

Lyle Regenwetter

PH.D. CANDIDATE · MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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Education

Massachusetts Institute of Technology (GPA: 4.9/5.0)

- PhD. Candidate (Dec. 2025 anticipated)
- S.M. in Mechanical Engineering (May 2022),

Cambridge, MA
Sep. 2020 - Present

University of Illinois at Urbana-Champaign (GPA: 3.9/4.0)

- B.S. in Mechanical Engineering with highest honors
- B.S. in Electrical Engineering with high honors
- Minor in Computer Science

Urbana, IL
Aug. 2016 - May 2020

Research Experience

MIT Design Computation and Digital Engineering Lab

PH.D. CANDIDATE, INAUGURAL MEMBER

- Pioneering “Generative Optimization” frameworks that combine generative AI and direct design optimization
- Developing new training formulations for Generative AI models using hard negative examples
- Developed five open-source design datasets spanning bicycle design to structural optimization

Cambridge, MA
Aug. 2020 - Present

UIUC Networked Autonomous Vehicles Laboratory

UNDERGRADUATE RESEARCH ASSISTANT

- Developed autonomous hovercraft for research of multimodal drone swarms
- Led design, simulation, and fabrication of custom bidirectional propellers
- Designed custom hardware (bidirectional propellers, air bearing, printed circuit boards with computation, power, sensing systems)
- Implemented software and control (Kalman sensor fusion filter, path following control)

Urbana, IL
Jan. 2019 - Jul. 2020

UIUC Smith Research Group

UNDERGRADUATE RESEARCH ASSISTANT

- Added controlled recirculation to Cation Intercalation Desalination (CID) cell
- Designed system simulation and machine learning driven system optimization
- Designed and built custom electrical system for power, pump control, valve actuation

Urbana, IL
Jan. 2020 - May. 2020

UIUC Center for Plasma-Material Interactions

UNDERGRADUATE RESEARCH ASSISTANT

- Designed magnet pack geometry and electrical pulse waveform to optimize atomic deposition processes
- Upgraded and maintained vacuum chamber & accessories

Urbana, IL
Nov. 2017 - May. 2019

Journal Publications

MCD: A Model-Agnostic Counterfactual Search Method for Multi-Modal Design Modifications

JOURNAL OF MECHANICAL DESIGN

- Authors: **Regenwetter, L**; Abu Obaideh, Y; Ahmed, F
- Project Page: decode.mit.edu/projects/counterfactuals/

Published
Feb. 2025

Constraining Generative Models for Engineering Design with Negative Data

TRANSACTIONS ON MACHINE LEARNING RESEARCH (TMLR)

- Authors: **Regenwetter, L**; Giannone, G; Srivastava, A; Gutfreund, D; Ahmed, F

Published
Dec. 2024

Beyond Statistical Similarity: Rethinking Metrics for Deep Generative Models in Eng. Design

COMPUTER AIDED DESIGN

- Authors: **Regenwetter, L**; Srivastava, A.; Gutfreund, D.; Ahmed, F
- Project Page: decode.mit.edu/projects/metrics/
- Article: <https://meche.mit.edu/news-media/excel-engineering-design-generative-ai-must-learn-innovate-study-finds>

Published
Oct. 2023

FRAMED: An AutoML Approach for Structural Performance Prediction of Bicycle Frames

COMPUTER AIDED DESIGN

- Authors: **Regenwetter, L**; Weaver, C.; Ahmed, F
- Project Page: decode.mit.edu/projects/framed/

Published
Nov. 2022

Deep Generative Models in Engineering Design: A Review

JOURNAL OF MECHANICAL DESIGN

- Authors: **Regenwetter, L**; Nobari, AH; Ahmed, F

Published

Jan. 2022

BIKED: A Dataset for Computational Bicycle Design with Machine Learning Benchmarks

JOURNAL OF MECHANICAL DESIGN

- Authors: **Regenwetter, L**; Curry, B; Ahmed, F
- Project Page: decode.mit.edu/projects/biked/

Published

Sep. 2021

Low porosity, high areal-capacity Prussian blue analogue electrodes enhance salt removal and thermodynamic efficiency in symmetric Faradaic deionization with automated fluid control

WATER RESEARCH X

- Authors: Reale, ER; **Regenwetter, L**; Agrawal, A; Dardon, B; Dicola, B; Sanagala, S; Smith, KC
- Article: mechse.illinois.edu/news/41396

Published

Aug. 2021

Conference and Workshop Publications

Towards Domain-Adaptive Resolution-Free 3D Topology Opt. with Neural Implicit Fields

INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES

- Authors: Nobari, AH; **Regenwetter, L**; Ahmed, F

In Proceedings

Aug. 2024

Learning from Invalid Data: On Constraint Satisfaction in Generative Models

NEURIPS DIFFUSION MODELS WORKSHOP

- Authors: Giannone, G; **Regenwetter, L**; Srivastava, A; Gutfreund, D; Ahmed, F

In Workshop

Dec. 2022

Design Target Achievement Index: A Differentiable Metric to Enhance Deep Generative Models in Multi-Objective Inverse Design

INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES

- Authors: **Regenwetter, L**; Ahmed, F

In Proceedings

Aug. 2022

Towards goal, feasibility, and diversity-oriented deep generative models in design

