

**Ph.D. in Information Technology
Thesis Defense**

October 2nd, 2026

At 02:00 p.m.

Conference Room Emilio Gatti - Building 20

Antonio COVIELLO – 38th Cycle

**DESIGN ANALYSIS AND IMPLEMENTATION OF CNN-LIKE METHODS FOR ENG
SIGNAL CLASSIFICATION**

Supervisor: Prof. Maurizio Magarini

Abstract:

When peripheral nerves are damaged, communication between the periphery and the brain is interrupted, generating motor and sensory deficits. Treatments currently exist that attempt to solve the problem; however, they have limited effectiveness, which varies depending on many factors. To guarantee a solution, in recent years new implantable biomedical devices have been developed that attempt to solve these problems by directly bypassing the lesion. In order to create a device of this kind, it is first necessary to better understand the signal by studying and analyzing it through databases available online, and once its characteristics have been understood, it will be possible to create a device that can truly measure the signal. The signal measured from the nerve, the electroneurogram (ENG), is a signal that presents some critical issues, such as: low intensity, relatively high overlapping noise, reduced selectivity during acquisition, and strong biological variability. To address these limitations, a pipeline was first developed that could clean the signal effectively, and then convolutional type classifiers were created in order to classify it. ENGNet and IT proved to be the most promising networks, reaching F1-score levels of 94.5% and 93.1% respectively, while maintaining high execution speed, below 5ms, and a low number of parameters (5000 for ENGNet). Once the nature of the ENG signal had been understood, a flexible multimodal platform capable of sampling biological signals of different nature, called PNRD, was developed. Initial measurements were carried out that made it possible to measure superficial signals such as ECG, EOG, sEMG and EEG, demonstrating that the measurement is possible. PNRD therefore represents an experimental basis that can be adapted, by changing electrodes and filters, in future works also for the study of ENG signals.

PhD Committee

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