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Google Scholar | GitHub

Robby Costales Ph.D.

I am an ML researcher and engineer who designs scalable, open-ended learning systems for adaptive agents. My long-term vision is to build autonomous agents that are reliable collaborators and enablers of human creativity.

Industry Experience

Google DeepMind | Research Scientist Intern — Mountain View, CA
Gemini RL & Code — Advised by Yang Song & Stephan Lee — May 2025 - Aug 2025

- Studied agentic LLM sampling strategies to produce abundant RL post-training data.
- Designed novel sampling methods that improved pass@k on Humanity's Last Exam.
- Analyzed relative efficacy of methods across Gemini model sizes and problem types.

Google Research, Brain Team | Student Researcher — Mountain View, CA
RL Research Team — Advised by Izzeddin Gür — May 2022 - Dec 2022

- Studied semi-supervised skill learning and hierarchical decision transformers.

Capital One Financial | Data Engineering Intern — New York, NY
Data Quality Monitoring — Advised by Zeira Zhou — May 2019 - Aug 2019

- Stress-tested performance of third-party tool under heavy workloads with Dask, demonstrating viability for use in production data monitoring application.

Education

University of Southern California — Los Angeles, CA
Ph.D. in Computer Science — Aug 2020 - Dec 2025

- Thesis: *Open-Ended Training of Adaptive Agents*
- Advisor: Prof. Stefanos Nikolaidis (previously, Prof. Fei Sha)
- Research areas: Meta-reinforcement learning, exploration strategies, autocurricula, unsupervised environment design, quality diversity optimization, machine learning

Columbia University — New York, NY
B.S. in Computer Science, Intelligent Systems — 2018 - 2020

Bard College at Simon's Rock | Early College (age 16) — Great Barrington, MA
A.A. and B.A. in Computer Science — 2015 - 2018

Awards

- **Outstanding Reviewer**, Intl Conference on Machine Learning (ICML) — 2025
- **Spotlight Presentation**, Intl Conference on Learning Representations (ICLR) — 2022
- **Viterbi School of Engineering CSCI Department Fellowship** ($32,000) — 2020
- **REUs** ($5,000 × 2) at Univ. of Miami, Washington Univ. in St. Louis — 2017-2018
- **Winner**, Congressional Art Competition — 2015

Selected Publications

1. **R Costales**, S Nikolaidis. Scale-Resistant Learning Objectives Produce Emergent Internal Autocurricula. *Manuscript in preparation for submission*, 2025.

   Establishes a novel connection between scale-resistant actor-critic meta-RL learners and autocurricula methods, and demonstrates that their combined effects are synergistic.

2. **R Costales**, S Nikolaidis. Enabling Adaptive Agent Training in Open-Ended Simulators by Targeting Diversity. *NeurIPS*, 2024. arxiv.org/abs/2411.04466.

   Introduces DIVA, an evolutionary approach which uses quality diversity (QD) optimization for generating diverse tasks to train adaptive agents in open-ended simulators.

3. S Iqbal, **R Costales**, F Sha. ALMA: Hierarchical Learning for Composite Multi-Agent Tasks. *NeurIPS*, 2022. arxiv.org/abs/2205.14205.

   Presents a general learning method for leveraging structured multi-agent tasks, resulting in sophisticated coordination behavior and outperforming competitive MARL baselines.

4. **R Costales**, S Iqbal, F Sha. Possibility Before Utility: Learning and Using Hierarchical Affordances. *ICLR*, 2022 (Spotlight presentation). arxiv.org/abs/2203.12686.

   Introduces HAL, a hierarchical reinforcement learning (HRL) approach that learns a model of affordances to prune impossible subtasks for more effective learning.

Academia Experience

University of Southern California | Research Assistant — Los Angeles, CA
ICAROS Lab | *Advised by Prof. Stefanos Nikolaidis* — Jan 2023 - Dec 2025
- Meta-RL, quality diversity (QD) optimization, and autocurricula research.

University of Southern California | Research Assistant — Los Angeles, CA
ShaLab | *Advised by Prof. Fei Sha* — Aug 2020 - May 2022
- Hierarchical RL and multi-agent RL research.

Columbia University | Undergraduate Research Assistant — New York, NY
Software Systems Lab | *Advised by Prof. Junfeng Yang* — Feb 2019 - Jun 2020
- Published CVPR workshop paper, *Live Trojan Attacks on Deep Neural Networks*.

Columbia University | Undergraduate Research Assistant — New York, NY
Programming Systems Lab | *Advised by Prof. Gail Kaiser* — May 2017 - Aug 2017
- Developed platform that intelligently teaches students to code through puzzles.

Washington University in St. Louis | Research Intern (REU) — St. Louis, MO
VIBE Lab | *Advised by Prof. Alvitta Ottley* — May 2018 - Aug 2018
- Real-time inference of user intentions while exploring St. Louis Crime Map.

University of Miami | Research Intern (REU) — Miami, FL
Miami Project to Cure Paralysis | *Advised by Prof. Vance Lemmon* — May 2017 - Aug 2017
- Used unsupervised learning techniques to analyze *in vitro* nerve growth data.

Skills

Tools: Python, PyTorch, JAX, TensorFlow, C++, JavaScript

Research expertise: Reinforcement learning (RL), exploration, meta-RL, hierarchical RL (HRL), multi-agent RL, quality diversity (QD) optimization, evolutionary algorithms

Selected coursework: Statistics, Dynamics of Representation Learning, Online Learning, Computer Vision, Robotics, Unsupervised ML, Applied Deep Learning

Service

Conference reviewing: *ICML, NeurIPS, ICLR, AAAI*

Mentorship: *CURVE* program (USC), and *Viterbi Graduate Mentorship Program* (USC)

Press

USC at ICLR 2022: learning how to learn, decision making in complex environments, better forecasting models (USC News), 2022.

Robotics Studio and Beyond: Pink Panther (Columbia Engineering), 2021.

Teaching

- **Machine Learning for Data Science**. TA. University of Southern California. 2025.
- **Machine Learning** (5×). TA. University of Southern California. 2023-2025.
- **Artificial Intelligence** (2×). TA. Columbia University. 2020.
- **Cloud Computing and Big Data**. TA. Columbia University. 2019.
- **SIAM Coding Bootcamp**. Instructor. Columbia University. Taught basics of machine learning via `scikit-learn` to high school students. 2018.
- **Introduction to Computer Science**. TA. Bard College at Simon's Rock. 2017.
- **Physics**. College Academy. Summer enrichment for high schoolers. Instructor. 2016.

Mentees

- **Sankalp Agrawal** — B.S., Ohio State University. Co-advised via USC CURVE. 2024–2025.
- **Bhargav Panguluru** — B.S., University of Southern California. 2024–2025.
- **Ayan Bhowmick** — M.S., University of Southern California. 2024.