Raúl Astudillo

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EDUCATION

Cornell University *August 2016-August 2022*
Ph.D. in Operations Research and Information Engineering
Advisor: Peter Frazier
Minors: Computer Science and Statistics

University of Guanajuato & Center for Research in Mathematics *August 2011-June 2016*
B.Sc. in Mathematics
GPA: 9.7/10
Highest GPA of the 2011-2016 class

ACADEMIC POSITIONS

California Institute of Technology *September 2022-Present*
Postdoctoral Scholar
Supervisor: Yisong Yue

INDUSTRY POSITIONS

Facebook
Visiting Researcher *October 2020-March 2021*
Supervisor: Eytan Bakshy
Research Intern *June-September 2020*
Supervisor: Daniel Jiang

ExxonMobil Upstream Research Company
Research Intern *June-August 2019*
Supervisors: Liz Curry and Xiao-Hui Wu
Research Intern *June-August 2018*
Supervisors: Damian Burch and Xiao-Hui Wu

RESEARCH INTERESTS

My research interests lie at the intersection between operations research and machine learning. By integrating tools from both fields, I develop algorithms that enable intelligent decision-making in complex environments where information is costly to gather or process. My work has found application in areas such as cellular agriculture, materials design, and protein engineering.

PUBLICATIONS & PREPRINTS

1. J. Bowden, R. Astudillo, C. Yeh, J. Song, Y. Chen, T. Desautels, and Y. Yue, "New insights on Bayesian optimization with deep kernel learning", *Preprint*.
2. F. Huber, S. Rojas Gonzalez, and R. Astudillo, "Bayesian preference elicitation for decision support in multi-objective optimization", *Submitted*.
3. V. Mishra, R. Astudillo, P. Frazier, and F. Zhang, "Probably-convergent source seeking with mobile agents" (Early version appeared in the NeurIPS 2023 Workshop on Adaptive Experimental Design and Active Learning in the Real World), *Submitted*.

4. R. Astudillo, K. Li, M. Tucker, X. Chen, A. Ames, and Y. Yue, "Preferential multi-objective Bayesian optimization" (Early version appeared in the ICML 2023 Workshop on The Many Facets of Preference-Based Learning), *Submitted*.

5. J. Yang, R. Lal, J. Bowden, R. Astudillo, M. Hameedi, Y. Yue, and F. Arnold, "Active learning-assisted directed evolution", *Nature Communications, 2024 (Forthcoming)*.

6. C. Cheng, R. Astudillo, T. Desautels, and Y. Yue, "Practical Bayesian algorithm execution via posterior sampling" (Finalist in the 2024 INFORMS Undergraduate Operations Research Prize Competition), *Advances in Neural Information Processing Systems, 2024 (Forthcoming)*.

7. Q. Xie, R. Astudillo, P. Frazier, Z. Scully, and A. Terein, "Cost-aware Bayesian optimization via the Pandora's box Gittins index" (Finalist in the 2024 INFORMS Data Mining Best Paper Competition), *Advances in Neural Information Processing Systems, 2024 (Forthcoming)*.

8. B. Sha, R. Astudillo, and P. Frazier, "Multi-attribute optimization under preference uncertainty" (Finalist in the 2020 INFORMS Undergraduate Operations Research Prize Competition), *Winter Simulation Conference, 2024 (Forthcoming)*.

9. P. Buathong, J. Wan, R. Astudillo, S. Daulton, M. Balandat, and P. Frazier, "Bayesian optimization of function networks with partial evaluations", *International Conference on Machine Learning, 2024*.

10. J. Jannink, R. Astudillo, and P. Frazier, "Insight into a two-part plant breeding scheme through Bayesian optimization of budget allocations", *Crop Science, 2023*.

11. R. Astudillo, Z. Lin, E. Bakshy, and P. Frazier, "qEUBO: A decision-theoretic acquisition function for preferential Bayesian optimization", *International Conference on Artificial Intelligence and Statistics, 2023*.

12. Z. Cosenza, R. Astudillo, P. Frazier, K. Baar, and D. Block, "Multi-information source Bayesian optimization of culture media for cellular agriculture" (Spotlight in the ICML 2022 Adaptive Experimental Design and Active Learning in the Real World Workshop), *Biotechnology and Bioengineering, 2022*.

13. Z. Lin, R. Astudillo, P. Frazier, and E. Bakshy, "Preference exploration for efficient Bayesian optimization with multiple outcomes", *International Conference on Artificial Intelligence and Statistics, 2022*.

14. R. Astudillo, and P. Frazier, "Thinking inside the box: A tutorial on grey-box Bayesian optimization", *Advanced Tutorial in the Winter Simulation Conference, 2021*.

