# Roberto Calandra

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## Research Expertise

Reinforcement Learning, Robotics, Optimization, Gaussian Processes, Deep Learning

## Education

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| 2012–2016 (est) | **Ph.D. Candidate in Computer Science**, *Technische Universität Darmstadt*, Germany. <br> Thesis topic: Probabilistic Methods in Learning for Control & Robotics <br> Advisor: Jan Peters (TU Darmstadt) <br> Instructor: Marc P. Deisenroth (Imperial College London) |
| 2009–2011 | **M.Sc. in Machine Learning and Data Mining**, *Aalto University*, Finland. <br> Thesis topic: An Exploration of Deep Belief Networks toward Adaptive Learning <br> Advisor: Olli Simula (Aalto University) <br> Instructors: Federico Montesino Pouzols (University of Helsinki), Tapani Raiko (Aalto University) |
| 2004–2009 | **B.S. in Computer Science Engineering**, *Università degli Studi di Palermo*, Italy. <br> Thesis topic: Design and Building of a Robotics Mobile Platform <br> Advisor: Haris Dindo (Università degli Studi di Palermo) |

## Additional Education

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| 15–24 Jul 2013 | **iCub Summer School 2013**, *Sestri Levante*, Italy. <br> *Topic:* Software engineering for humanoid robots |
| 9–27 Jul 2012 | **Graduate Summer School: Deep Learning, Feature Learning**, *Institute for Pure and Applied Mathematics (IPAM), University of California, Los Angeles (UCLA)*, US. |
| 11–20 Apr 2012 | **Machine Learning Summer School (MLSS) 2012**, *La Palma*, Spain. |
| 18–22 Sep 2006 | **6th International UJI Robotic School**, *Robotic Intelligence Lab of Jaume-I University*, Spain. <br> *Topic:* Research and development on Humanoid Robots |

## Professional Experience

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| Jul–Oct 2015 | **Research Intern**, *Microsoft Research*, Cambridge, UK. <br> Worked in the Machine Learning and Perception (MLP) group on the AIX project. <br> [BBC coverage of the project] <br> Advisors: Andrew Blake, Katja Hofmann |
| May–Dec 2010 | **Research Assistant**, *Bayesian Methodology group*, Aalto University, Finland. <br> Worked as data analyst using Gaussian Processes. Developed novel variational inference methods based on EP for LOO. Contributed to the development of the Gaussian Processes toolbox GPStuff. <br> Advisor: Aki Vehtari |
| Mar–May 2008 | **Intern**, *BELTEC s.r.l.*, Italy. <br> Designed software and hardware components for industrial automation on two different projects for *SELEX Galileo*, and on a project for the *INAF - Istituto Nazionale di Astrofisica* (Italian national institute for astrophysics). |

## Invited Presentations

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| 16 Oct 2015 | **University College London**, *London*, UK, **host:** Guy Lever. |
| 14 Oct 2015 | **University of Oxford**, *Oxford*, UK, **host:** Michael Osborne, Machine Learning Research Group. |
| 13 Oct 2015 | **Imperial College London**, *London*, UK, **host:** Stefan Leutenegger, Dyson Robotics Lab. |
| 03 Jun 2015 | **University of British Columbia**, *Vancouver*, Canada, **host:** Mark Schmidt. |
| 02 Jun 2015 | **University of Washington**, *Seattle*, US, **host:** Dieter Fox, Robotics and State Estimation Lab. |
| 01 Apr 2015 | **TU Freiburg**, *Freiburg*, Germany, **host:** Frank Hutter. |
| 31 Mar 2015 | **TU Freiburg**, *Freiburg*, Germany, **host:** Wolfram Burgard, Autonome Intelligente Systeme. |
| 22 Dec 2014 | **Università degli Studi di Palermo**, *Palermo*, Italy. |
| 24 Apr 2014 | **Bosch Research**, *Stuttgart*, Germany. |
| 13 Nov 2013 | **Imperial College London**, *London*, UK. |

## Teaching & Supervision Experience

### Teaching

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| Spring 2015 | **Machine Learning I: Statistical Approaches Lecture**, *Teaching Assistant*, TU Darmstadt. |
| Fall 2013 & Fall 2014 | **Robot Learning Lecture**, *Teaching Assistant*, TU Darmstadt. |