ICML WORKSHOP ON MACHINE LEARNING IN COMPUTATIONAL DESIGN

- Authors: **Regenwetter, L**; Ahmed, F

In Workshop

Jul. 2022

BIKED: A Dataset and Machine Learning Benchmarks for Data-Driven Bicycle Design

INTERNATIONAL DESIGN ENGINEERING TECHNICAL CONFERENCES

- Authors: **Regenwetter, L**; Curry, B; Ahmed, F

In Proceedings

Aug. 2021

Publications Under Review

NITO: Neural Implicit Fields for Resolution-free Topology Optimization

TRANSACTIONS ON MACHINE LEARNING RESEARCH

- Authors: Nobari, AH; **Regenwetter, L**; Giannone, G; Ahmed, F

Under Review

Jan. 2025

Generative Optimization: A Perspective on AI-Enhanced Problem Solving in Engineering

NATURE MACHINE INTELLIGENCE

- Authors: Picard, C, **Regenwetter, L**; Nobari, AH; Srivastava, A.; Ahmed, F

Under Review

Jan. 2025

Research Presentations

International Design Engineering Technical Conferences

- Research Talk: Training Generative Models to Satisfy Design Constraints with Negative Data

Washington DC

Aug. 2024

Neural Information Processing Systems (NeurIPS) Diffusion Model Workshop

- Constraining Generative Models for Engineering Design with Negative Data

New Orleans, LA

Dec. 2023

International Design Engineering Technical Conferences

- Research Talk: Design Target Achievement Index: A Differentiable Metric to Enhance Deep Generative Models in Multi-Objective Inverse Design

St. Louis, MO

Aug. 2022

EBI-Sanger-Cambridge-PhD Symposium 2021

- Research Talk: The Diagnostic Potential of AI in COVID-related Stroke; w/ Mensah, E; Vogt, A

Virtual

Sep. 2021

International Design Engineering Technical Conferences

- Research Talk: BIKED: A Dataset and Machine Learning Benchmarks for Data-Driven Bicycle Design

Virtual

Aug. 2021

UIUC undergraduate research symposium

- Poster Presentation: Further Characterization of HiPIMS & Serpentine Linear Magnetron; w/ Bartlett, N; Aktuna, A

Urbana, IL

Apr. 2019

Teaching Experience

MIT 2.s155/6: Artificial Intelligence and Machine Learning for Engineering Design

Cambridge, MA

TEACHING ASSISTANT (4 SEMESTERS)

Sep. 2021 - Present

- Designed challenge problems, course demos, and reading assignments for first four offerings of this graduate course
- Teaching performance rated 6.7/7.0, averaged over 75 course evaluations across four semesters

Work Experience

Boeing

Huntsville, AL

ELECTRICAL ENGINEERING INTERN

Jun. 2019 - Aug. 2019

- US Missile Defense Agency Project – ICBM tracking and interception
- Developed sensor feedback logic, designed wiring and connector layouts
- Responsible for system wide wiring database, coordinated design interfacing between teams, corrected over 1000 database errors
- Revised, updated, and verified critical design documentation

Denso

Battle Creek, MI

PROCESS ENGINEERING RESEARCH AND DEVELOPMENT INTERN

Jun. 2018 - Aug. 2018

- Developed a proof-of-concept contactless dimensional measurement system using infrared laser array
- Identified \$5.4 million of unaccounted scrap through statistical field investigation, reported to Denso global president
- Proposed Design of Experiments (DOE) testing procedure to assess 3D printing & post-processing methods for service part fabrication
- Tested additive manufacturing materials and processing including: Ultem, Nylon, ABS, vapor treatment, annealing, epoxy coating

Scholarships & Honors

2024	Fellowship , MIT Morningside Academy of Design (MAD) Fellowship	Cambridge, MA
2022	Honorable Mention , NSF Graduate Research Fellowship Program	Cambridge, MA
2022	Third Place , 2022 ASME-CIE Hackathon	St. Louis, MO
2020	Runner up , 2020 ASME-IMECE Hackathon	Virtual
2020	Scholarship , University of Illinois Chancellor's Scholar	Urbana, IL
2020	Scholarship , Edmund J. James Scholar	Urbana, IL
2020	Recipient , Kenneth J. Trigger Award	Urbana, IL
2020	Recipient , University of Illinois Dean's list (9x)	Urbana, IL
2019	Scholarship , Association for Facilities Engineering	Urbana, IL
2018	First Place , Association of Environmental Engineering & Science Professors Competition	Urbana, IL
2016	Honors , National Merit Scholar	Urbana, IL
2014	Qualifier , USA Junior Mathematical Olympiad	Urbana, IL

Skills

Machine Learning	Generative Models, Supervised learning, Cross-val, AutoML, ML Explainability, Multimodal ML, ML fundamentals
Coding & Software	Python (2000+ hrs.), Matlab (100+ hrs.), C++ (30+ hrs.), C (10+ hrs.), Julia (10+ hrs.)
Modeling Software	PTC Creo (500+ hrs.), Solidworks (100+ hrs.), KiCAD (20+ hrs.)
Optimization	Heuristic (genetic algorithms, Particle Swarm, Simulated Annealing, ...), gradient-based (ML-based, Quasi-Newton)
Simulation	Solidworks CFD (20+ hrs.), Solidworks FEA (20+ hrs.), CREO FEA (10+ hrs.)
Electrical Skills	Printed circuit board design & soldering, sensing, power systems (basic), digital systems (basic)
Computing	Algorithms, parallel computing, numerical methods
Control Systems	Kalman filtering & sensor fusion, control principles, PID control
Machining	Additive manufacturing, lathe, mill, waterjet, press brake, CNC
Language	English (native speaker), German (advanced), Luxembourgish (beginner)
Communication	LaTeX (300+ hrs.), technical writing, research presentations (20+)

Reviewing

To date, I have reviewed for the following journals and conferences: Journal of Computational Design and Engineering (1x), Engineering Computations (1x), Design Science (1x), Discover Mechanical Engineering (1x), International Design Engineering Technical Conferences (7x), Ain Shams Engineering Journal (1x), Sports Engineering (1x).