

# Raul Garcia

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## Education

### Rice University.

- PhD Computational and Applied Mathematics 2025
  - Advisor: Andrew J. Schaefer
- MA Computational and Applied Mathematics 2023
  - Advisor: Illya V. Hicks

### University of California, Davis.

- BS Applied Mathematics 2018
  - Cum laude

## Interests

Mixed-integer programming, optimization under uncertainty, mathematical software, operations research, deep learning applications

## Experience

2022-Present **Research Assistant**, *Dept. of Radiation Oncology*, Univ. of Texas MD Anderson Cancer Center, Houston TX.  
Clifton D. Fuller Laboratory.

Fall 2022 **Research Mentor**, *Data to Knowledge Lab*, Rice University, Houston TX.  
Mentored a team of students on a capstone data science project focusing on forecasting yearly battery replacements for medical devices (sponsored by LivaNova). Team took 1st place in showcase.

Summer 2022 **Research Intern**, *MIT Lincoln Laboratory*, Lexington MA.  
Group 42 - Surveillance Systems  
Contributed algorithm analysis tool for development of the Airborne Collision Avoidance System X and its variants.

2019–2020 **Quality Product Auditor**, *Pacific Southwest Container*, Modesto CA.  
Performed daily testing and data collection of products. Assisted in development of experiments for analysis of product quality. Conducted internal process audits.

### Other Experience

2017–2018 **Reader**, *Dept. of Mathematics*, UC Davis, Davis CA.  
Undergraduate grader for courses in Real Analysis and Ordinary Differential Equations.

Summer 2017 **Orientation Leader**, *Student Housing*, UC Davis, Davis CA.  
Advised and mentored incoming students with course scheduling, degree requirements, campus resource navigation, and student life.

## Awards and Fellowships

- 2022–2025 **NIH Research Supplement to Promote Diversity in Health-Related Research**, National Cancer Institute (NCI).  
Full financial support.
- 2022–2025 **GEM Fellowship**, MIT Lincoln Laboratory.
- 2022 **NSF AGEP STRIDES Scholar**.
- 2022 **Research Mentoring Fellowship**, *Data to Knowledge Lab*, Rice University.
- 2020–2024 **Computational Science and Engineering Recruiting Fellowship**, *Ken Kennedy Institute*, Rice University.

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## Publications

### **A combinatorial disjunctive constraint approach to optimal path planning.**

Raul Garcia, Illya V. Hicks, Joey Huchette, Miles Olson

*To appear in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2023.*

### **Deep object detection for waterbird monitoring using aerial imagery.**

Krish Kabra, Alexander Xiong, Wenbin Li, Minxuan Luo, William Lu, Raul Garcia, Dhananjay Singh Vijay, Jiahui Yu, Maojie Tang, Tianjiao Yu, Hank Arnold, Anna Vallery, Richard Gibbons, Arko Barman

*IEEE International Conference on Machine Learning and Applications 2022.*

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## Software

- Summer 2022 **Airborne Collision Avoidance System X (ACAS X)**, Software for generating airborne collision avoidance advisories for manned and unmanned aircraft. Implemented in C++, Julia and MATLAB.
- Logic formulated as a Markov decision process. Computational strategies employed for handling large state space, including parallel computing and multilinear interpolation
  - Contributed visualization tool for analysis of policy evolution through the course of the value iteration algorithm
  - Developed by Group 42 at MIT Lincoln Laboratory
- Spring 2022 **Audubon\_F21**, Python package for identifying and censusing various colonial waterbird species from aerial UAV imagery.
- Sponsored by Houston Audubon for their waterbird population monitoring studies
  - Employs Faster R-CNN object detection model (Detectron2) with data augmentation and Bayesian optimization hyperparameter tuning
  - Led experimentation of custom implementation utilizing a DenseNet backbone
  - Co-developer with various students from the Rice Data to Knowledge Lab
- 2021–Present **ClutteredEnvPathOpt.jl**, Julia package employing various MIP approaches to optimal path planning of robots and drones in cluttered environments.
- Implemented the independent branching scheme to formulate obstacle avoidance disjunctive constraints, including an algorithm for obtaining the necessary biclique covers on a special class of graphs
  - Includes infrastructure for creating obstacles, generating obstacle-free regions, and constructing the associated graphs
  - Co-developer with Joey Huchette and Miles Olson

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## Teaching

Rice University

Department of Computational Applied Mathematics & Operations Research

**Grader**, CAAM 519: Computational Science I.

Fall 2022

**Grader**, CAAM 378: Introduction to Operations Research and Optimization.

Spring 2022

**Grader**, CAAM 335/334: Matrix Analysis/Matrix Analysis for Data Science.

Fall 2021, Spring 2021, Fall 2020

[University of California, Davis](#)

Department of Mathematics

**Teaching Assistant**, MAT 17ABC: Calculus for Bioscience Students.

Spring 2017, Fall 2016, Spring 2016

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## [Presentations](#)

**"Leveraging Machine Learning to Develop Collision Avoidance Systems for Manned and Unmanned Aircraft"**.

○ TAPIA Conference in Computing, Sep 2022

**"A Combinatorial Disjunctive Constraint Approach to Optimal Path Planning"**.

○ INFORMS Annual Meeting, Oct 2022

○ MIP Workshop (poster), May 2022

○ Kavraki Lab, Apr 2022

**"Deep Learning for Precision Waterbird Monitoring"**.

○ Rice D2K Showcase (poster), Apr 2021

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## [Service, Outreach & Activities](#)

2020–Present **Society for Industrial and Applied Mathematics (SIAM) Student Chapter**, Rice University.

○ Treasurer, 2022-2023

○ Doctoral Program Recruitment Representative, 2022-2023

○ Graduate Seminar Chair, 2021-2022

○ Grill Master, 2020-2021

2022–Present **Latin American Graduate Student Association (LAGSA)**, Rice University.

○ Treasurer, 2023-2024

2020–Present **LatinGrads**, Rice University.

Summer 2021 **Instructor**, *Tapia STEM Camp*, Rice University.

Guided high school students from underrepresented backgrounds on projects focusing on computational thinking and equity

2020–Present **Graduate Student Association Soccer Club**, Rice University.

○ Treasurer, 2022-2023

2020–2021 **Mentor**, *Association of Women in Mathematics (AWM)*, Rice University.

Served as mentor to a group of first-year Rice students interested in mathematics

2015–2018 **Chicano and Latino Engineers and Scientists Society (CALESS)**, UC Davis.

## [Memberships](#)

- Institute for Operations Research and the Management Sciences (INFORMS)
- Society for Industrial and Applied Mathematics (SIAM)

## Relevant Coursework

Linear and Integer Programming; Stochastic Optimization; Online Optimization and Decision Making Under Uncertainty; Stochastic Simulation; Applied Machine Learning Projects; Intro to Machine Learning; Iterative Methods for Systems of Equations and Unconstrained Optimization; Advanced Numerical Analysis; Computational Science; Object-Oriented Programming

## Programming Languages and Software

Programming & Software Julia, Python, C++, C, Gurobi, MATLAB, Rust

Libraries Proficient: JuMP  
Experience with: Detectron2, PyTorch, scikit-learn

## Languages

English, Spanish