Biography

Yasuharu Koike received B.S., M.S., and Dr. Eng. degrees from Tokyo Institute of Technology, Tokyo, Japan in 1987, 1989, 1996. From 1989 to 1998, he worked at Toyota Motor Corporation. From 1991 to 1994, he transferred to Advanced Telecommunications Research (ATR) Human Information Processing Laboratories, Kyoto, Japan. In 1998, he moved to the Precision & Intelligence Laboratory, Tokyo Institute of Technology, Tokyo, Japan, where he is currently a professor of Institute of Innovative Research.
He was a researcher of Precursory Research for Embryonic Science and Technology (PRESTO), Japan Science and Technology Corporation from 2000 to 2004 and of CREST, JST since 2004 to 2014. His research interests include human motor control theory, human interface, brain machine interface and their applications. He is a member of Society for Neuroscience, IEICE, VRSJ and JNNS.

Force field adaptation based on musulo-skeletal computational model

Abstract:
The end point control hypothesis was rejected by Bizzi's experiment, but if the existence of a forward dynamics model is assumed, a hypothesis which does not require trajectory planning is still attractive. The CNS learns how to generate reaching movements toward various targets in the workspace. However, it is difficult to perform various movements with high accuracy using a single feedback controller. Since the gravitational force acting on the arm depends on the posture of the arm, the force required to hold the hand at the target varies with the target position. For these reasons, there is no guarantee that a single feedback controller trained for a particular target would generate accurate reaching movements to other targets. Here we introduce an additional controller called an inverse statics model, which supports the feedback controller in generating reaching movements toward various targets. It handles the static component of the inverse dynamics of the arm. That is, it transforms a desired position (or posture) into a set of motor commands that leads the hand to the desired position and holds it there. Note that the arm converges to a certain equilibrium posture when a constant set of motor commands is sent to the muscles because of the spring-like properties of the musculoskeletal system.
This computational learning-controlling model can be used to learn the dynamics of the environment, such as force field without any prior knowledge. So velocity force filed was applied to this model. The trajectory converged to the straight line without a trajectory planning. This is first demonstration to show learning result for force field adaptation without trajectory planning.