Ryan Julian

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EDUCATION

PhD, Computer Science — Robotics and Machine Learning	*Aug 2017-Present*
University of Southern California	*Expected Graduation*
▪ Advisor: Prof. Gaurav Sukhatme (co-advised by Stefan Schaal 2017-18)	*May 2021*
▪ **Thesis Topic:** Algorithms and Systems for Continual Robot Learning	
B.S. Electrical Engineering and Computer Sciences	*Aug 2008–May 2012*
University of California, Berkeley	
International Baccalaureate Diploma	*Aug 2004–May 2008*
Cocoa Beach Jr./Sr. High School	

EMPLOYMENT

Student Researcher, Google Brain, Robotics Team — *Jun 2019-Present*
Advised by Karol Hausman, Chelsea Finn, and Sergey Levine
- Performs peer-reviewed research on **large scale robot learning systems** for manipulation, including design of neural network architectures, losses, training and data processing methods, etc. See Publications.
- Created **"Never Stop Learning"** algorithm for continually adapting robot learning systems to novel environments, lighting conditions, objects, robot wear-and-tear, etc.
- Lead designer of a robot learning system which fuses multiple types of supervision (human language commands, goal images, RL rewards, etc.), to allow robots to quickly generalize (zero-shot) to complex manipulation tasks they have never performed before.

Visiting Student, UC Berkeley RAIL Lab (Sergey Levine) — *May 2018-Sept 2018*
Collaborators: Abhishek Gupta, Kristian Hartikainen, Kate Rakelly

PhD Research Assistant, University of Southern California — *Aug 2017-Present*
Advised by Prof. Gaurav Sukhatme, USC RESL
Co-Advisor Prof. Stefan Schaal, USC CLMC (2017-18)
- Authored **8 publications** appearing at **top conferences and journals**, on multi-task and continual reinforcement learning for robotics. See Publications.
- **Managed a team of 10** student employees developing robotics, learning, and simulation libraries for 4 years, including technical team lead responsibilities (code reviews, goal setting, mentoring, etc.) and people management responsibilities (interviewing and hiring, working with reports on professional development goals, etc.). See Open Source.
- Served as a **peer reviewer for 14 journals, conferences, and workshops**
- Teaching Assistant for 2 semesters of Introduction to Computer Science

Software Engineer, Google Cloud Platform — *Jan 2017-Aug 2017*
- Implemented backend software for a high-performance in-memory cache cloud service
- Designed billing database, API hooks, and reporting pipeline for a per-second billing of a cloud service

Robotics Software Engineer, X (formerly Google Robotics/Replicant) — *May 2014-Dec 2016*
- Supported state-of-the-art robot learning work published by Google X and Google Brain, e.g.
  - Deep Learning for Robots: Learning from Large-Scale Interaction

- ◦ [Teaching Robots to Understand Semantic Concepts](#)
  - ◦ [How Robots Can Acquire New Skills from Their Shared Experience](#)
- Designed programming environments, visualization tools, libraries, and associated on-robot software which make easy for non-experts to develop robotic behaviors
- Developed software components on the cloud, client/UI, and robot to allow for efficient teleoperation of mobile robots across the public internet. This involved novel visualization and control features to adapt to latency, bandwidth budgeting, and optimizing control and data communications architectures
- Designed and deployed high-precision robotic test stations for qualifying and calibrating electromechanical robot components, such as brushless motors and load cells
- Developed and maintained a system for data collection, event tracking, and process flow on a complex robot manufacturing line, including robotics, automation, GUI, cloud, and data processing components. System was proven over 1 year on a pilot-scale robot manufacturing line processing ~1000 parts/day.

