Curriculum Vitae

Boris Belousov

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Boris Belousov
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Research Interests

Reinforcement learning, stochastic optimization, optimal control/filtering. Development and application of learning algorithms for estimation and control of robotic systems: learning from demonstration, risk-sensitive stochastic optimization, model learning, tactile sensing, robotic manipulation.

Education

Technical University of Darmstadt (TUDa)   **2016–2022**
Ph.D. student within the Intelligent Autonomous Systems Group
Thesis topic: "On Optimal Behavior Under Uncertainty in Humans and Robots"
Committee: Prof. Dr. Marc Toussaint; Prof. Constantin A. Rothkopf, Ph.D.;
Prof. Dr. Oliver Tessmann; Prof. Dr. Oskar von Stryk; Prof. Stefan Roth, Ph.D.
Advisor: Prof. Jan Peters, Ph.D.
Grade: passed with distinction, summa cum laude

University of Erlangen–Nuremberg (FAU)   **2013–2016**
M.Sc. in Electrical Engineering
Communications and Multimedia Engineering
GPA: 1.4/1.0

Moscow Institute of Physics and Technology (MIPT)   **2009–2013**
B.Sc. in Applied Mathematics and Physics
Electrical Engineering and Cybernetics
GPA: 4.9/5.0

Professional Experience

Graduate Research Assistant, TU Darmstadt   **2016–2022**
Performed research on robot learning, published 1 book, 3 journals, 11 conferences, 5 workshops, 3 preprints; assisted in teaching lectures on statistical machine learning & reinforcement learning; supervised theses (12 M.Sc., 3 B.Sc.), 17 student projects, and 1 seminar; co-authored 3 successful grant proposals.

Student Research Assistant, FAU Erlangen-Nuremberg   **2014–2015**
Research in signal processing & machine learning, application of Bayesian inference to spatio-temporal filtering (beam forming, blind source separation).

System Engineer, Netcracker Technology Corp., Moscow   **2012–2013**
Developed optical communication network models (SDH/PDH, DWDM) and mechanisms for graphical representation of heterogeneous multilevel networks (Java, SQL), formulated system requirements and design specifications.

Intern, Intel-MIPT Laboratory, Moscow   **2010–2011**
Contributed to the development of a functional and performance simulators of a multimedia digital signal processor under the guidance of senior Intel engineers (C++ implementation of instruction pipeline).

Awards and Scholarships

Best Oral Paper Award Nomination, Humanoids, Toronto   **2019**
Paper "Building a Library of Tactile Skills Based on FingerVision".

Mike Stilman Paper Award Nomination, Humanoids, Toronto   **2019**
Paper "Building a Library of Tactile Skills Based on FingerVision".

Best Poster Award, 2nd Place, Ben-Gurion University, Israel   **2017**
Paper "Catching Heuristics Are Optimal Control Policies" at *13th Karniel Computational Motor Control Workshop*, Ben-Gurion University, Israel.

Scholarship for Master Studies, DAAD   **2013–2015**
Competitive scholarship from the German Academic Exchange Service (DAAD) for foreign students pursuing an M.Sc. degree in Germany. Acceptance rate 10%.

State Scholarship of Russian Federation   **2010–2012**
Government funding for outstanding students covering monthly costs of living.

Publications

Books and Journal Papers

Belousov, B.; Wibranek, B.; Schneider, J.; Schneider, T.; Chalvatzaki, G.; Peters, J.; Tessmann, O. (2022). Robotic Architectural Assembly With Tactile Skills: Simulation and Optimization. *Automation in Construction*, 133, 104006.

Belousov, B.; Abdulsamad, H.; Klink, P.; Parisi, S.; Peters, J. (2021). Reinforcement Learning Algorithms: Analysis and Applications. *Springer International Publishing.*

Klink, P.; Abdulsamad, H.; **Belousov, B.**; D'Eramo, C.; Peters, J.; Pajarinen, J. (2021). A Probabilistic Interpretation of Self-Paced Learning With Applications to Reinforcement Learning. *Journal of Machine Learning Research (JMLR)*, 22(182), 1-52.

Belousov, B.; Peters, J (2019). Entropic Regularization of Markov Decision Processes. *Entropy*, 21(7), 674.

Conference Papers

Funk, N.; Chalvatzaki, G.; **Belousov, B.**; Peters, J. (2022). Learn2Assemble With Structured Representations and Search for Robotic Architectural Construction. In *Conference on Robot Learning (CoRL)* (pp. 1401-1411). PMLR.

