Towards Reproducing Humans' Exquisite Dexterity and Reactivity

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Abstract: Our homes, offices and urban surroundings are carefully built to be inhabited by us, humans. Tools and furniture are designed to be easily manipulated by the human hand. Floors and stairs are modeled for human-sized legs. For robots to work seamlessly in our environments they should have bodies that resemble in shape, size and strength to the human body, and use these with the same dexterity and reactivity.

This talk will provide an overview of techniques developed at LASA to enable robust, fast and flexible manipulation. Learning is guided by human demonstrations. Robust manipulation is achieved through sampling over distributions of feasible grasps. Smooth exploration leverages on complete tactile sensing coverage and learned variable impedance strategies. Bi-manual coordination offers ways to exploit the entire robot's workspace. Imprecise positioning and sensing is overcome using active compliant strategies, similar to that displayed by humans when facing situations with high uncertainty.

The talk will conclude with examples in which robots achieve super-human capabilities for catching fast moving objects with a dexterity that exceeds that displayed by human beings.

Biography: Professor Aude Billard is head of the Learning Algorithms and Systems Laboratory (LASA) at the School of Engineering at the EPFL. She received a M.Sc. in Physics from EPFL (1995), a MSc. in Knowledge-based Systems (1996) and a Ph.D. in Artificial Intelligence (1998) from the University of Edinburgh. She was the recipient of the Intel Corporation Teaching award, the Swiss National Science Foundation career award in 2002, the Outstanding Young Person in Science and Innovation from the Swiss Chamber of Commerce and the IEEE-RAS Best Reviewer Award. Her research on human-robot interaction and robot learning from human demonstration was featured in numerous premier venues (BBC, IEEE Spectrum, Wired) and received numerous best paper awards at major robotics conferences, among which ICRA, IROS and ROMAN, as well as the 2015 King-Sun Fu Memorial Award for the best 2014 IEEE Transaction in Robotics paper.

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