

Inverse optimal control

Frédéric Jean

An inverse optimal control problem is stated as follows. Assume that we are given a control system and a class L of cost function. With each cost function in L , one can associate the set of solutions of the corresponding optimal control problem. The inverse optimal control problem consists in determining an inverse of this mapping. This kind of problem arises naturally in the study of human motor control, for determining which law governs a particular body movement, such as arm pointing motions or goal-oriented locomotion. Indeed, a nowadays widely accepted paradigm in neurophysiology is that, among all possible movements, the accomplished ones satisfy suitable optimality criteria. Once a dynamical model of the movements under consideration is given, as well as a set of recorded experimental data, one is then led to solve an inverse optimal control problem.

In this talk we will present the approach we have developed to study this problem in the case of movements of the arm and of goal-oriented human locomotion. We will discuss the well-posedness of this inverse problem, and see how the cost structure may be deduced from qualitative properties highlighted by the experimental data. We also show how this approach allows to determine the natural duration of some human motions.