

# Rudolf Lioutikov

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## Curriculum Vitæ

### Research Interest

**Machine-Learning:** Imitation Learning, Reinforcement Learning, Optimal Decision Making, Policy Search, Explainable AI, Skill and Behavior Representation, Skill Acquisition, Movement Segmentation, Structure Learning, Skill Composition and Sequencing, Life-Long Learning, Active Learning

**Robotics:** Intuitive Robots, Anthropomorphic Robots, Human-Robot Interaction, Semi-Autonomy, Motor Skills, Movement Primitive Representation, Grasping, Manipulation, Adaptive Control, Human-In-The-Loop, Multi-Agent Systems, Robot Assisted Rehabilitation, Intelligent Prosthetics

### Current Position

06.2021 – **Emmy-Noether Research Group Leader**, *Intuitive Robots Lab*, **Karlsruhe Institute of Technology**.  
Karlsruhe, Baden-Württemberg, Germany

### Past Positions

01.2019 – 05.2021 **Assistant Professor of Practice**, *Texas Institute for Discovery Education in Science*, College of Natural Sciences, **University of Texas at Austin**.  
Austin, Texas, USA

### Education

10.2013 – 10.2018 **Ph.D. Student**, *Intelligent Autonomous Systems*, Technical University Darmstadt, Darmstadt, Germany.

**Graduated with highest distinction / summa cum laude**

08.2015 – 09.2015 **Summer School**, *Machine Learning Summer School*, Kyoto, Japan.

10.2011 – 09.2013 **M.Sc. in Computer Science**, *Technical University Darmstadt*, Darmstadt, Germany.

Focus on Robotics and Machine Learning. Minor in Bionics.

07.2010 – 09.2011 **Exchange**, *National University of the Province Buenos Aires*, Tandil, Argentina.

10.2006 – 07.2010 **B.Sc. in Computer Science**, *Technical University Darmstadt*, Darmstadt, Germany.

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## Honors and Awards

- 2020 Accepted into the Emmy-Noether Programme of the German Research Foundation (DFG)
- 2019 Georges Giralt Award Finalist, European Robotics Forum grants this award for best European robotics Ph.D. thesis
- 2015 Best Paper Award Finalist, IEEE International Conference on Robotics and Automation (ICRA)  
Best Student Paper Award Finalist, IEEE International Conference on Robotics and Automation (ICRA)  
Best Service Robotics Paper Award Finalist, IEEE International Conference on Robotics and Automation (ICRA)

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## Grants

- 2020 **Intuitive Robot Intelligence**, Emmy-Noether Programme of the German Research Foundation (DFG)

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## Research Experience

- 06.2021 – **Research Group Leader**, *Intuitive Robots Lab, Karlsruhe Institute of Technology*.  
Karlsruhe, Baden-Württemberg, Germany
- 01.2019 – 05.2021 **Assistant Professor of Practice**, *Texas Institute for Discovery Education in Science*, College of Natural Sciences, **University of Texas at Austin**.  
Austin, Texas, USA
- 10.2013 – 10.2018 **Graduate Research Assistant**, *Intelligent Autonomous Systems - Technical University Darmstadt*, Developing new methods to introduce robotics into small and medium sized enterprises.  
3rd Hand Project - Seventh Framework Programme (FP7-ICT-2013-10)
- 09.2012 – 09.2013 **Undergraduate Research Assistant**, *Intelligent Autonomous Systems - Technical University Darmstadt*, Evaluation of robot learning methods on a throwing scenario.

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## Teaching Experience

- 01.2019 – 05.2021 **Assistant Professor**, *Robot Learning*, University of Texas at Austin.
- 10.2015 – 04.2016 **Teaching Assistant**, *Robot Learning*, Technical University Darmstadt.
- 04.2015 – 10.2015 **Teaching Assistant**, *Intelligent Multi-Agent Systems*, Technical University Darmstadt.
- 10.2014 – 04.2015 **Teaching Assistant**, *Technical Foundations of Computer Science*, Technical University Darmstadt.
- 04.2013 – 09.2013 **Lecture Assistant**, *Software Engineering Design and Construction*, Technical University Darmstadt.