Muratore, F.; Gruner, T.; Wiese, F.; **Belousov, B.**; Gienger, M.; Peters, J. (2022). Neural Posterior Domain Randomization. In *Conference on Robot Learning (CoRL)* (1532-1542). PMLR.

Wibranek, B.; Liu, Y.; Funk, N.; **Belousov, B.**; Peters, J.; Tessmann, O. (2021). Reinforcement Learning for Sequential Assembly of SL-Blocks-Self-interlocking Combinatorial Design Based on Machine Learning. In *39th eCAADe Conference* (pp. 27-36).

Schultheis, M.; **Belousov, B.**; Abdulsamad, H.; Peters, J. (2020). Receding Horizon Curiosity. In *Conference on Robot Learning (CoRL)* (pp. 1278-1288). PMLR.

Klink, P.; Abdulsamad, H.; **Belousov, B.**; Peters, J. (2020). Self-Paced Contextual Reinforcement Learning. In *Conference on Robot Learning (CoRL)* (pp. 513-529). PMLR.

Lutter, M.; **Belousov, B.**; Listmann, K.; Clever, D.; Peters, J. (2020). HJB Optimal Feedback Control With Deep Differential Value Functions and Action Constraints. In *Conference on Robot Learning (CoRL)* (pp. 640-650). PMLR.

Eilers, C.; Eschmann, J.; Menzenbach, R.; **Belousov, B.**; Muratore, F.; Peters, J. (2020). Underactuated Waypoint Trajectory Optimization for Light Painting Photography. In *International Conference on Robotics and Automation (ICRA)* (pp. 1505-1510). IEEE.

Nass, D.; **Belousov, B.**; Peters, J. (2019). Entropic Risk Measure in Policy Search. In *International Conference on Intelligent Robots and Systems (IROS)* (pp. 1101-1106). IEEE.

Belousov, B.; Sadybakasov, A.; Wibranek, B.; Veiga, F.; Tessmann, O.; Peters, J. (2019). Building a Library of Tactile Skills Based on FingerVision. In *IEEE-RAS 19th International Conference on Humanoid Robots (Humanoids)* (pp. 717-722). IEEE.

Wibranek, B.; **Belousov, B.**; Sadybakasov, A.; Peters, J.; Tessmann, O. (2019). Interactive Structure-Robotic Repositioning of Vertical Elements in Man-Machine Collaborative Assembly through Vision-Based Tactile Sensing. In *37th eCAADe Conference* (pp. 705-713).

Belousov, B.; Neumann, G.; Rothkopf, C.; Peters, J. (2016). Catching Heuristics Are Optimal Control Policies. In *Neural Information Processing Systems (NeurIPS)* (1434-1442).

Workshop Papers

Lutter, M.; Clever, D.; **Belousov, B.**; Listmann, K.; Peters, J. (2020). Evaluating the Robustness of HJB Optimal Feedback Control. In *52th International Symposium on Robotics (ISR)* (pp. 1-8). VDE.

Belousov, B.; Abdulsamad, H.; Schultheis, M.; Peters, J. (2019). Belief Space Model Predictive Control for Approximately Optimal System Identification. In *Conference on Reinforcement Learning and Decision Making (RLDM)*.

Belousov, B.; Peters, J. (2018). Entropic Regularization of Markov Decision Processes. In *38th International Workshop on Bayesian Inference and Maximum Entropy Methods*.

Belousov, B.; Peters, J. (2018). Mean Squared Advantage Minimization as a Consequence of Entropic Policy Improvement Regularization. In *European Workshops on RL (EWRL)*.

Belousov, B.; Neumann, G.; Rothkopf, C.; Peters, J. (2017). Catching Heuristics Are Optimal Control Policies. In *13th Karniel Computational Motor Control Workshop (KCMW)*.

Preprints

Lutter, M.; **Belousov, B.**; Mannor, S.; Fox, D.; Garg, A.; Peters, J. (2021). Continuous-Time Fitted Value Iteration for Robust Policies. *arXiv preprint arXiv:2110.01954*.

Abdulsamad, H.; Dorau, T.; **Belousov, B.**; Zhu, J. J.; Peters, J. (2021). Distributionally Robust Trajectory Optimization Under Uncertain Dynamics via Relative-Entropy Trust Regions. *arXiv preprint arXiv:2103.15388*.

