Séminaires ISIR

Jeudi 27 Mars 2014 à 11h00

Gerald E. Loeb

Campus Jussieu, 4 place Jussieu, Paris
Salle de réunion H20

Title : Biomimetic Strategies for Machine Touch

Abstract : The human hand can identify and manipulate unknown objects far better than any robot. These capabilities require a sophisticated sense of touch. There are sophisticated technologies to capture and analyze sounds and images but touch is more challenging. Biological touch requires interpretation of sensory data that depends as much on the parameters of each exploratory movement and the mechanical properties of the fingertip as on the properties of the object being explored. I will demonstrate a biomimetic tactile sensor called the BioTac that has most of the mechanical properties and sensory modalities of a human fingertip. We developed an algorithm called Bayesian Exploration to optimize the selection of exploratory movements and the interpretation of the resulting tactile data. We applied the sensor and the algorithm to a very challenging problem in blind identification of 117 different textured materials by a specialized robot. We obtained results that far surpassed human performance - 95% accuracy in a median of 5 exploratory movements and the ability to discriminate between pairs of objects that humans found to be indistinguishable. Now we are applying similarly biomimetic strategies to robots that can explore and identify properties such as hardness, friction, contours, edges and thermal effusivity. Developing such robots provides powerful insights into how the anatomical details that we copied from the human finger (deformable skin, fingerprints, fingernail, apical tuft, etc.) enable the remarkable haptic perception and dexterity that humans enjoy. Embodying perceptual algorithms in robots may provide a way to test theories of neural computation that are extremely difficult to train and observe in experimental animals.

Short Bio : Dr. Loeb was born in New Brunswick, NJ, received his B.A. ('69) and M.D. ('72) from Johns Hopkins University, and trained in surgery at the University of Arizona. He spent 15 years in the Laboratory of Neural Control at the National Institutes of Health and 12 years at Queen's University where he was Professor of Physiology and Director of the Bio-Medical Engineering Unit. He served as Chief Scientist (consulting) for Advanced Bionics Corp. of Sylmar, California, from 1994-1999. Dr. Loeb joined USC in September, 1999. He has published over 250 journal articles and chapters, a book on electromyography, and holds 58 patents.