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## Student Supervision

- 07.2019 – 08.2019 **FRI Fellowship**, *Self-Supervised Semantic Grounding of Movement Primitive Sequences*, University of Texas at Austin, Bhave, S.; Kodali, P.; O'Neil, C.; Trowbridge, I.
- 07.2019 – 08.2019 **FRI Fellowship**, *Self-Supervised Segmentation of Movement Primitive Sequences*, University of Texas at Austin, Bhave, R.; Hao, K.; Thomson, I.
- 04.2017 – 10.2017 **Student Research Project**, *Learning Grammars for Sequencing Movement Primitives*, Technical University Darmstadt, Berninger, K.; Szlag, S.
- 10.2016 – 04.2017 **Student Research Project**, *Probabilistic Trajectory Segmentation by Means of Hierarchical Dirichlet Process Switching Linear Dynamical Systems*, Technical University Darmstadt, Sieb, M.; Schultheis, M.; Szlag, S.
- 01.2016 – 07.2016 **Master's Thesis**, *Context-driven Movement Primitive Adaptation*, Technical University Darmstadt, Wilbers, D.
- 10.2015 – 04.2016 **Master's Thesis**, *Combining Human Demonstrations and Motion Planning for Movement Primitive Optimization*, Technical University Darmstadt, Koert, D.
- 04.2014 – 04.2015 **Student Research Project**, *Inverse Kinematics for Optimal Human-robot Collaboration*, Technical University Darmstadt, Koert, D.
- 04.2014 – 04.2015 **Student Research Project**, *Sequencing of Movement Primitives for Task- and Motion Planning*, Technical University Darmstadt, Sigg M.; Faller, F.
- 10.2013 – 04.2014 **Student Research Project**, *Competitive Robot Pong*, Technical University Darmstadt, Koert, D.; Vandommele, T.

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## Industrial Experience

- 07.2006 – 07.2010 **Student Trainee**, *Bisnode Informatics Germany GmbH*, Darmstadt, Germany.  
Web development  
User statistics and behavioral analysis for webapplications

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## Interdisciplinary Skills

### programming

C, C++, Java, Matlab, Python, Perl, ROS, SL

### languages

**german** native language

**english** advanced

**spanish** advanced

**russian** basic

**french** rudimentary

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## Workshop Organization

- 2021 Empowering Interactive Robots by Learning Through Multimodal Feedback Channels, 23rd ACM International Conference on Multimodal Interaction, Co-Organizer

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## Research Community Contribution

- 2021 **Associate Editor** IEEE Robotics and Automation Letters  
**Area Chair** Conference on Robot Learning  
**Area Chair** The IEEE/RSJ International Conference on Intelligent Robots and Systems  
The IEEE International Conference on Robotics and Automation
- 2020 Conference on Robot Learning  
AAAI Conference on Artificial Intelligence
- 2019 Advances in Neural Information Processing Systems  
Conference on Robot Learning
- 2018 The IEEE/RSJ International Conference on Intelligent Robots and Systems  
The IEEE Robotics and Automation Letters
- 2017 The IEEE International Conference on Robotics and Automation  
The IEEE Robotics and Automation Letters  
The IEEE/RSJ International Conference on Intelligent Robots and Systems
- 2016 The IEEE International Conference on Robotics and Automation  
The International Journal of Robotics Research  
The IEEE/RSJ International Conference on Intelligent Robots and Systems  
The 25th International Joint Conference on Artificial Intelligence
- 2015 Automatica  
Autonomously Learning Robots Workshop at Advances in Neural Information Processing Systems  
The IEEE/RSJ International Conference on Intelligent Robots and Systems
- 2014 The IEEE/RSJ International Conference on Intelligent Robots and Systems

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## Publications

### Ph.D. Thesis

- 2018 • **Lioutikov, R.**, *Parsing Motion and Composing Behavior for Semi-Autonomous Manipulation*, Intelligent Autonomous Systems - Technical University Darmstadt,  
**Thesis Advisor:** Prof. Dr. Jan Peters, Ph.D.  
**External Referee:** Prof. Ken Goldberg (UC Berkeley)  
**Committee:** Prof. Andreas Koch (TU Darmstadt),  
Prof. Oskar von Stryk (TU Darmstadt),  
Prof. Kristian Kersting (TU Darmstadt)

### Master's Thesis

- 2013 • **Lioutikov, R.**, *Learning time-dependent feedback policies with model-based policy search*, Intelligent Autonomous Systems - Technical University Darmstadt,  
Thesis Advisors: Dr. tech. Gerhard Neumann, Prof. Dr. Jan Peters, Ph.D.

