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

Vectra
Remote

Principle Software Engineer
January 2023 — September 2023

- Mathematical modeling of a variety of problems related to enterprise cybersecurity.
- Designed a comprehensive data governance strategy that included a data catalog, schema registry, and type system to facilitate data governance policies.
- Designed ETL systems, including writing design and implementation documents.
- Development of core internal infrastructure (Python, Go, AWS, Azure).
- Liaison between engineering and data science as someone who understands both worlds.

Halcyon Tech, Inc.
Remote

Data Scientist
December 2021 — April 2022

- Collaborated with leading security and malware experts as member of R&D quantitative team
- Architected feature extraction pipelines from a variety of curated 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

LORIS

February 2022 – Present

Loris is a term rewriting and computer algebra system based on pattern matching algorithms developed by Besik Dundua, Temur Kutsia, and Mircea Marin. Written in February 2022, to my knowledge, this is the first and only implementation of these algorithms. The computer algebra system was added in October 2022 and will form the basis for a series of blog articles on concurrency, parallelism, and optimization. `https://github.com/rljacobson/loris`

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.

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.

OTHER RECREATIONAL PROJECTS

2020—2022

Powerful pattern matching algorithm in Rust (lemur/loris) ; port of Z3's SAT solver, Maude term rewriting system to Rust (ZSAT, Mod); Rust library to represent source code spans in parser applications (Saucepan).

`https://github.com/rljacobson?tab=repositories&type=source`

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`.

- "Making a Pratt Parser Generator" *After Math,* personal blog (August 13, 2020).
  `https://www.robertjacobson.dev/designing-a-pratt-parser-generator`

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

References available upon request.