

DHRUV JATKAR

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[Full C.V.](#)

EDUCATION

Northeastern University

September 2021 – December 2025

Bachelor of Science in Computer Science and Biology

Boston, MA

Bachelor of Science in Mathematics

- **Relevant Coursework:** Optimization and Complexity, Machine Learning and Statistical Learning Theory, Algorithms, Real Analysis, Dynamical Systems, Computer Vision, Probability Theory, Formal Methods, Software Engineering
- **Awards:** National Merit Scholarship, Undergraduate Research Fellowship

EXPERIENCE

Research Assistant

October 2021 – Present

Undergraduate at Northeastern University, Visiting Student at MIT

- Advised by Profs. Eduardo Sontag, Benjamin Woolston (Northeastern), and Domitilla Del Vecchio (MIT). Resulted in **6 papers, 5 conference presentations, and 4 manuscripts in preparation**
- Studied advanced topics in control theory for machine learning with a focus on linear neural networks. Proved global convergence of gradient flow for broad classes of analytic loss functions, with applications in fast model fine-tuning.

NASA Ames Research Center - Intrinsic

August 2019 – March 2020

Research Intern

- Developed a convolutional-neural-network image-analysis utility at Intrinsic that automatically counted microbial colonies.

PUBLICATIONS & RESEARCH ACTIVITIES ([†] indicates co-first authors.)

Publications and Preprints

- [1] de Oliveira, A. C. B., **Jatkar, D. D.**, & Sontag, E. D. (2025). On the convergence of overparameterized problems: Inherent properties of the compositional structure of neural networks. *arXiv preprint, arXiv:2511.09810*. [Submitted to *Learning for Dynamics and Control (L4DC) 2026*].
- [2] **Jatkar, D. D.**[†], Manoj, K.[†], Sontag, E. D., & Del Vecchio, D. (2025). Paradoxical gene regulation explained by competition for genomic sites. *bioRxiv preprint, doi:10.1101/2025.11.27.691022*. [Submitting to *Proceedings of the National Academy of Sciences*].
- [3] Duvall, A., Al-Radhawi, M. A., **Jatkar, D. D.**, & Sontag, E. D. (2024). Interplay between contractivity and monotonicity for reaction networks. *arXiv preprint, arXiv:2404.18734*. [Submitted with revisions to *SIAM Journal on Applied Dynamical Systems*].
- [4] Al-Radhawi, M. A., Manoj, K., **Jatkar, D. D.**, Duvall, A., Del Vecchio, D., & Sontag, E. D. (2024). Competition for binding targets results in paradoxical effects for simultaneous activator and repressor action. In *Proceedings of the IEEE 63rd Conference on Decision and Control (CDC)*, pp. 5579–5585.
- [5] **Jatkar, D. D.**[†], Al-Radhawi, M. A.[†], Voigt, C. A., & Sontag, E. D. (2025). Modeling and minimization of dCas9-induced competition in CRISPRi-based genetic circuits. *bioRxiv preprint, doi:10.1101/2025.11.05.686856*.
- [6] Tran, A. P.[†], **Jatkar, D. D.**[†], Al-Radhawi, M. A., Ernst, E., & Sontag, E. D. (2025). Optimization of heuristic logic synthesis by iteratively reducing circuit substructures using a database of optimal implementations. *bioRxiv preprint, doi:10.1101/2025.11.28.691216*.

Papers to Be Submitted (Available Upon Request)

- [7] **Jatkar, D. D.**[†], de Oliveira, A. C. B.[†], Stohr, A., Woolston, B. M., & Sontag, E. D. Optimal engineering of a symbiotic aerobe–anaerobe coculture.
- [8] **Jatkar, D. D.**[†], de Oliveira, A. C. B.[†], & Sontag, E. D. Numerical methods for linearly constrained optimizations satisfying a weak form of the Polyak–Łojasiewicz inequality.
- [9] **Jatkar, D. D.**, Sontag, E. D., & Grunberg, T. W. Permutation symmetry breaking enables fast and complete enumeration of logic circuits.

[10] Zhou, G., **Jatkar, D. D.**, Gasparrini, W., Stohr, A., & Woolston, B. M. A synthetic symbiotic co-culture of aerobes and anaerobes for bioproduction from CO₂ and H₂.

Conference Talks and Posters

- **Jatkar, D. D.**, Manoj, K., Sontag, E. D., & Del Vecchio, D. (2025). Retroactivity and binding site competition leads to repression by an activator. Poster, SEED 2025, Houston, TX, USA.
- **Jatkar, D. D.**, Al-Radhawi, M. A., & Sontag, E. D. (2024). Modeling and minimization of dCas9-induced competition in CRISPRi-based genetic circuits. Poster, 7th International Conference on CRISPR Technologies, San Diego, CA, USA.
- **Jatkar, D. D.**, Zhou, G., Stohr, A., Gasparrini, W., Sontag, E. D., & Woolston, B. M. (2024). Engineering syntrophy in an anaerobe–aerobe co-culture for waste gas valorization. Poster, SIMB Annual Meeting 2024, Boston, MA, USA.
- **Jatkar, D. D.**, Zhou, G., & Woolston, B. M. (2023). Elucidating interactions in engineered microbial communities towards renewable biofuel production. Talk, ACS NERM 2023, Boston, MA, USA.

Service

- *Invited Reviewer*, IEEE Conference on Decision and Control (CDC) 2025

PROJECTS

GP-LoRA: Accelerated Fine-Tuning | *PyTorch*

[GitHub](#)

Engineered an open-source **PyTorch extension** that accelerates the convergence of **foundation-model fine-tuning** by integrating custom **LoRA** updates with imbalanced parameters into existing training loops. Built a modular **optimizer wrapper** as a iteration on standard tools like AdamW. Currently validating performance gains via reproducible benchmarks on GPT-2 and RoBERTa architectures. **Developed from the insights in [1]**.

Scheduler: Notebook-to-SLURM Workflow Composer | *TypeScript, Electron, Go, Python, SLURM*

[GitHub](#)

Built a **Code-OSS fork** that converts annotated **Jupyter notebooks** into **SLURM** job plans with stage dependencies. Wrote **TypeScript** extensions for job composition, cluster SSH, and **LLM-assisted** planning. Implemented a **Go** agent with **WebSocket/HTTP** endpoints for job submission and live log streaming. Added **Python** tooling for **AST-based** notebook analysis, stage execution, and artifacts.

TECHNICAL SKILLS

Languages: Java, Python, C++, Matlab, Swift, Typescript, Racket

Libraries: PyTorch, React.js, Gurobipy