UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Equilibrium control with a minimal support basis: the case of balancing on a tight-rope

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Description

Motivation and application domain

In recent years the stabilisation of the upright posture against the direct destabilising influence of gravity as well as the indirect destabilising effect of delayed feedback control has been the object of many studies, focusing on the synergistic contribution of muscle stiffness and the exploitation of the saddle-like dynamics of the inverted pendulum approximation of the standing human body via an intermittent feedback control strategy.

General objectives and main activities

Recently it was found that the single inverted pendulum approximation is not a real limit because the same intermittent control policy can explain ankle-joint coordination. Moreover, it was found that the same control paradigm applies also to the CIP (Cart Inverted Pendulum) stabilisation that involves a completely different biomechanical system but a similar dynamical task. The goal of the proposed thesis is to verify to which extent such generalizing capability of the brain extends also to still another complex and challenging equilibrium control paradigm, namely the case of balancing on a tight-rope. The thesis work will include an experimental part, based on motion capture (Vicon system) for acquiring information about the relative motion of the body and the balancing bar, and a modeling part, aiming at the simulation of an intermittent control model for reproducing the recorded sway movements.

Training Objectives (technical/analytical tools, experimental methodologies)

- motion analysis sytem
- signal processing / data analysis
- modelling/simulation
- Research skills such as methods design, data interpretation and analysis will also be learned during this project.

Place(s) where the thesis work will be carried out: IIT (Erzelli), bioing. lab (DIBRIS)

Additional information

Maximum number of students: 1