

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.

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

Presto! Distilling Steps and Layers for Accelerating Music Generation.
Zachary Novack, Ge Zhu, Jonah Casebeer, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan
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
1st 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
[1st Place: Statistics & Data Science Research Showcase](#) May 2021
[Summer Undergraduate Research Fellowship \(SURF\)](#) June 2020
[2nd 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

- 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

Preprints

- **Presto! Distilling Steps and Layers for Accelerating Music Generation.**
Zachary Novack, Ge Zhu, Jonah Casebeer, Julian McAuley, Taylor Berg-Kirkpatrick, Nicholas J. Bryan
2024

Conference Papers

- **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 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

**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 (AI/ML Area Chair): UCSD (CSE, 2023-Present)

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