15. R. Astudillo, D.R. Jiang, M. Balandat, E. Bakshy, and P. Frazier, "Multi-step budgeted Bayesian optimization with unknown evaluation costs", *Advances in Neural Information Processing Systems, 2021*.

16. R. Astudillo and P. Frazier, "Bayesian optimization of function networks", *Advances in Neural Information Processing Systems, 2021*.

17. S. Cakmak, R. Astudillo, P. Frazier and E. Zhou, "Bayesian optimization of risk measures", *Advances in Neural Information Processing Systems, 2020*.

18. R. Astudillo and P. Frazier, "Multi-attribute Bayesian optimization with interactive preference learning", *International Conference on Artificial Intelligence and Statistics, 2020*.

19. R. Astudillo and P. Frazier, "Bayesian optimization of composite functions", *International Conference on Machine Learning, 2019*.

SELECTED AWARDS

Rising Star in Data Science - UChicago and UC San Diego	*2024*
Rising Star in Management Science & Engineering - Stanford University	*2024*
Outstanding Reviewer Award - NeurIPS	*2021*
Second Prize - XXII International Mathematics Competition for University Students	*2015*
Orgullo UG Academic Excellence Award - University of Guanajuato	*2014*
Academic Excellence Fellowship - Center for Research in Mathematics	*2012-2016*

SELECTED PRESENTATIONS

1. "Composite Bayesian optimization for efficient and scalable adaptive experimentation", *Online Reading Group on Modern Adaptive Experimental Design and Active Learning in the Real World, Virtual, 2024.*
2. "Bayesian optimization with Bayesian deep kernel learning", *SIAM Conference on Uncertainty Quantification, Trieste, Italy, 2024.*
3. "Multi-information source Bayesian optimization of culture media for cellular agriculture", *SIAM Conference on Computational Science and Engineering, Amsterdam, Netherlands 2023.*
4. "EUBO: A decision-theoretic acquisition function for preferential Bayesian optimization", *INFORMS Annual Meeting, Indianapolis, IN 2022.*
5. "Thinking inside the box: A tutorial on grey-box Bayesian optimization", *Advanced Tutorial in the Winter Simulation Conference, Phoenix, AZ, October 2021.*
6. "Grey-box Bayesian optimization", *Young Researchers Workshop, Cornell University's School of Operations Research and Information Engineering, Ithaca, NY, 2021.*
7. "Interactive Bayesian optimization with user preferences", *Facebook Adaptive Experimentation Workshop, New York City, NY, 2020.*
8. "Bayesian optimization of composite functions with application to computationally expensive inverse problems", *Applied Inverse Problems Conference, Grenoble, France, 2019.*
9. "Bayesian optimization of composite functions", *International Conference on Machine Learning, Long Beach, CA, 2019.*
10. "Bayesian optimization of composite functions", *2nd Uber Science Symposium, San Francisco, CA*, 2019.

MENTORING EXPERIENCE

Graduate Students

- Victor Amaya Carvajal - Duke University *June 2024-Present*
- Felix Huber - University of Stuttgart *April 2024-Present*
- Qian Xie - Cornell University *August 2023-Present*
- Poompol Buathong - Cornell University *June 2022-May 2024*

Undergraduate Students

- Eric Lee - California Institute of Technology *July 2024-Present*
- Andrew Zabelo - California Institute of Technology *March 2024-Present*
- Chu Xin (Cloris) Cheng - California Institute of Technology *November 2023-Present*
- Bhavik Sha - Cornell University *February 2020-October 2020*

TEACHING EXPERIENCE

Instructor

- Uncertainty Quantification (Graduate) - California Institute of Technology *Spring 2023*
- Engineering Stochastic Processes (Undergraduate) - Cornell University *Summer 2021*

Teaching Assistant

- Statistical Principles (Graduate) - Cornell University *Fall 2018*
- Engineering Stochastic Processes (Undergraduate) - Cornell University *Fall 2017*
- Basic Probability and Statistics (Undergraduate)- Cornell University *Fall 2016*
- Measure Theory and Probability (Graduate) - Center for Research in Mathematics *Fall 2015*
- Complex Analysis (Undergraduate) - University of Guanajuato *Spring 2015*

ACADEMIC SERVICE

Conference Reviewing
AISTATS, ICLR, ICML, NeurIPS

Journal Reviewing
Artificial Intelligence, INFORMS Journal on Computing, Neural Computation, Operations Research, SIAM Review, Technometrics

LANGUAGES

English (proficient), Spanish (native)