

Dissertation press release

07.05.2019

Programming robots for assembly tasks by showing them how the task is done

Title of the dissertation	Learning Compliant Assembly Skills from Demonstrations
Contents of the dissertation	<p>Robots are often better and more accurate than humans in repetitive tasks. However, programming a robot to perform a task is a time consuming task. In this dissertation I show how anybody can efficiently program a robot to perform assembly tasks, such that the robot can exploit the environmental contact forces to deal with uncertainties. The robot learned from only a couple of demonstrations to first align two hose couplers and then interlock them, relying only on the contact forces between the objects and not on vision. In addition I showed that even when the contact forces do not give any guidance, the robot can learn a meaningful search strategy from the human demonstration such that it can complete the task with a good accuracy. A good example that we used as experiment is inserting a plug into a socket without proper vision sensing.</p> <p>The key idea of my dissertation is to combine Learning from Demonstration (LfD) paradigm with compliant motions. In LfD, a person naïve to robotics can give the robot a demonstration by either teleoperation or by grabbing a robot and then performing the task that the robot must learn. Compliant motions mean that the robot is compliant towards sudden contact forces. Thus the robot does not cause damage to itself or the environment when suddenly hitting an obstacle, and the robot can even use the environment as guidance when visual guidance is not enough. This dissertation presents a set of methods starting from these principles and shows how they can be efficiently leveraged to increase the level of automation in places where the use of robots is currently infeasible. Possible locations for usage are, for example, manufacturing Small and Medium-sized Enterprises (SMEs) and construction sites.</p>
Field of the dissertation	Automation, Systems and Control Engineering; Robotics
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Place of the defence	Aalto University, School of Science, lecture hall T2, Konemiehentie 2, Espoo
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Custos	Professor Ville Kyrki, Aalto University School of Electrical Engineering, Department of Electrical Engineering and Automation
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