R&D Engineer, [LEAP Motion](#)   *Aug 2013–April 2014*
- Developed hardware, firmware, and software for computer-based hand and body tracking sensing technology
- Researched and implemented novel algorithms for camera calibration and synchronization, sensor fusion, and perception. See [Patents](#).
- Brought up board and firmware for multiple CMOS image sensors and USB controllers
- Lead hiring effort for Firmware Engineering team; recruited and trained 3 new hires in 3 months

Research Scientist, University of California, Berkeley   *May 2011–May 2013*
with Prof. Ronald Fearing, [Biomimetic Millisystems Laboratory](#)
with Prof. Pieter Abbeel, [Robot Learning Lab](#)   *May 2011–May 2012 as*
- Lead robotics platform concept, design, and dissemination for [10-institution US](#) *Undergraduate*
  [Army robotics development consortium](#)   *Research Apprentice*
- Coordinated 5 undergraduate and 3 graduate students, collaborated with 10 universities
- Designed [two](#) [generations](#) of user-friendly robotics and computer vision controllers, in two one-year cycles. Both had the highest computing power per-mass of any robot in the world.
- Maintained Linux software stack with Ubuntu, ROS, OpenCV, and custom kernel drivers.
- Performed peer-reviewed research on multi-agent control, computer vision, and perception. See [Publications](#).

Embedded Software R&D Intern, National Instruments   *May–Aug. 2011*
Android GPS Software Intern, Qualcomm   *May–Aug 2010*
Launch Control System Software Intern, NASA Kennedy Space Center   *Jun–Aug 2008/2009*

OPEN SOURCE AND COMMUNITY SERVICE

Founder and Lead Maintainer, [Reinforcement Learning Working Group](#)
- Mission: Provide a forum for high-quality community-developed software for   *Dec 2017–Present*
  robot learning and reinforcement learning
- **Creator and lead maintainer of the flagship project [garage](#),** a high-quality library for reinforcement learning research, developed to industry-level design, testing, and stability standards

- Designed APIs and implementation for reinforcement learning subsystems such as neural network definition, optimization, high-throughput simulation, replay buffers, logging, etc.
- **Co-Creator of [MetaWorld Multi-Task RL benchmark](#)**, which provides a standardized benchmark and evaluation procedure for multi-task and continual robot learning using 50 unique simulated robot manipulation tasks.
- Open source maintainer tasks, such as setting the long-term roadmap, recruiting and collaborating with contributors, maintaining high levels of automation and continuous integration, managing the release process, writing documentation, maintaining forums for collaboration such as Slack and mailing lists, and promotion to the research community and general public.
- Combined >500 downloads/mo., >1500 GitHub stars, 90 contributors, 100 citations in the academic literature.

Co-Founder and Board Member, PiE Robotics   *Jan 2009–Present*
- Co-founded non-profit organization with the mission of building a robotics competition for underserved Bay Area high schools, by uniting college students interested in robotics and hands-on engineering, product design, and peer mentoring and education
- As Board Member and Adviser, helps craft long-term vision, mentors young staff on leadership and engineering, and established non-profit corporation for long-term finance and governance
- As Director, established brand and organization structure; grew organization from 3 staff and 6 teams to 40 staff, 40 mentors, and 12 teams; raised and managed $30,000 in 2 years
- As Co-Founder, developed games and robotics platforms for use in competition

# JOURNAL AND CONFERENCE PUBLICATIONS   * - Equal Contribution

"Many-Modal RL: Combining Images, Language, Rewards, and More for Robot Skill Representation Learning." **Ryan C. Julian*, Ted Xiao*,** Yevgen Chebotar, Sergey Levine, Chelsea Finn, and Karol Hausman. **In Preparation** for *Conference on Robot Learning*, 2021 (CoRL 2021).

"Visual Meta-World: A Robotics Benchmark for Visual Multi-Task Reinforcement Learning." Avnish Narayan*, **Ryan C. Julian*,** Hayden Shively, Adithya Bellathur, Gaurav S. Sukhatme, Sergey Levine, Chelsea Finn, and Karol Hausman. **In Preparation** for *Conference on Robot Learning*, 2021 (CoRL 2021).

"Mix and Morph: Fast and Forget-Free Continual Multi-Task Reinforcement Learning for Robotics.", **Ryan C. Julian*,** K.R. Zentner*, Ujjwal Puri, Yulun Zhang, Karol Hausman, and Gaurav S. Sukhatme. **In Preparation** for *Robotics: Science and Systems*, 2021 (RSS 2021).

