Computational Neuromechanics

Francisco Valero-Cuevas
Professor of biomedical engineering and biokinesiology and physical therapy
University of Southern California

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While neuro-prosthetics has received much attention recently, current technological advances can also be applied to an older and equally pressing problem. Versatile sensorimotor function is a vital contributor to quality of life that is very commonly degraded by aging and numerous neurological conditions. My work has been devoted to extending our technical and analytical tools to confront this age-old reverse engineering problem. I will describe some of our core technologies including innovative physiological recordings from the hand, muscles and brain; novel experimental paradigms for manipulation; a unique mechatronic system to drive the tendons of actual (unembalmed) cadaveric hands; data-driven model inference; and a mathematical/computational framework based on computational geometry to understand motor versatility, muscle redundancy, and robustness to muscle dysfunction.

By presenting several examples of successful application of these technologies, I will illustrate our current understanding of the neuro-mechanics of manipulation, future directions and cross-fertilization efforts to other areas of engineering, neuroscience and medicine.