

# Zachary Novack

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RESEARCH INTERESTS	Generative AI for Music/Audio, Controllable Generative Models, Efficient Generation	
EDUCATION	<i>Ph.D. in Computer Science</i>	Fall 2022 - Present
BACKGROUND	<a href="#">University of California – San Diego</a> , San Diego, CA Advisors: Julian McAuley, Taylor Berg-Kirkpatrick	
	<i>M.S. in Computer Science</i>	Fall 2022 - Spring 2024
	<a href="#">University of California – San Diego</a> , San Diego, CA Advisors: Julian McAuley, Taylor Berg-Kirkpatrick	
	<i>B.S. in Statistics &amp; Machine Learning</i>	August 2018 - May 2022
	<a href="#">Carnegie Mellon University</a> , Pittsburgh, PA Advisors: Zachary Lipton, Simon DeDeo <ul style="list-style-type: none"><li>• Minor in Sonic Arts (music technology)</li><li>• 3.93/4.0 GPA</li></ul>	
SELECTED RESEARCH	<b><a href="#">DITTO: Diffusion Inference-Time T-Optimization for Music Generation.</a></b> <b>Zachary Novack</b> , Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan. ICML ( <b>Oral, Top 1.5%</b> ) 2024.	
	<b><a href="#">DITTO-2: Distilled Diffusion Inference-Time T-Optimization for Music Generation.</a></b> <b>Zachary Novack</b> , Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan. ISMIR 2024.	
	<b><a href="#">Unsupervised Lead Sheet Generation via Semantic Compression.</a></b> <b>Zachary Novack</b> , Nikita Srivatsan, Taylor Berg-Kirkpatrick, Julian McAuley. AES Symposium on AI & the Musician, 2024.	
	<b><a href="#">CHiLS: Zero-Shot Image Classification with Hierarchical Label Sets.</a></b> <b>Zachary Novack</b> , Julian McAuley, Zachary Lipton, Saurabh Garg. ICLR MRL Workshop, 2023. ICML 2023.	
SELECTED ACCOLADES	Malcolm R. Stacey Memorial Fellowship	Spring 2024
	1 <sup>st</sup> Place: Adobe Intern Project Expo	August 2023
	NSF Graduate Research Fellowship - Honorable Mention	Spring 2022
	Phi Beta Kappa Member	October 2021 - Present
	<a href="#">Andrew Carnegie Society Scholar</a>	September 2021 - Present
	<a href="#">Small Undergraduate Research Grant (SURG)</a>	June 2021
	<a href="#">Dietrich Senior Honors Research Fellowship</a>	May 2021
	1 <sup>st</sup> Place: Statistics & Data Science Research Showcase	May 2021
	<a href="#">Summer Undergraduate Research Fellowship (SURF)</a>	June 2020
	2 <sup>nd</sup> Place: 15-112 Term Project Showcase	April 2019
	Dean's List: High Honors	December 2018 - May 2022
	<a href="#">Quantitative Social Science Scholar</a>	August 2018 - May 2022
	Paul Mellon Memorial Presidential Scholarship	August 2018 - May 2022

**WORK  
EXPERIENCE**

**Adobe – Audio Group**

Summer 2023 - Present

*Research Scientist Intern under Nicholas Bryan*

- Investigating methods for **interactive control** (ICML 2024) and **efficient generation** (ISMIR 2024) for audio-domain generative music models.

**ACMI Lab** (CMU)

Spring 2021 - Spring 2023

*Research Assistant under Zachary Lipton*

- Developed new method to leverage hierarchical class information for zero-shot prediction in CLIP models (ICML 2023).
- Performed large-scale verification study validate explicit regularization mechanisms for SGD across modern image benchmarks and model types (ICLR 2023).

**Laboratory for Social Minds** (CMU)

Summer 2020 - Fall 2022

*Research Assistant under Simon DeDeo*

- Designed a temporal Bayesian framework to analyze social media addiction.
- Investigated ideological network evolution on the fringe web forums /pol/ (4chan) and The Red Pill (Reddit).

