A Hierarchical Control Architecture for High-Speed Visual Servoing

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Abstract— The efferent signal is the impulses from the brain to muscle or organ tissue. The afferent signal is the sensation that transmits the state of peripheral body parts to the brain. The motor control architectures of biological systems have hierarchical structures in which the efferent/afferent signals interact. Thanks to this architecture flexible and reflective action is realized. In this paper a hierarchical control architecture for high-speed visual servoing is proposed on the basis of a biological signal interaction model. The proposed architecture has three modules: servo, motion planner and adaptation. The afferent signal corresponds to the feedback signal from the sensors; the efferent signal corresponds to the motion command; and these signals interact in a hierarchical manner that realize a parameter adaptation mechanism. A series of dynamical tasks: tracking/grasping/handling of a moving object is implemented as an example of high-speed visual servoing. The system contains DSP network, high-speed active vision, dextrous hand and 7 DOF manipulator. Real time experiments are conducted and the results exhibit the responsiveness and flexibility of the proposed hierarchical architecture.