PhD Proposal

Analysis and evaluation of surgical skills by EEG and machine learning

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Topic	

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Medical simulation is a field that aims to improve training of health professionals before their first contact with the patient and throughout their professional life. The challenges around simulation for learning include the development of realistic systems, easily configurable, at limited cost, the study of technical and non-technical skills and the design of reliable metrics for quantitative and objective performance evaluation. The objective of this project is to study the relevance of electroencephalographic (EEG) measurements for the analysis of surgical skills. Different categories of measures were used to study surgical skills. Observation is most common with, for example, the development of standardized scores (such as OSATS, GOALS, NOTATS, ...). The limits are its subjectivity and the need for observers. The use of sensors for automatic and quantitative skill analysis is an important research topic. Sensors can be related to 1) the location of the used instruments or of people using position sensors, 2) automated observation by video analysis with the development of computer vision methods, or 3) physiological measurements. Among the latter, the literature has shown some studies using measures of brain activity. This type of measurement has a very strong potential to allow access to the characterization of cognitive aspects of performance, fundamental in expertise but difficult to grasp with other sensors. Recently, thanks in particular to the emergence of brain/computer interfaces (BCI), light, wireless and low-cost systems have appeared.

Within the framework of this PhD thesis, thanks to an automatic learning approach, the doctoral student will study the relationships between EEG measurements and surgical skills, within the framework of simple training sessions. We will also study performance and measurements in degraded conditions that may involve cognitive skills. This project will take place in the context of a recently created surgical school at the Faculty of Medicine in Rennes with a research-oriented platform (including EEG system, position sensors, and organic and non-organic simulators).