8

Title: Co-design of an intelligent adaptive front-end for decoding complex physiological signals in noisy environments

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Proposal Summary:

The reliable acquisition of very low-amplitude physiological signals such as ECG, EEG, EMG, or PPG is essential for portable, wearable, and implantable biomedical systems. These signals are typically collected in environments subject to various sources of electronic noise, electromagnetic interference, motion artifacts, variations in electrode impedance, and disturbances related to usage conditions. In a conventional acquisition chain, the analog front end is typically designed for a predefined operating scenario and handles signal amplification, filtering, and matching prior to analog-to-digital conversion. However, this fixed architecture may involve trade-offs between noise level, gain, dynamic range, bandwidth, power consumption, and robustness when acquisition conditions change.
This doctoral thesis proposes a co-design approach combining an adaptive discrete electronic front-end, analog-to-digital conversion, and deep learning algorithms running on an NVIDIA Jetson platform dedicated to edge AI. The main idea is to no longer view analog conditioning as a fixed chain, but rather as a system capable of adapting its parameters based on the quality of the observed signal.