### Journal Articles

- 2019 • **Lioutikov, R.**; Maeda, G.; Veiga, F.F.; Kersting, K.; Peters, J., *Learning Attribute Grammars for Movement Primitive Sequencing*, International Journal of Robotics Research (IJRR).
- 2017 • **Lioutikov, R.**; Neumann, G.; Maeda, G.; Peters, J., *Learning Movement Primitive Libraries through Probabilistic Segmentation*, International Journal of Robotics Research (IJRR).
- Maeda, G.; Neumann, G.; Ewerton, M; **Lioutikov, R.**; Kroemer, O; Peters, J., *Probabilistic Movement Primitives for Coordination of Multiple Human-Robot Collaborative Tasks*, Autonomous Robots (AURO).
  - Maeda, G.; Ewerton, M.; Neumann, G.; **Lioutikov, R.**; Peters, J., *Phase Estimation for Fast Action Recognition and Trajectory Generation in Human-Robot Collaboration*, International Journal of Robotics Research (IJRR).
  - Osa, T.; Ghalamzan, E. A. M.; Stolkin, R.; **Lioutikov, R.**; Peters, J.; Neumann, G., *Guiding Trajectory Optimization by Demonstrated Distributions*, IEEE Robotics and Automation Letters (RA-L).
  - Paraschos, A.; **Lioutikov, R.**; Peters, J.; Neumann, G., *Probabilistic Prioritization of Movement Primitives*, Proceedings of the International Conference on Intelligent Robot Systems, and IEEE Robotics and Automation Letters (RA-L).
- 2014 • **Lioutikov, R.**; Paraschos, A.; Peters, J.; Neumann, G., *Generalizing Movements with Information Theoretic Stochastic Optimal Control*, Journal of Aerospace Information Systems (JAIS).

## Articles in Conference Proceedings

- 2021 • Jain, A.; **Lioutikov, R.**; Giguere, S.; Niekum, S., *Distributional Depth-Based Estimation of Object Articulation Models*, Conference on Robot Learning (CoRL).
- Jain, A.; **Lioutikov, R.**; Chuck, C.; Niekum, S., *ScrewNet: Category-Independent Articulation Model Estimation From DepthImages Using Screw Theory*, Proceedings of the IEEE International Conference on Robotics and Automation (ICRA).
  - Memarian, F.; Goo, W.; **Lioutikov, R.**; Topcu, U.; Niekum, S., *Self-Supervised Online Reward Shaping in Sparse-Reward Environments*, International Conference on Intelligent Robots and Systems (IROS).
- 2018 • **Lioutikov, R.**; Maeda, G.; Veiga, F.F.; Kersting, K.; Peters, J., *Inducing Probabilistic Context-Free Grammars for the Sequencing of Robot Movement Primitives*, Proceedings of the IEEE International Conference on Robotics and Automation (ICRA).
- 2017 • Wilbers, D.; **Lioutikov, R.**; Peters, J., *Context-Driven Movement Primitive Adaptation*, Proceedings of the IEEE International Conference on Robotics and Automation (ICRA).
- 2016 • Maeda, G.; Maloo, A.; Ewerton, M.; **Lioutikov, R.**; Peters, J., *Anticipative Interaction Primitives for Human-Robot Collaboration*, AAAI Fall Symposium Series. Shared Autonomy in Research and Practice.
- Koert, D.; Maeda, G.J.; **Lioutikov, R.**; Neumann, G.; Peters, J., *Demonstration Based Trajectory Optimization for Generalizable Robot Motions*, Proceedings of the International Conference on Humanoid Robots (HUMANOIDS).
- 2015 • **Lioutikov, R.**; Neumann, G.; Maeda, G.; Peters, J., *Probabilistic Segmentation Applied to an Assembly Task*, Proceedings of the International Conference on Humanoid Robots (HUMANOIDS).
- Ewerton, M; Maeda, G; **Lioutikov, R.**; Amor, H.B.; Peters J.; Neumann, G., *Learning Multiple Collaborative Tasks with a Mixture of Interaction Primitives*, IEEE International Conference on Robotics and Automation (ICRA).  
Best Conference Paper Award Finalist, Best Student Paper Award Finalist, Best Service Robotics Paper Award Finalist
  - Maeda, G.; Neumann, G.; Ewerton, M.; **Lioutikov, R.**; Peters, J., *A Probabilistic Framework for Semi-Autonomous Robots Based on Interaction Primitives with Phase Estimation*, Proceedings of the International Symposium of Robotics Research (ISRR).
  - Abdolmaleki, A.; **Lioutikov, R.**; Peters, J; Lau, N.; Reis, L.; Neumann, G., *Model-Based Relative Entropy Stochastic Search*, Advances in Neural Information Processing Systems (NIPS).
- 2014 • **Lioutikov, R.**; Paraschos, A.; Peters, J.; Neumann, G., *Sample-Based Information-Theoretic Stochastic Optimal Control*, Proceedings of the IEEE International Conference on Robotics and Automation (ICRA).
- **Lioutikov, R.**; Kroemer, O.; Peters, J.; Maeda, G., *Learning Manipulation by Sequencing Motor Primitives with a Two-Armed Robot*, Proceedings of the 13th International Conference on Intelligent Autonomous Systems (IAS).

