Robert **Jacobson**

Mathematician · Computer Scientist

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Education

Texas A&M University

College Station, Texas

Ph.D. in Mathematics

August 2005 — May 2012

- Thesis Title: *Weighted Bergman kernel functions and the Lu Qi-keng Problem.*
- Advisor: Harold P. Boas

Southern Adventist University

Collegedale, Tennessee

B.S. in Mathematics and Computer Science (double major)

March 2000 — December 2004

- Senior Thesis Title: *Computing the partition function*
- Graduation Honors: "Southern Scholar" (Honor Society), Magna Cum Laude

Skills

Domains of Expertise	**Mathematics** • Mathematical and Statistical Modeling • **Computer Science** • Algorithm Design • Image Processing, Computer Vision • **Compiler Construction, Programming Languages** • Software Engineering / Programming • Easily learns new programming languages • Data Cleaning • **Mentoring/Teaching** • Rapid Prototyping • Technical Writing
Programming Languages	**15+ years of experience** or have written a **compiler**: Python, C++, Java, SQL, Mathematica (Wolfram Language), L^6 • Functional proficiency: JavaScript, OCaml, **Rust**, C, Prolog/Soufflé • Nonfunctional proficiency: Haskell, Lisp/Scheme, Kotlin, x64 assembly
Technologies	**OpenCV**, scikit-image • AWS, Azure, MySQL/MariaDB, Linux • SQLAlchemy, Flask • **Pandas**, SciPy, NumPy, SymPy, Matplotlib • **Mathematica**, SageMath

Experience

Halcyon Tech, Inc.

Remote

Data Scientist

2021 — Present

- Collaborated with leading security and malware experts as member of R&D quantitative team
- Architected feature extraction pipelines from a variety of currated and streaming data sources
- Designed bespoke clustering, matching, and prediction algorithms; applied classical ML and statistical methods
- Authored reports and presentations communicating my novel technical innovations to nontechnical audiences
- Advised leadership regarding power and limitations of mathematics and artificial intelligence to serve the company mission

Nature Intelligence System

Bristol, Rhode Island

Computer Scientist

June 2017 — Present

- Started as the grand prize winner of the Wildlife Crime Tech Challenge. Leverages smart invoice technology involving computer vision, mathematical modeling, and data analysis to help port inspectors find illegal trade hidden in plain sight.
- Expanded to partnerships with Conservation International and the University of Massachusetts Boston.
- Designed scalable API, algorithms, and data structures, increasing throughput by at least an order of magnitude
- Redesigned database schema; Mentored data cleaning and pipelining
- Built best-in-domain scientific name recognition algorithm for the wildlife trade
- Co-wrote Damerau–Levenshtein edit distance function (UDF) for MySQL/MariaDB, fastest in the world, a "fuzzy" search algorithm
- Grew international relationships to develop business viability, establish industry needs, facilitate knowledge sharing among governmental & NGO partners

Roger Williams University

Bristol, Rhode Island

Assistant Professor of Mathematics

August 2012 — August 2019

- Taught courses at every level of the curriculum
- Performed longitudinal statistical study of the mathematics program internally
- Mentored undergraduate research in mathematics, engineering, biology, and marine biology: novel computer vision algorithms, GIS algorithms, Bayesian inference, computer vision in microscopy
- Collaborated with biology faculty in applications of computer vision & data science
- Extensive service record: KME Mathematics Honors Society faculty mentor; started Hawks Allies LGBT allies program; served the Honors Advisory Council, Division Academic Standards Committee, Math & Natural Science Seminar Committee, Faculty Senate Diversity Committee, Bias Education Response Team, multiple search committees

Texas A&M University *College Station, Texas*

Teaching Assistant / Recitation Instructor / Help Session Tutor *August 2005 — May 2012*

- Taught recitation sections for Business Math, Algebra, and Calculus
- Led lab sections in MATLAB and Maple for the Engineering Calculus sequence and Honors Calculus Sequence
- Graded papers, held one-on-one tutoring sessions, held office hours, proctored exams

Projects & Activities

Selected current and past personal and professional projects

Blazingly Fast Damerau–Levenshtein Edit Distance UDF for MySQL *February, 2019*

An extremely fast, memory efficient, and memory safe Damerau-Levenshtein edit distance implementation for the MySQL DBMS. Joint work with Frederik Hertzum. `https://github.com/rljacobson/Levenshtein`

WAM - Warren's abstract machine implementation of Prolog written in Rust *Summer 2020 – Present*

There are many articles and tutorial series on implementing compilers and interpreters available online, but there are very few about logic programming languages and theorem provers and even fewer targeted to a general programming audience. This project is intended to fill this gap.

Formal Programming Language Specification for Wolfram Language *May, 2018 – Present*

A formal language specification for the Wolfram Language, independent from Wolfram, LLC.
`https://wltools.github.io/LanguageSpec/`

Automated Shipment Forensics *June, 2017 – Present*

The grand prize winning project of the Wildlife Crime Tech Challenge. Leverages "smart invoice" technology involving computer vision, mathematical modeling, and data analysis to help port inspectors find illegal trade hidden in plain sight.