### Supervision

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| Fall 2015 | **1-Semester Project**, *F. Treede, P. Konow and M. Bied*, Design of controllers for the dynamic bipedal walker *FaBi*. <br> Supervised jointly with Philipp Beckerle and Alexandra Voloshina (to be completed) |
| Fall 2015 | **Bachelor Thesis**, *F. Unverzagt*, Modeling Robustness for Multi-Objective Optimization. <br> (to be completed) |
| Fall 2015 | **1-Semester Project**, *L. Fritsche*, Learning to walk on rough terrain. <br> (to be completed) |
| Fall 2014 – Spring 2015 | **2-Semesters Project**, *L. Fritsche and F. Unverzagt*, Human-friendly Telecontrol of the *iCub*. <br> Resulted in the publication: Fritsche, L.; Unverzagt, F.; Peters, J.; Calandra, R. (2015). First-Person Tele-Operation of a Humanoid Robot, Proceedings of the International Conference on Humanoid Robots (HUMANOIDS) |
| Fall 2014 | **1-Semester Project**, *J. Geukes and M. Nakatenus*, Towards Balancing with the *iCub*. |
| Spring 2015 | **1-Semester Project**, *G. Leser, J. Hatzenbühler, J. Schwaab and N. Eschner*, Implementation and Improvement of the bipedal walking robot *Fox*. <br> Supervised jointly with Philipp Beckerle |
| 2014 | **Bachelor Thesis**, *A. Schaefer*, Prediction of Finger Flexion from ECoG Data with Deep Neural Networks. <br> Supervised jointly with Jan Peters |
| 2014 | **Bachelor Thesis**, *D. Pfau*, Multi-Objective Optimization and Analysis of a Musculoskeletal Robot for Bipedal Locomotion. <br> Supervised jointly with Katayon Radkhah |
| 2014 | **Bachelor Thesis**, *M. Laux*, Online Feature Learning for Reinforcement Learning. |
| 2014 | **Bachelor Thesis**, *A. Hochlaender*, Reinforcement Learning of PACMAN. <br> Supervised jointly with Gerhard Neumann |
| 2014 | **1-Semester Project**, *S. Luthardt*, Deep Learning for Artificial Skin. |
| Fall 2013 | **1-Semester Project**, *M. Prediger, F. Schnell and V. Negoescu*, Advanced Bayesian optimization models. |
| Spring 2013 | **1-Semester Project**, *D. Dittmar and B. Koch*, Robot learning for ball bouncing. |

Fall 2012    **1-Semester Project**, *E. Wolter and T. Baark*, Learning to bounce a ball with a robotic arm.

## Professional Service

**Organizer**, *NIPS Workshop on Bayesian optimization (BayesOpt)*, 2015.

### Reviewer for Journals

*Robotics and Autonomous Systems.*

*IEEE Transactions on Robotics (TRO).*

*Neurocomputing.*

*IEEE Transactions on Cybernetics.*

*IEEE Transactions on Systems, Man, and Cybernetics - Part B: Cybernetics.*

*Autonomous Robots (AuRo): Special Issue on Whole-body control for Humanoid Robots.*

*Autonomous Robots (AuRo): Special Issue on Assistive and Rehabilitation Robotics.*

### Reviewer for Conferences & Workshops

2014    *IEEE/ASME Internationl Conference on Advanced Intelligent Mechatronics (AIM).*

2014–2016    *International Conference on Artificial Intelligence and Statistics (AISTATS).*

2014–2015    *IEEE/RAS International Conference on Humanoid Robots (HUMANOIDS).*

2014    *International Conference on Artificial Neural Networks (ICANN).*

2015    *IEEE International Conference on Robotics and Automation (ICRA).*

2013, 2016    *International Joint Conference on Artificial Intelligence (IJCAI).*

2013–2015    *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).*

2014–2015    *Neural Information Processing Systems (NIPS).*

2014–2016    *Robotics: Science and Systems (RSS).*

2014    *NIPS Workshop on Bayesian optimization (BayesOpt).*

2014    *NIPS Workshop on Autonomously Learning Robots.*

## Publications

### Journals

[1] **Roberto Calandra**, Serena Ivaldi, Marc. P. Deisenroth, and Jan Peters. Learning from artificial skin: Torque control in presence of contacts using high-dimensional tactile sensors. (to be submitted).