**Unisys Corporation**

Summer 2020 - Spring 2021

*AI/ML Intern*

- Designed time-series models (ARIMA, LSTM, Facebook Prophet) for computer resource utilization prediction under distribution shift

**PAPERS &  
PUBLIC WORKS**

*Tutorials*

- **Connecting Music Audio and Natural Language**

SeungHeon Doh, Ilaria Manco, **Zachary Novack**, Jong Wook Kim, Ke Chen  
International Society of Music Information Retrieval (ISMIR), 2024

*Workshops / Preprints*

- **FUTGA: Towards Fine-grained Music Understanding through Temporally-Enhanced Generative Augmentation**

Junda Wu, **Zachary Novack**, Amit Namburi, Jiaheng Dai, Hao-Wen Dong, Zhouhang Xie, Carol Chen, Julian McAuley  
2024

- **Unsupervised Lead Sheet Generation via Semantic Compression**

**Zachary Novack**, Nikita Srivatsan, Taylor Berg-Kirkpatrick, Julian McAuley  
AES International Symposium on AI and the Musician, 2024

*Conference Papers*

- **DITTO-2: Distilled Diffusion Inference-Time T-Optimization for Music Generation.**

**Zachary Novack**, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan  
International Society of Music Information Retrieval (ISMIR), 2024

- **DITTO: Diffusion Inference-Time T-Optimization for Music Generation.**

**Zachary Novack**, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan  
**Oral (Top 1.5%)** at International Conference on Machine Learning (ICML), 2024

- **CHiLS: Zero-Shot Image Classification with Hierarchical Label Sets**

**Zachary Novack**, Julian McAuley, Zachary Lipton, Saurabh Garg  
International Conference on Machine Learning (ICML), 2023  
ICLR Workshop on Multimodal Representation Learning, 2023

- **Disentangling the Mechanisms Behind Implicit Regularization in SGD**  
Zachary Novack, Simran Kaur, Tanya Marwah, Saurabh Garg, Zachary Lipton  
International Conference on Learning Representations (ICLR), 2023  
**Spotlight** and **Best Poster** at NeurIPS Workshop on The Benefits of Higher-Order Optimization in Machine Learning, 2022

#### *Nonrefereed Papers*

- **Down the Rabbit Hole: Modeling Twitter Dynamics through Bayesian Inference**  
Zachary Novack  
Senior Honors Thesis (Carnegie Mellon University), 2022
- **Personalized Sequential Recommendation for Adaptive Itemization in MOBA Games**  
Zachary Novack  
Web Mining and Recommender Systems (CSE 258) Course Project (UC San Diego), 2022
- **Towards Generalizable Deep Speech Anonymization**  
Aaron Broukhim, Zachary Novack  
Deep Generative Models (CSE 291) Course Project (UC San Diego), 2022
- **Approximating Optimal Transport via GANs for Recourse Disparity Analysis**  
Zachary Novack, Qi Xuan Teo, Ryan Steed  
Probabilistic Graphical Models (10-708) Course Project (Carnegie Mellon University), 2022
- **Tracking Political Sentiment on Cold War China in Congressional Speeches**  
Zachary Novack, Eden Hu, and Mason Lin  
**1st Place** at Statistics and Data Science Research Showcase (Carnegie Mellon University), 2021
- **Lunch at the EigenSalad Bar: Linear Approaches to Dimensionality Reduction for Image Processing**  
Zachary Novack  
Numerical Linear Algebra (21-344) Course Project (Carnegie Mellon University), 2021

#### *Blog Posts*

- **Armchair Statistics: Benford's Law and other Misconceptions in the Age of Data**  
Zachary Novack  
Carnegie Mellon University Triple Helix, 2021

#### INVITED TALKS

- |  |               |
|--|---------------|
| <b>DITTO: Diffusion Inference-Time T-Optimization for Music Generation</b> |               |
| • University of Rochester AI Audio Lab                                     | December 2023 |
| • MIT AI Music Reading Group   | February 2024 |
| • Spotify MIQ Reading Group  | February 2024 |
| • UC San Diego AI Seminar  | March 2024    |
| • ICML Oral  | July 2024     |
| • BISH Bash  | August 2024   |