- Maeda, G.J.; Ewerton, M.; **Lioutikov, R.**; Amor, H.B.; Peters, J.; Neumann, G., *Learning Interaction for Collaborative Tasks with Probabilistic Movement Primitives*, Proceedings of the International Conference on Humanoid Robots (HUMANOIDS).

### Workshop papers

- 2018
- **Lioutikov, R.**; Faller, F.; Sigg, M.; Perters, J.; Maeda, G., *A Graph-Search Based Approach for Movement Primitive Sequencing*, Abstract-Only Session. IEEE International Conference on Robotics and Automation (ICRA)
  - **Lioutikov, R.**; Maeda, G.; Veiga, F.F.; Kersting, K.; Peters, J., *Learning Intuitive Grammars for Movement Primitive Sequences*, Robot Teammates Operating in Dynamic, Unstructured Environments. IEEE International Conference on Robotics and Automation (ICRA)
  - **Lioutikov, R.**; Perters, J., *Movement Primitive Sequencing via Attribute Grammars*, Third Machine Learning in Planning and Control of Robot Motion Workshop. IEEE International Conference on Robotics and Automation (ICRA)
- 2016
- Maeda, G.; Maloo, A.; Ewerton, M.; **Lioutikov, R.**; Peters, J., *Proactive Human-Robot Collaboration with Interaction Primitives*, International Workshop on Human-Friendly Robotics (HFR).
- 2015
- Lopes, M.; Peters, J.; Piater, J.; Toussaint, M.; Baisero, A.; Busch, B.; Erkent, O.; Kroemer, O.; **Lioutikov, R.**; Maeda, G.; Mollard, Y.; Munzer, T.; Shukla, D., *Semi-Autonomous 3rd-Hand Robot*, Workshop on Cognitive Robotics in Future Manufacturing Scenarios. European Robotics Forum
  - Rueckert, E.; **Lioutikov, R.**; Calandra, R.; Schmidt, M.; Beckerle, P.; Peters, J., *Low-cost Sensor Glove with Force Feedback for Learning from Demonstrations using Probabilistic Trajectory Representations*, Workshop on Tactile and force sensing for autonomous compliant intelligent robots.. IEEE International Conference on Robotics and Automation (ICRA)
- 2014
- **Lioutikov, R.**; Kroemer, O.; Peters, J.; Maeda, G., *Towards a Third Hand*, 1st International Workshop on Intelligent Robot Assistants. International Conference on Intelligent Autonomous Systems (IAS)
  - Ewerton, M.; Neumann, G.; **Lioutikov, R.**; Amor, H.B.; Peters, J.; Maeda, G., *Modeling Spatio-Temporal Variability in Human-Robot Interaction with Probabilistic Movement Primitives*, Workshop on Machine Learning for Social Robotics. IEEE International Conference on Robotics and Automation (ICRA)