[2] **Roberto Calandra**, André Seyfarth, Jan Peters, and Marc P. Deisenroth. Bayesian optimization for learning gaits under uncertainty. *Annals of Mathematics and Artificial Intelligence (AMAI)*, 2015.

### Conferences

[1] Lars Fritsche, Felix Unverzagt, Jan Peters, and **Roberto Calandra**. First-person tele-operation of a humanoid robot. In *Proceedings of the International Conference on Humanoid Robots (HUMANOIDS)*, 2015.

[2] **Roberto Calandra**, Serena Ivaldi, Marc. P. Deisenroth, E. Rueckert, and Jan Peters. Learning inverse dynamics models with contacts. In *Proceedings of the International Conference on Robotics and Automation (ICRA)*, pages 3186 – 3191. IEEE, 2015.

[3] **Roberto Calandra**, S. Ivaldi, Marc P. Deisenroth, and J. Peters. Learning torque control in presence of contacts using tactile sensing from robot skin. In *Proceedings of the International Conference on Humanoid Robots (HUMANOIDS)*, 2015.

[4] **Roberto Calandra**, André Seyfarth, Jan Peters, and Marc P. Deisenroth. An experimental

comparison of Bayesian optimization for bipedal locomotion. In *Proceedings of 2014 IEEE International Conference on Robotics and Automation (ICRA)*, 2014.

[5] **Roberto Calandra**, Nakul Gopalan, André Seyfarth, Jan Peters, and Marc P. Deisenroth. Bayesian gait optimization for bipedal locomotion. In *Proceedings of Learning and Intelligent OptimizatioN Conference (LION)*, pages 274–290, 2014.

[6] Marc P. Deisenroth, **Roberto Calandra**, André Seyfarth, and Jan Peters. Toward fast policy search for learning legged locomotion. In *International Conference on Intelligent Robots and Systems (IROS)*, 2012.

[7] **Roberto Calandra**, Tapani Raiko, Marc P. Deisenroth, and F. Montesino Pouzols. Learning deep belief networks from non-stationary streams. In *International Conference on Artificial Neural Networks (ICANN)*, 2012.

### Workshops & Technical Reports

[1] E. Rueckert, R. Lioutikov, **Roberto Calandra**, M. Schmidt, P. Beckerle, and Jan Peters. Low-cost sensor glove with force feedback for learning from demonstrations using probabilistic trajectory representations. ICRA2015 Workshop on Tactile & force sensing for autonomous, compliant, intelligent robots, 2015.

[2] **Roberto Calandra**, Serena Ivaldi, Marc. P. Deisenroth, E. Rueckert, and Jan Peters. Learning inverse dynamics models with contacts using tactile sensors. ICRA2015 Workshop on Tactile & force sensing for autonomous, compliant, intelligent robots, 2015.

[3] **Roberto Calandra**, Jan. Peters, Carl E. Rasmussen, and Marc P. Deisenroth. Manifold Gaussian Processes for Regression. *ArXiv e-prints*, February 2014.

[4] **Roberto Calandra**, Jan Peters, and Marc P. Deisenroth. Pareto front modeling for sensitivity analysis in multi-objective bayesian optimization. NIPS Workshop on Bayesian Optimization (BayesOpt), 2014.

[5] Katayon Radkhah, **Roberto Calandra**, and Marc P. Deisenroth. Learning musculoskeletal dynamics with non-parametric models. ICRA2013 Workshop on Novel Methods for Learning and Optimization of Control Policies and Trajectories for Robotics, 2013.

[6] **Roberto Calandra**, Jan Peters, André Seyfarth, and Marc P. Deisenroth. An experimental evaluation of bayesian optimization on bipedal locomotion. NIPS 2013 workshop on Bayesian optimization (BayesOpt), 2013.

### References

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