Belousov, B., Peters, J. (2017). f-Divergence Constrained Policy Improvement. *arXiv preprint arXiv:1801.00056*.

Teaching

Reinforcement Learning (18 ECTS), TUDa   Fall 2018
Teaching assistant for the lecture, seminar, and lab project. Developed homeworks, exercises, organized the seminar, designed software for the lab project. Coordinated a team of supervisors and oversaw the writing of a book based on the seminar papers.

Statistical Machine Learning (6 ECTS), TUDa   Spring 2018
Teaching assistant for the lecture and exercises. Designed homeworks and exam problems, presented exercise solutions, managed communication with students.

Robot Learning: Integrated Project (6 ECTS), TUDa   Fall 2017
Taught introductory lectures on reinforcement learning and real-robot control; organized project supervision, evaluation, grading.

Supervision

Siebenborn, M. (B.Sc.'22)	Evaluating Decision Transformer Architecture on Robot Learning Tasks
Gruner, T. (M.Sc.'21)	Wasserstein-Optimal Bayesian System Identification for Domain Randomization
Schneider, T. (M.Sc.'21)	Active Inference for Robotic Manipulation
Wegner, F. (M.Sc.'21)	Learning Vision-Based Tactile Representations for Robotic Architectural Assembly
Rathjens, J. (M.Sc.'21)	Accelerated Policy Search
Galljamov, R. (M.Sc.'20)	Sample-Efficient Learning-Based Controller for Bipedal Walking in Robotic Systems
Dorau, T. (M.Sc.'20)	Distributionally Robust Optimization for Optimal Control
Semmler, M. (M.Sc.'20)	Sequential Bayesian Optimal Experimental Design for Nonlinear Dynamics
Eilers, C. (B.Sc.'19)	Bayesian Optimization for Learning from Randomized Simulations
Schultheis, M. (M.Sc.'19)	Bayesian Reinforcement Learning for System Identification
Klink, P. (M.Sc.'19)	Generalization and Transferability in Reinforcement Learning
Sadybakasov, A. (M.Sc.'19)	Learning Vision-Based Tactile Skills for Robotic Architectural Assembly
Ebeling, L. (B.Sc.'19)	Experimental Validation of an MPC-POMDP Model of Ball Catching
Nass, D. (M.Sc.'18)	Risk-Sensitive Policy Search for Robot-Badminton
Song, Y. (M.Sc.'18)	Minimax and Entropic Proximal Policy Optimization

Skills

Programming: Python (PyTorch, Pyro, CasADi), LaTeX, Linux, C/C++, Git.
Robotics: light-weight robot arms (Kuka iiwa, Barrett WAM, UR10), grippers (Schunk EGH, Robotis), drones (DJI Mavic Pro 2), cameras (Intel RealSense), tactile sensors (FingerVision, Digit), tracking systems (Optitrack, PupilLabs).
Languages: Russian (native), English (fluent), German (fluent).

Research Grants

Aristotle Project, ANR & BMBF   **2021–2025**
Contributed to a joint French-German proposal funded by the French National Research Agency (ANR) and the German Federal Ministry of Education and Research (BMBF). Project title "See, Touch and Manipulate: Robot Learning for Dexterous Robot Bimanual Manipulation Through Vision and Touch". Total funding 560.000 €, duration 48 months.

Artificial Intelligence in Construction (AICO)   **2021–2025**
Co-developed a proposal for 1 fully funded Ph.D. position on "Robot Learning for Modular Assembly of Architectural Structures" funded by Nexplore/Hochtief within the AICO program at TU Darmstadt.

Forum for Interdisciplinary Research (FiF), TUDa   **2020–2021**
Co-authored a proof of concept proposal on "Multimatrial Modular Assembly Through Robot Learning and Tactile Sensing" awarded with 60.000 € for 1 year by TU Darmstadt.

Reviewing

JMLR, TMLR, NeurIPS, ICML, AAAI, ICLR, EAAI, CORL, ICRA, IROS, AURO, RA-L, TR-O.

Volunteering

Board of European Students of Technology (BEST)   **2014–2015**
As a member of BEST in Erlangen, participated in the organization of the European BEST Engineering Competition (EBEC), carried out project promotion, facilitated the preparation of career seminars for students.

Member of Student Council at MIPT, Moscow   **2012–2013**
Supervision of first-year students, organization of social events and invited talks.