"Actionable Models: Unsupervised Offline Learning of Robotic Skills.", Yevgen Chebotar, Karol Hausman, Yao Lu, Ted Xiao, Alex Irpan, Benjamin Eysenbach, **Ryan C. Julian**, Chelsea Finn, Sergey Levine. **Under Review** at *International Conference on Machine Learning*, 2021 (ICML 2021).

"Never Stop Learning: The Effectiveness of Fine-Tuning in Robotic Reinforcement Learning" **Ryan C. Julian**, Benjamin Swanson, Gaurav S. Sukhatme, Sergey Levine, Chelsea Finn, and Karol Hausman. In *Conference on Robot Learning*, 2020 (CoRL 2020).
[Talk] [Video] [VentureBeat] [USC News] [Two Minute Papers]

"Scaling Simulation-to-Real Transfer by Learning a Latent Space of Robot Skills." **Ryan C. Julian**, Eric Heiden, Zhanpeng He, Hejia Zhang, Stefan Schaal, Joseph Lim, Gaurav S Sukhatme, and Karol Hausman. *The International Journal of Robotics Research* 39, no. 10-11 (IJRR, September 2020): 1259-78.

"Meta-World: A Benchmark and Evaluation for Multi-Task and Meta Reinforcement Learning." Tianhe Yu*, Deirdre Quillen*, Zhanpeng He*, **Ryan C. Julian**, Karol Hausman, Chelsea Finn, and Sergey Levine. In *Conference on Robot Learning*, 2019 (CoRL 2019). PMLR, 2020.

"Scaling Simulation-to-Real Transfer by Learning Composable Robot Skills." **Ryan C. Julian**, Eric Heiden, Zhanpeng He, Hejia Zhang, Stefan Schaal, Joseph Lim, Gaurav Sukhatme, and Karol Hausman. In *International Symposium on Experimental Robotics*, 2018 (ISER 2018). Springer, Cham, 2018. [Video]

"Cooperative Control and Modeling for Narrow Passage Traversal With an Ornithopter MAV and Lightweight Ground Station." **Ryan C. Julian**, Cameron J. Rose, Humphrey Hu, and Ronald S. Fearing. In *Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems,* 2013 (AAMAS 2013).

"Performance Analysis and Terrain Classification for a Legged Robot Over Rough Terrain." Fernando L. Garcia Bermudez, **Ryan C. Julian**, Duncan W. Haldane, Pieter Abbeel, and Ronald S. Fearing. In *IEEE/RSJ International Conference on Intelligent Robots and Systems,* 2012 (IROS 2012). IEEE, 2012.

WORKSHOP PUBLICATIONS, PRE-PRINTS, AND INVITED TALKS   * - Equal Contribution

"Towards Exploiting Geometry and Time for Fast Off-Distribution Adaptation in Multi-Task Robot Learning." K.R. Zentner*, **Ryan C. Julian***, Ujjwal Puri, Yulun Zhang, and Gaurav S. Sukhatme. In *NeurIPS 2020 Workshop: Challenges of Real World Reinforcement Learning* and *NeurIPS 2020 Workshop: Offline RL*. 2020. [Talk (Real World RL)] [Talk (Offline RL)]

"Robots That Never Stop Learning." **Ryan C. Julian**. Intel Research, Deep Learning Community of Practice. June 16th, 2020.

"Efficient Adaptation for End-to-End Vision-Based Robotic Manipulation" **Ryan C. Julian**, Benjamin Swanson, Sergey Levine, Chelsea Finn, and Karol Hausman. In *ICML 2020 Workshop: Inductive Biases, Invariances, and Generalization in Reinforcement Learning (BIG), ICML 2020 Workshop: Lifelong Learning,* and *2020 Virtual Conference on Reinforcement Learning for Real Life (RL4RealLife).*

"Meta-World: A Benchmark and Evaluation for Multi-Task and Meta Reinforcement Learning." Tianhe Yu*, Deirdre Quillen*, Zhanpeng He*, **Ryan C. Julian**, Karol Hausman, Chelsea Finn, and Sergey Levine.. In *NeurIPS Workshop: Meta-Learning* and *NeurIPS Workshop: Deep Reinforcement Learning*. 2019.

