Developing a new index of postural stability: light-touch threshold

Motivation and application domain
Fingertip contact influences human postural control. Such additional tactile information allowed the subjects to significantly reduce the size of sway movements, measured by different postural parameters, such as sway length or sway area. It was also found that very small contact forces, of the order of 1N, could elicit this phenomenon and, at such level of interaction, purely biomechanical explanations would not match the findings while suggesting a multi-sensory integration process.

General objectives and main activities
The rationale of the thesis is to extend the light-touch paradigm by evaluating the threshold of the contact force capable to elicit a sizable reduction of sway in order to use it in the clinical settings, in particular in neuromotor pathologies (for example multiple sclerosis, Parkinson) that also affect sensory channels and sensorimotor integration. The experimental setup will consist of a force platform and a simple haptic interface for applying a controlled contact force. The setup will be applied first to control subjects, in order to evaluate the robustness of the light-touch threshold estimation. In the final part of the thesis a preliminary test will be performed with a few patients for evaluating the feasibility of such innovative method in the clinical setting. The full clinical validation would follow, in a following thesis.

Training Objectives (technical/analytical tools, experimental methodologies)
The students will learn
- to evaluate parameters of postural sway from the force platform
- to control the haptic interface
- to use techniques of advanced statistical data analysis
- to improve their knowledge of Matlab and C++
- to work in an international team with people with different backgrounds (engineers, physicians, physical therapists)

Pre-requisite abilities/skills: Matlab and C++ programming

Maximum number of students: 1