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Editorial Open Access

Learnable Robotic Interfaces

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Editorial

An ever long standing vision of robotics is to create autonomous and semi-autonomous shared-control robots which can assist humans in unpredictable situations. Researchers have come closer to this vision, with the present rise in cyber-physical systems and other highly capable robots in different robotics labs around the world. It is imperative now to create such robotic systems and robotic interfacing devices that learn by themselves to accomplish tasks, triggered by surrounding changes and abstract level commands. Machine learning will play a pivotal role in this situation by making robots fully adaptive and taking robots out of research labs into fully operated human environments. In order to achieve that, robots and robotic interfaces, will make use of perceptual stimuli e.g. tactile feedback (a feel of touch), visual sensing, and translate these into motor control commands. Closing this complex loop from sensing to actuation, machine learning will be required in different levels for instance sensor-based thinking, planning and motor control. Among the hidden problems faced at each level includes motor primitive learning, model learning, probabilistic planning, data-fusion and motor control. The research involving the development, design, modeling and analysis of smart robotic interfaces addresses high impact problems of aged population (rehabilitation), user interfaces for minimal invasive robotic surgery and computer interactivity with redundant body movements. This kind of research is motivated by evidence that there is a profound disconnect between the computer technology and the people with disabilities, hence there is a need to develop smart learnable robotic interfaces capable of bridging this gap. Specifically, smart interfaces can be utilized to translate the movement intentions of spinal cord injured patients into wheelchair control commands. This research highlights a necessity of taking a step towards the development of a new family of adaptive robotic interfaces i.e., "Body machine interfaces (BoMIs)", mapping the motor skills of the users into efficient patterns of control. It is envisioned that these interfaces will undergo a process of concurrent learning: while users practice controlling the robotic device, the interface modifies itself to accommodate for the user's behavior. Virtual reality can also play a key role in this process, by shielding the users from risks of collisions and other accidents, thus allowing for training protocols that would be impossible with current medical or rehabilitation methods. The robotic and robotic interface learning has become a central research problem and has attracted a lot of funding from different research organizations and competitions such as Australian Research Council (ARC), Defense Advanced Research Projects Agency (DARPA) robotics challenge and many research labs. Statistics and machine learning has attracted a growing number of robot cists, robotic applications are now motivated with state of-the-art machine learning algorithms. An increase in interest in robotic learning can also be seen through a large number of journal and conference articles being published at important robotic conferences and journals.