"Simulator Predictive Control: Using Learned Task Representations and MPC for Zero-Shot Generalization and Sequencing." Zhanpeng He, **Ryan C. Julian**, Eric Heiden, Hejia Zhang, Joseph J. Lim, Stefan Schaal, Gaurav Sukhatme, and Karol Hausman. In *NeurIPS Workshop: Deep Reinforcement Learning*. 2018. [Video]

"Auto-conditioned Recurrent Mixture Density Networks for Complex Trajectory Generation." Hejia Zhang, Eric Heiden, **Ryan C. Julian**, Zhanpeng He, Joseph Lim, and Gaurav S. Sukhatme. In *Southern California Robotics Symposium*. 2018.

TEACHING AND ACADEMIC SERVICE

Teaching	Teaching Assistant, USC CSCI 109: Introduction to Computer Science Fall 2018 and Spring 2018
Journal Reviewing and Conference Program Committees	International Journal of Robotics Research (IJRR) / IEEE Robotics and Automation Letters (RA-L) / IEEE Transactions on Robotics (TR-O) / Autonomous Robotics (Journal) / Conference on Robot Learning (CoRL) / Robotics: Science and Systems (RSS) / International Conference on Machine Learning (ICML) / International Conference on Learning Representations (ICLR) / Neural Information Processing Systems (NeurIPS) / ICLR 2021 Workshop: A Roadmap to Never-Ending RL / ICML 2020 Workshop: Lifelong Learning/ ICRA 2020 Workshop: Machine Learning in Planning and Control of Robot Motion / ICML 2019 Workshop: Multi-Task and Lifelong Reinforcement Learning / ICLR 2019 Workshop: Structure and Priors in Reinforcement Learning (SPiRL)

SKILLS, TOOLS, & CODE

Programming	Python, C++, Java, C, Go, Bash, Lisp

Design Tools	PyTorch, TensorFlow, NumPy, SciPy, Matplotlib, Pandas, Seaborn, OpenAI Gym, Bazel, Git, Gerrit, GitHub, GitHub Actions, TravisCI, Jenkins, Google Cloud Platform, Amazon AWS, Docker, REST APIs, Protocol Buffers, gRPC, ROS, OpenCV, EAGLE CAD, SolidWorks, MATLAB, NI LabVIEW
Expertise	multi-task reinforcement learning / transfer learning / deep learning / deep reinforcement learning / variational inference / imitation learning / robotics / artificial intelligence / machine learning / computer vision / imaging and sensor SoCs / automation / cloud computing / product development and project management / STEM mentoring, outreach, and education / non-profit management and fundraising
Coursework	robotics / deep learning / machine learning / computer vision / convex optimization / artificial intelligence / algorithms and computer science theory / linear algebra / probability and stochastic processes / control theory / operating systems / embedded systems / mechatronic design
GitHub	github.com/rlworkgroup (Reinforcement Learning Working Group - Lead Maintainer) github.com/ryanjulian (Personal projects and early PhD research) github.com/openai/baselines (Author of GAIL implementation)

PATENTS

"Method for synchronizing operation of systems." Ryan Christopher Julian, H. E. Hongyuan, and David Samuel Holz. U.S. Patent 9,348,419, issued May 24, 2016.

"Dynamic, free-space user interactions for machine control." Raffi Bedikian, Jonathan Marsden, Keith Mertens, David Holz, Maxwell Sills, Matias Perez, Gabriel A. Hare, and Ryan Julian. U.S. Patent 9,459,697, issued October 4, 2016.

AWARDS AND HONORS

PhD Fellow, Max Planck Institute for Intelligent Systems	UC Berkeley Regents' and Chancellor's Scholar
Amazon Research Award 2018	National Merit Scholar
Amazon Research Award 2020	