Human not monkey robotics: Neuro-inspired object manipulation with dextrous hands

Dextrous robotics research is focussed on grasping as a key ability of human-like operations we would like to achieve with robotics, however grasping is already mastered by monkeys. In contrast, the human hand has unique capabilities of complex object manipulations., e.g. to turn a screwdriver or knead the dough (Thomik, Fenske & Faisal 2015). In this research project, we want to focus on human-level robotics of in-hand object manipulation (Konnaris, Thomik & Faisal 2016), towards a better understanding of the human hand control mechanism which enables this unique movement dexterity. To that end, we bring together two leading research groups working from the two ends of this problem: 1. Prof David Franklin, TUM - In-hand manipulation and the human hand's control of mechanical properties (stiffness/impedance, forces and end-points) and 2. Prof Aldo Faisal, Imperial - Neuromimetic robotics approaches derived from biological and behavioural data.

The TUM team will focus on the modelling of the control mechanisms necessary, and examine and model the control mechanisms during complex object manipulation performed by humans, with a focus on impedance-based control (Franklin & Wolpert 2011). The Imperial team will focus on proprioception during object manipulations and will study human haptic exploration of complex objects. The project will also utilize the Ethohand II, an innovative robotic hand which replicates the dexterity of the human hand with its 22 degrees of freedom and a ball joint for the thumb, which was previously designed by the Imperial team.

* We are recruiting two PhD students to start Fall 2020 as part of Imperial College London – Technische Universität München (TUM) Joint Academy of Doctoral Studies

One student would be based in our lab at Imperial College London and the other in David Franklin's lab at Technische Universität München.

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