

Justin D Vrana

software engineer | synthetic biologist



Contact

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Education

2021 anticipated	PhD, Bioengineering	University of Washington- Seattle
2010	BS, Chemistry & Philosophy Grad. with Distinction Honors in Chemistry	University of Wisconsin- Madison
2010	Cert. of Computer Science	University of Wisconsin- Madison

Skills

🔌 Software

Languages Python (expert), Javascript, Ruby, C, C++, Java (novice)

Web Frameworks Ruby-on-Rails, Flask, Django, React, GraphQL

Databases SQL, no-SQL mongoDB, and no-SQL Neo4j (graph database)

Machine Learning Deep reinforcement learning & graph neural networks using Pytorch and TensorFlow

Visualization Python tools such as matplotlib/seaborn, Plotly, Bokeh, Jupyter, D3.js (novice)

Team Co-ordination Proficient with common team tools such as Jira, Asana, Slack. Proficient with continuous-integration and development tools on Docker, Docker-compose, Dockerhub, Git, Gitlab, Github, CircleCI, and Jenkins.

Other skills discrete mathematics (networks/graphs), algorithm development

🔌 Wetlab

Mammalian lentiviral transductions, DNA transfections, cell line maintainance, microscopy, cell sorting, flow cytometry

Microbiology CRISPR cell engineering, yeast cell culture, ecoli cell culture, yeast genomic integrations, plasmid construction, DNA cloning (gibson assembly, golden-gate, overlap extension PCR, library cloning)

Engineer and scientist that specializes in development of software that accelerates research and makes science more accessible. With 14 years of life science research experience and 6 years of software development experience, can work with diverse teams spanning multiple fields. Successful track record for small-team driven projects and projects involving large interdisciplinary co-ordination.

Relevant Experience

UW-Seattle 2018-present	Researcher	Graduate researcher for large-scale Synergistic Design and Discovery (SD2) DARPA program effort to accelerate scientific research. Co-ordinated with industry and academic teams across the U.S. to develop automated and distributed design-build-test-learn pipeline for engineering new yeast strains. Developed software-enabled cell construction pipeline which boosted yeast cell strain construction throughput by 5-fold and reduced plasmid construction labor and cost by 4-fold at campus cloud lab. Integrated software tools with existing continuous integration (CI) and distributed computing infrastructure from the Texas Advanced Computing Center (TACC).
UW-Seattle 2014-present	PhD Researcher	Conducted synthetic biology research in yeast and mammalian cells. With small-team, designed CRISPR technologies and tools for eukaryotic cells. Performed mathematical modeling of cell behavior and fitted experimental results using differential evolution optimization. Designed deep learning models of cell circuit behavior using graph convolutional neural networks. Developed deep reinforcement learning algorithms in Pytorch to design new cell circuits from cell design specifications.
UW-Seattle 2017-2018	Teaching Assistant	Taught programming in C/C++ for master's level Advanced Programming for Embedded Systems course. Developed automated testing and grading scripts using GoogleTest Framework for students.
Global Impact Seattle, WA 2017-2019	Co-founder and Software Lead	Co-founded small global health company around low-cost accessible diagnostics (OLA-Simple). Developed iPad Ruby-on-Rails + AngularJS app to guide nurses and clinical technician to perform low-cost HIV diagnostics for patients based on Aquarium software. Won NSF I-Corp grant to conduct customer research and business viability. Traveled Mexico City, Mexico and Nairobi, Kenya to present research and technology to clinical and academic researchers. Using app, 98% of new users were able successfully complete diagnostic assay.
UW-Seattle Seattle, WA 2017-2018	Amazon Catalyst Fellow	Developed digitally guided protocols and workflows in which users are able to design custom mammalian cell lines, develop experimental workflows to assay them, view and analyze data, and execute experiments, all from the comfort of a coffee shop. Awarded \$100K from Amazon Catalyst program to develop software and wetlab space.
UC-Denver Denver, CO 2011-2014	Research Assistant	Conducted research in genetic engineering of yeast and mammalian cells. Designed and performed experiments to validate light-activated genetic tools for optogenetics research.
UW-Madison Madison, WI 2008-2011	Research Assistant	Developed platform for single molecule dynamic studies and confined 2-dimensional biochemistry. Used semi-automated microscope system and high-throughput computing cluster to construct low-resolution genome maps.

Selected Software Projects

2019-present	Caldera <i>lead developer</i>	Organism agnostic and data-driven genetic circuit designer driven by deep graph neural network and reinforcement learning. Trains on single-cell RNA-seq data and converts a behavioral specification to a genetic circuit design.
2019-present	Terrarium <i>lead developer</i>	A dynamic computer-aided process planner (CAPP) for biology designed for agile manufacturing of biological products. Converts a cell strain specifications into executable wetlab plans.
2017-2020	DASi <i>lead developer</i>	DASi is an automatic DNA cloning plan designer aimed for operating on small budgets by focusing on material re-use and a dead-simple user interface. Converts user-defined DNA sequences into executable molecular biology steps that builds specified sequences.
2016-2020	Aquarium <i>developer</i>	An open-source human-in-the-loop laboratory automation system that enables rapid, flexible, and reproducible workflow development and execution. Created Python-API ("Pydent") for algorithmically designing, executing, and analyzing scientific experiments using Aquarium software

Selected Publications

2021	Aquarium: open-source laboratory software for design, execution and data management	Oxford University Press: Synthetic Biology	JD Vrana, OD Lange, ..., E Klavins
2021	Implementation of an interactive mobile application to pilot a rapid assay to detect HIV drug resistance mutations in Kenya	AIDS (accepted)	JD Vrana, N Panpradist, ..., IA Beck
2017	Digital logic circuits in yeast with CRISPR-dCas9 NOR gates	Nature Communications	MW Gander, JD Vrana, WE Voje, JM Carothers, E Klavins
2014	An optimized optogenetic clustering tool for probing protein interaction and function	Nature communications	A Taslimi, JD Vrana, D Chen, S Borinskaya, BJ Mayer, MJ Kennedy, CL Tucker