



Colloquium

Inductive Biases for Robot Learning

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Host: Christoph Lampert

Abstract:Autonomous robots that can assist humans in situations of daily life have been a long standing vision of robotics, artificial intelligence, and cognitive sciences. A first step towards this goal is to create robots that can learn tasks triggered by environmental context or higher level instruction. However, learning techniques have yet to live up to this promise as only few methods manage to scale to high-dimensional manipulator or humanoid robots. In this talk, we investigate a general framework suitable for learning motor skills in robotics which is based on the principles behind many analytical robotics approaches. To accomplish robot reinforcement learning learning from just few trials, the learning system can no longer explore all learn-able solutions but has to prioritize one solution over others – independent of the observed data. Such prioritization requires explicit or implicit assumptions, often called ‘induction biases’ in machine learning. Extrapolation to new robot learning tasks requires induction biases deeply rooted in general principles and domain knowledge from robotics, physics and control. Empirical evaluations on a several robot systems illustrate the effectiveness and applicability to learning control on an anthropomorphic robot arm. These robot motor skills range from toy examples (e.g., paddling a ball, ball-in-a-cup) to playing robot table tennis, juggling and manipulation of various objects.

Bio:Jan Peters is a full professor (W3) for Intelligent Autonomous Systems at the Computer Science Department of the Technische Universität Darmstadt since 2011, and, at the same time, he is the dept head of the research department on Systems AI for Robot Learning (SAIROL) at the German Research Center for Artificial Intelligence (Deutsches Forschungszentrum für Künstliche Intelligenz, DFKI) since 2022. He is also is a founding research faculty member of the Hessian Center for Artificial Intelligence. Jan Peters has received the Dick Volz Best 2007 US PhD Thesis Runner-Up Award, the Robotics: Science & Systems - Early Career Spotlight, the INNS Young Investigator Award, and the IEEE Robotics & Automation Society's Early Career Award as well as numerous best paper awards. In 2015, he received an ERC Starting Grant and in 2019, he was appointed IEEE Fellow, in 2020 ELLIS fellow and in 2021 AAIA fellow. Despite being a faculty member at TU Darmstadt only since 2011, Jan Peters has already nurtured a series of outstanding young researchers into successful careers. These include new faculty members at leading universities in the USA, Japan, Germany, Finland and Holland, postdoctoral scholars at top computer science departments (including MIT, CMU, and Berkeley) and young leaders at top AI companies (including Amazon, Boston Dynamics, Google and Facebook/Meta). Jan Peters has studied Computer Science, Electrical, Mechanical and Control Engineering at TU Munich and FernUni Hagen in Germany, at the National University of Singapore (NUS) and the University of Southern California (USC).

He has received four Master's degrees in these disciplines as well as a Computer Science PhD from USC. Jan Peters has performed research in Germany at DLR, TU Munich and the Max Planck Institute for Biological Cybernetics (in addition to the institutions above), in Japan at the Advanced Telecommunication Research Center (ATR), at USC and at both NUS and Siemens Advanced Engineering in Singapore. He has led research groups on Machine Learning for Robotics at the Max Planck Institutes for Biological Cybernetics (2007-2010) and Intelligent Systems (2010-2021).

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Raiffeisen Lecture Hall



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