**Unsupervised Lead Sheet Generation via Semantic Compression**  
 • AES AI & the Musician Symposium June 2024

**Disentangling the Mechanisms Behind Implicit Regularization in SGD**  
 • HOOML Workshop, NeurIPS December 2022

**TEACHING  
EXPERIENCE**

*Graduate Teaching Assistant*  
 University of California - San Diego, San Diego, CA  
 • CSE 258: Web Mining and Recommender Systems Fall 2023  
*Prof. Julian McAuley*

*Undergraduate Teaching Assistant*  
 Carnegie Mellon University, Pittsburgh, PA  
 • 10-600: Machine Learning Primer Summer 2022  
*Prof. Matthew Gormley*  
 • 10-301/601: Introduction to Machine Learning Fall 2021 - Summer 2022  
*Prof. Matthew Gormley and Henry Chai*  
 • 85-340: Research Methods for Social Psychology Fall 2021  
*Prof. David Creswell*  
 • 36-225: Introduction to Probability Theory Summer 2021  
*Prof. Peter Freeman*  
 • 36-226: Introduction to Statistical Inference Spring 2021  
*Prof. Peter Freeman and Nynke Niezink*  
 • 88-300: Programming for Social Scientists Summer 2020 - Spring 2021  
*Prof. Mark Patterson*

**ACADEMIC  
SERVICE**

**Reviewer:** ICLR (2023), ICASSP (2023), NeurIPS (2023), ISMIR (2024)  
**Ph.D. Admissions Committee:** CSE Department, UCSD (2023)  
**Ph.D. Visit Day Committee:** CSE Department, UCSD (2023, 2024)

**MUSICAL  
ACTIVITIES**

**Teaching Experience**  
*Front Ensemble Technician* Fall 2023 - Present  
[POW Percussion Ensemble](#), Anaheim, CA  
*Audio Team* Summer 2023 - Present  
[Pacific Crest Drum & Bugle Corps](#), Diamond Bar, CA  
 • Facilitated design and live interfacing with large-scale audio rig for 150 active performers  
*Front Ensemble Coordinator* Fall 2019 - Summer 2020  
[Gateway Senior High School](#), Monroeville, PA  
 • Led rehearsals and designed pedagogical structure for the front ensemble (non-mobile percussion) in Gateway's marching band and indoor percussion programs, working with a group of 10-15 students from ages 14-18.  
*Performer and Composer* Spring 2019 - Spring 2020  
[Exploded Ensemble](#), Carnegie Mellon University, Pittsburgh, PA  
 • Designed large-scale Max/MSP programs for multimedia interactive performances

- Composed electro-acoustic pieces for mixed instrumentation ensembles

*Percussion Arranger*

Fall 2018 - Spring 2019

[Tomball High School Indoor Percussion](#), Tomball, TX

- Arranged musical production for large percussion ensemble in order to compete in the Winter Guard International (WGI) national circuit

## Projects

[RoboPierre](#)

Spring 2020

Adaptive Impressionist Music via Generative Modeling

- Developed interactive web app to randomly generate polyphonic music trained on impressionistic composers
- Implemented using Google Magenta's Polyphony RNN and custom stochastic voice leading algorithm

*ThereMyn*

Spring 2019

Motion-Controlled Monophonic Synthesizer

- Used infrared distance monitor to drive audio signal creation
- Created front-end GUI to translate audio signals into a usable motion-controlled synthesizer

## SKILLS

*Programming Languages and Packages*

- Python (Pytorch, Tensorflow, Scikit-Learn, PySpark, CVXPY), R (dplyr, tscount, zoo), C, Matlab, SQL (postgres, MySQL), Stan, Git, Shell, Max/MSP/Jitter

*Other Skills*

- AWS (S3, EC2, EMR), Microsoft Azure, Docker, Agile, Jira, Grafana, Ableton Live

## SELECTED

## COURSEWORK

**UC San Diego**

Deep Generative Models, Search and Optimization, Information Visualization, Recommender Systems, Computing Education, Math for Robotics

**Carnegie Mellon University**

Probabilistic Graphical Models, Convex Optimization, Multimedia Signal Processing, ML w/Large Datasets, Real Analysis, Numerical Linear Algebra, Probability & Statistics, Statistical Computing, Linear Algebra, Philosophy of ML, Algorithms & Data Structures