FoxySheep *May, 2013 – Present*

FoxySheep is a collection of language technologies that allow software projects to interact with Mathematica code. FoxySheep is free, open source, cross-platform software with bindings for Python and Java. `https://github.com/rljacobson/FoxySheep`

Other recreational projects *2020—2022*

Powerful pattern matching algorithm in Rust (lemur/loris) ; port of Z3's SAT solver to Rust (ZSAT); Rust library to represent source code spans in parser applications (Saucepan); Lesk, a spiritual descendent of Michael Lesk's scanner generator lex written in Rust and modern technologies. `https://github.com/rljacobson?tab=repositories&type=source`

Presentations & Posters

Machine Learning and Data Sharing to Combat the Illegal Wildlife Trade (London, UK), ZSL, *Automated Shipment Forensics*, May 31, 2018.

Wildlife Trafficking Platform Workshop (London, UK), City of London Animal Inspection Center, *Machine Learning for Conservationists* and *Automated Shipment Forensics Platform*, May 31, 2018.

Joint Meeting of Ichthyologists and Herpetologists (Austin, TX), Special Session on Fish Reproduction and Development, *Stop Counting Eggs!: Using Computer Vision To Gather Data*, July 15, 2017.

MathFest 2017 (Chicago, IL), General Contributed Paper Session in Teaching and Learning Calculus, and Mathematics and Technology, *Teaching Complex Analysis with a Spherical Camera,* July 28, 2017.

Roger Williams University (Bristol, RI), Math & Science Spring 2016 Seminar Series, *Mathematical Art and Complex Analysis,* March 23, 2016.

Joint Mathematics Meetings (Seattle, WA), MAA Session on the Development and Adoption of Open Educational Resources for Teaching and Learning, *Bridging the Closed and Open: How FoxySheep Can Benefit Both Proprietary and Open Technologies for Teaching and Research,* January 8, 2016.

Roger Williams University (Bristol, RI), Math & Science Fall 2014 Seminar Series, *The Mathematics of Typography,* November 9, 2014.

Roger Williams University (Bristol, RI), Math & Science Spring 2014 Seminar Series, *Mathematics of Spying: How the NSA put a backdoor into the NIST standard for an elliptic curve pseudorandom number generator,* May 2014.

223rd Meeting of the American Astronomical Society (Washington, DC), Poster Session, Adria Updike and Robert Jacobson, *Extrapolating Dust Composition from GRB SEDs: A Cautionary Tale,* January, 2014.

Joint Mathematics Meetings (Baltimore, MD), Special Session on Complex and Geometric Analysis, *Weighted Bergman kernel functions associated to meromorphic functions,* January 2014.

Texas A&M University (College Station, TX), Graduate Student Seminar, *Notions of Convexity*, Fall, 2010.

Texas A&M University (College Station, TX), Several Complex Variables Seminar, *Characterizing Pseudoconvex Domains*, Spring, 2009.

Writing

Pure Mathematics — *Research Articles*

- "Weighted Bergman Kernel Functions Associated to Meromorphic Functions." *Rocky Mountain Journal of Mathematics* 47, no. 1 (February 2017): 239–57. doi:10.1216/RMJ-2017-47-1-239. `https://goi.org/10.1216/RMJ-2017-47-1-239`
- "Pseudoconvexity and holomorphicity are two-dimensional phenomena," arXiv:0907.1304. Preprint online: `https://arxiv.org/abs/0907.1304`.

Computer Science — *Writing Online*

- "The Grammar of Mathematical Expressions." *After Math,* personal blog (September 3, 2018). `https://www.robertjacobson.dev/the-grammar-of-mathematical-expressions`
- "Generalizing PEMDAS: What is an operator?" *After Math,* personal blog (September 3, 2018). `https://www.robertjacobson.dev/generalizing-pemdas-what-is-an-operator`
- "What is the IELR(1) Parsing Algorithm?" *StackExchange* (November 2, 2018). `https://cs.stackexchange.com/q/99463`

Math Modeling, Science Communication — *Articles*

- "COVID-19: Population Testing vs. Thoughts and Prayers?," with Andrew Rhyne, *Medium,* (June 30, 2020). `https://medium.com/@arhyne/covid-19-population-testing-vs-thoughts-and-prayers-454e64946dde` An expanded more mathematical version is published on my blog: `https://www.robertjacobson.dev/Bayes-Theorem`.

Professional Memberships

American Mathematical Association
Mathematical Association of America
Association of Women in Mathematics
Association for Computing Machinery
Society for Industrial and Applied Mathematics
Association of Adventist Mathematicians
Kappa Mu Epsilon National Mathematics Honor Society (Faculty Advisor)

References available upon request.