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MODEL-BASED OPTIMIZATION FOR ROBOTICS

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Zoom: https://columbiauniversity.zoom.us/j/91247893326?pwd=L2JWU21aQzc4cU1ZQklEb0QrWGQvdz09

Time: *February 23rd, 2024, 10 AM EST*

Dr. Noémie Jaquier
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From Data Structure, Physics, and Human Knowledge: A Manifold of Robotic Geometries

Abstract:
To be deployed in our everyday life, robots must display outstanding learning and adaptation capabilities allowing them to act, react, and continuously learn in unstructured dynamic environments. In addition, robots should display such capabilities in real time, which entails the ability to continuously learn from small numbers of demonstrations and/or interactions. In this context, the quality and efficiency of robot learning approaches may be improved via the introduction of inductive bias. In this talk, I will view inductive bias through the lens of geometry, which is ubiquitous in robotics. Specifically, I will discuss via three examples how geometry-based inductive bias can be introduced into robot learning from data structures, from physics, and from human knowledge. First, I will show that the performance of various algorithms may be improved by considering the intrinsic geometric characteristics of data. Second, I will discuss how the dynamic properties of humans and robots are straightforwardly accounted for by considering physics-based geometric configuration spaces. Finally, I will show that imposing an additional geometric structure to probabilistic latent spaces allows us to learn low-dimensional representations of robotics taxonomies in continuous domains from which we can generate realistic motions.

Biography:
Noémie Jaquier is a postdoctoral researcher working with Prof. Tamim Asfour in the High Performance Humanoid Technologies Lab (H²T) at the Karlsruhe Institute of Technology (KIT) and currently a visiting postdoctoral scholar working with Prof. Oussama Khatib at the Stanford Robotics Lab. She obtained a PhD from the Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland in 2020. In 2019, she did a 6-months PhD sabbatical in the Bosch Center for Artificial Intelligence (BCAI), Germany. She obtained a Master in Robotics and Autonomous Systems and a Minor in Computational Neurosciences from EPFL in 2016 and a Bachelor in Microengineering from EPFL in 2014. Noémie' s research brings a novel Riemannian perspective to robot learning, optimization, and control by leveraging Riemannian geometry as inductive bias and as a theory to provide sound theoretical guarantees. She investigates data-efficient methods that build on geometric spaces and exploit the geometric information naturally arising in robotic data. Her work focuses on skills learning via human demonstrations and adaptation techniques with geometry as a cornerstone. It spans various applications in the field of robot manipulation.