

# Zachary Novack

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## RESEARCH INTERESTS

Generative AI for Music/Audio, Controllable Generative Models, Efficient AI

## EDUCATION BACKGROUND

*Ph.D. in Computer Science* Fall 2022 - Present

[University of California – San Diego](#), San Diego, CA  
Advisors: Julian McAuley, Taylor Berg-Kirkpatrick

*M.S. in Computer Science* Fall 2022 - Spring 2024

[University of California – San Diego](#), San Diego, CA  
Advisors: Julian McAuley, Taylor Berg-Kirkpatrick

*B.S. in Statistics & Machine Learning* August 2018 - May 2022

[Carnegie Mellon University](#), Pittsburgh, PA  
Advisors: Zachary Lipton, Simon DeDeo  
• Minor in Sonic Arts (music technology)  
• 3.93/4.0 GPA

## SELECTED RESEARCH

**DITTO: Diffusion Inference-Time T-Optimization for Music Generation.**  
**Zachary Novack**, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan.  
ICML (**Oral, Top 1.5%**) 2024.

**Presto! Distilling Steps and Layers for Accelerating Music Generation.**  
**Zachary Novack**, Ge Zhu, Jonah Casebeer, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan  
ICLR 2025

**DITTO-2: Distilled Diffusion Inference-Time T-Optimization for Music Generation.**  
**Zachary Novack**, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan.  
ISMIR 2024.

**CHiLS: Zero-Shot Image Classification with Hierarchical Label Sets.**  
**Zachary Novack**, Julian McAuley, Zachary Lipton, Saurabh Garg.  
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  
[Andrew Carnegie Society Scholar](#) September 2021 - Present  
[Small Undergraduate Research Grant \(SURG\)](#) June 2021  
[Dietrich Senior Honors Research Fellowship](#) May 2021  
1<sup>st</sup> Place: Statistics & Data Science Research Showcase May 2021  
[Summer Undergraduate Research Fellowship \(SURF\)](#) June 2020  
2<sup>nd</sup> Place: 15-112 Term Project Showcase April 2019  
Dean's List: High Honors December 2018 - May 2022  
[Quantitative Social Science Scholar](#) August 2018 - May 2022  
Paul Mellon Memorial Presidential Scholarship August 2018 - May 2022

## INVITED TALKS

- Presto! Distilling Steps and Layers for Accelerating Music Generation**  
• Boston AI Music Meetup January 2025  
• MIT Human-AI Resonance Group Janaury 2025
- DITTO: Diffusion Inference-Time T-Optimization for Music Generation**  
• 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 – Adobe 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

## 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

### *Conference Papers*

- **Presto! Distilling Steps and Layers for Accelerating Music Generation.**  
**Zachary Novack**, Ge Zhu, Jonah Casebeer, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan  
International Conference on Learning Representations (ICLR), 2025
- **PDMX: A Large-Scale Public Domain MusicXML Dataset for Symbolic Music Processing.**  
Phillip Long, **Zachary Novack**, Taylor Berg-Kirkpatrick, Julian McAuley  
International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2025  
NeurIPS Workshop on Creativity & Generative AI, 2024
- **CoLLAP: Contrastive Long-form Language-Audio Pretraining with Musical Temporal Structure Augmentation.**  
Junda Wu, Warren Li, **Zachary Novack**, Amit Namburi, Carol Chen, Julian McAuley  
International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2025  
SoCal NLP Symposium, 2024
- **FUTGA-MIR: Enhancing Fine-grained and Temporally-aware Music Understanding with Music Information Retrieval**  
Junda Wu, **Zachary Novack**, Amit Namburi, Jiaheng Dai, Hao-Wen Dong, Zhouhang Xie, Carol Chen, Julian McAuley  
International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2025
- **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

#### *Workshops*

- **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  
3rd Workshop on NLP for Music and Audio, 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

#### *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 Graphic 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

**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*

**WORK  
EXPERIENCE**

**Stability AI – Audio Group**

October 2024 – Present

*Research Scientist Intern under CJ Carr and Zach Evans*

**Adobe – Audio Group**

June 2023 - October 2024

*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

### ACADEMIC SERVICE

**Reviewer:** ICLR (2023-2024), ICASSP (2023-2024), NeurIPS (2023), ISMIR (2024)

**Ph.D. Admissions Committee:** UCSD (CSE, 2023)

**Ph.D. Visit Day Committee:** UCSD (CSE, 2023-2024 AI/ML Area Lead, 2025 General Chair)

### 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