Body signal analysis for monitoring fatigue in first responders

PhD Thesis Proposal

Proposed supervisor: Miguel Tavares Coimbra
Host Institution: IT – Instituto de Telecomunicações
Location: DCC, FCUP
Main Research Area: Signal Processing, Pattern Recognition

Introduction:
The goal of the Vital Responder research project [1] is to explore the synergies between innovative wearable technologies, scattered sensor networks, intelligent building technology and precise localization services to provide secure, reliable and effective first-response systems in critical emergency scenarios. Critical events, such as natural disaster or other large-scale emergency, induce fatigue and stress in first responders, such as fire fighters, policemen and paramedics. There are distinct fatigue and stress factors (and even pathologies) that were identified among these professionals. Nevertheless, previous work has uncovered a lack of real-time monitoring and decision technologies that can lead to in-depth understanding of the physiological fatigue processes and to the development of adequate response mechanisms.
In this PhD proposal, the student will be integrated into the Vital Responder project [1] and work on the data analysis task, with the objective of mathematically quantifying the effects of fatigue using signal processing methodologies. Furthermore, we expect that such research may lead to the automatic detection and prediction of critical fatigue situations.

Objectives and Proposed Methodology:

- Assist the creation of a large database of sensor data obtained from first responders in real situations.
- Consult clinical partners for expected motion and muscle behaviour when faced with fatigue.
- Quantify the short and long-term effects of fatigue on a first responder's gait.
- Use signal processing and pattern recognition methodologies for developing detectors of body fatigue.
- Publish all results in high-impact journals and conferences.

References:
[1] Vital Responder – CMU/Portugal Research Project – Funding: 519.456€

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