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*
Department of Computing and Mathematical Sciences
Postdoctoral Fellow
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 engineering design, digital agriculture, and personalized medicine.

PUBLICATIONS & PREPRINTS

1. J. Bowden, C. Yeh, R. Astudillo, J. Song, Y. Chen, T. Desautels, and Y. Yue, "Bayesian optimization with deep kernel learning revisited", *In preparation*.
2. V. Mishra, R. Astudillo, P. Frazier, and F. Zhang, "Probably-convergent source seeking with mobile agents" (Preliminary version appeared at the NeurIPS 2023 Workshop on Adaptive Experimental Design and Active Learning in the Real World), *Submitted*.
3. R. Astudillo and P. Frazier, "Bayesian optimization of function networks" (Preliminary version appeared in Advances in Neural Information Processing Systems), *Submitted*.

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

5. F. Huber, S. Rojas Gonzalez, and R. Astudillo, "Bayesian preference elicitation for decision support in multi-objective optimization", *Submitted*.

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

7. 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)*.

8. 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)*.

9. 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)*.

10. 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*.

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

12. 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*.

13. 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*.

14. 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*.

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

16. 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*.

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*
Finalist - INFORMS Data Mining Best Paper Competition	*2024*

Finalist - INFORMS Undergraduate Operations Research Prize Competition (Mentee's Award)	*2024*
Computing, Data, and Society Postdoctoral Fellowship - Caltech	*2024*
Outstanding Reviewer Award - NeurIPS	*2021*
Finalist - INFORMS Undergraduate Operations Research Prize Competition (Mentee's Award)	*2020*
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. "Bayesian optimization with Bayesian deep kernel learning", *SIAM Conference on Uncertainty Quantification, Trieste, Italy, 2024*.
2. "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*.
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", *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)

CONTACT REFERENCES

1. Peter Frazier
   Eleanor and Howard Morgan Professor
   School of Operations Research and Information Engineering
   Cornell University
   pf98@cornell.edu
   https://people.orie.cornell.edu/pfrazier/
2. Yisong Yue
   Professor
   Department of Computing and Mathematical Sciences
   California Institute of Technology
   yyue@caltech.edu (please CC Professor Yue's assistant at sabedin@caltech.edu)
   http://www.yisongyue.com/
3. Eytan Bakshy
   Research Director
   Meta
   eytan@meta.com
   https://eytan.github.io/
4. Juergen Branke
   Professor of Operational Research and Systems
   Warwick Business School
   University of Warwick
   Juergen.Branke@wbs.ac.uk
   https://www.wbs.ac.uk/about/person/juergen-branke/