Justin D Vrana

software engineer | synthetic biologist

Contact

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Education

2021 (anticpated)	PhD, Bioengineering	University of Washington-Seattle
2010	BS, Chemistry & Philosophy	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 Web Frameworks Ruby-on-Rails, Flask, Django, React, GraphQL
Databases SQL, no-SQL mongoDB, and noSQL 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 Coordination Proficient with common team tools such as Jira, Asana, Slack. Proficient with continuous-integration and development tools on Docker, DockerCompose, Dockerhub, Git, Gitlab, Github, CircleCI, and Jenkins.
Mathematics Discrete mathematics(networks/graphs), algorithm development

Wetlab

Mammalian
lentiviral transductions, DNA transfections, cell line maintenance, microscopy, cell sorting, flow cytometry
Microbiology CRISPR cell engineering, yeast cell culture, E. coli cell culture, yeast genomic integration, 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. Avid self-learner with breadth of knowledge spanning from chemistry, cell biology, genomics, and software development. 14 years of wetlab experience and 6 years of software development experience.

Relevant Experience

UW-Seattle 2018-2021	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 2014-2021	Graduate 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 2018-2019	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 diagnostics assay.
UW-Seattle 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	Undergraduate 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	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	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	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	An open-source human-in-the-loop laboratory automation system that enables rapid, flexible, and reproducible workflow development and execution.

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