Nathan Pruyne

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Education

Carnegie Mellon University — Pittsburgh, PA
Ph.D. in Computer Science, Computer Science Department; Advisor: Chris Donahue — *2025 - Present*

Northwestern University — Evanston, IL
B.S in Computer Science, 2nd Major in Music Technology, Minor in Sound Design — *2021 - 2025*

Research Experience

CMU Generative Creativity (G-CLef) Lab — Carnegie Mellon University
Graduate Researcher; Advisor: Dr. Chris Donahue — *August 2025 - Present*

- Work in automatic music transcription: collecting data and training models for multi-task transcription setups.
- Created **MulTTiPop**, an evaluation dataset for multitrack music transcription on commercial pop music.
- Future work in exploring creative workflows that integrate machine learning techniques, musicians' artistic visions, and music consumers' perceptions of machine-assisted music.

Interactive Audio Lab — Northwestern University
Undergraduate Researcher; Advisor: Dr. Bryan Pardo — *April 2022 - June 2025*

- Developed **HARP**, an editor for remote-hosted audio generation and analysis machine learning models in C++ and JUCE.
- Created interface and implementation to attribute generative music to melodically and timbrally similar songs in training data using audio embeddings.
- Implemented experiments and evaluated **ProMoNet** for fine-grain speech editing.
- Detected emphasized words in speech (**Emphases**) using pitch estimation, phoneme alignment, PyTorch convolutional and transformer neural networks.
- Implemented and evaluated pitch estimation neural networks (**PENN**) on speech and music datasets using PyTorch and Tensorboard.

TIDAL Lab — Northwestern University
Summer Intern; Advisor: Dr. Michael Horn — *June 2023 - August 2023*

- Taught Python via music composition and creation over Zoom and in person to students ages 10-18 using TunePad.
- Implemented digital audio workspace features into TunePad using Dart and JavaScript.

Globus Labs AI Team — Argonne National Laboratory
Computer Science Research Aide; Advisors: Dr. Ian Foster, Dr. Ben Blaiszik — *August 2021 - August 2022*

- Adapted framework for Convolutional Neural Networks to segment oxygen-evolution electrocatalysis video data.
- Implemented ML code for high performance computing, including the Argonne Theta supercomputer.
- Documented implementations of machine learning frameworks for use by materials scientists.

Materials Data Facility — The University of Chicago
Research Intern; Advisor: Dr. Ben Blaiszik — *June 2020 - August 2021*

- Achieved 5000x speedup on classification of dendrite segmentation imagery via 3D convolutional neural networks.
- Advised creation of Northwestern University materials science course module (MAT_SCI 395-6) on applying neural networks to materials data. Coursework includes Jupyter notebooks hosted on Google Colab.
- Organized and plotted cyclic voltammetry data using Pandas and Matplotlib.
- Applied SIFT, SURF, and other computer vision methods to electron microscopy data.

Publications

[1] **N. Pruyne**, B. Stoler, W. Chen, C.-y. Huang, S. Watanabe, and C. Donahue, "Multtipop: A multitrack transcription dataset for pop music," *arXiv preprint arXiv:2607.08756*, 2026.

[2] J. Barnett, **N. Pruyne**, N. Diakopoulos, and B. Pardo, "Ai-tribution: Enabling training data attribution for users of generative music models," in *Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society*, vol. 9, pp. 337–348, 2026.

[3] S. An, **N. Pruyne**, C. Donahue, and D. Jeong, "Transfer learning for rhythm game chart generation from music transcription and across games," *arXiv preprint arXiv:2610.14955*, 2026.

[4] F. Cwitkowitz, C. Benetatos, Q. Deng, H. Yu, **N. Pruyne**, P. O'Reilly, H. F. Garcia, Z. Duan, and B. Pardo, "Harp 3.0: Generalizing i/o and api support for machine learning in digital audio workstations," NeurIPS 2025 Workshop on AI for Music, 2025.

[5] P. O'Reilly, J. Barnett, H. F. Garcia, A. Chu, **N. Pruyne**, P. Seetharaman, and B. Pardo, "The rhythm in anything: Audio-prompted drums generation with masked language modeling," *arXiv preprint arXiv:2509.15625*, 2025.

[6] C. Benetatos, F. Cwitkowitz, **N. Pruyne**, H. F. Garcia, P. O'Reilly, Z. Duan, and B. Pardo, "Harp 2.0: Expanding hosted, asynchronous, remote processing for deep learning in the daw," in *ISMIR 2024 Late Breaking Demos*, 2024.

[7] M. Morrison, C. Churchwell, **N. Pruyne**, and B. Pardo, "Fine-grained and interpretable neural speech editing," in *INTERSPEECH 2024*, 2024.

[8] M. Morrison, P. Pawar, **N. Pruyne**, J. Cole, and B. Pardo, "Crowdsourced and automatic speech prominence estimation," in *2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 12281–12285, 2024.

[9] J. R. Lake, S. Rufer, J. James, **N. Pruyne**, A. Scourtas, M. Schwarting, A. Ambadkar, I. Foster, B. Blaiszik, and K. K. Varanasi, "Machine learning-guided discovery of gas evolving electrode bubble inactivation," *Nanoscale*, 2024.

[10] M. Morrison, C. Hsieh, **N. Pruyne**, and B. Pardo, "Cross-domain neural pitch and periodicity estimation," in *arXiv preprint arXiv:2301.12258*, 2023.

[11] J. James, **N. Pruyne**, T. Stan, M. Schwarting, J. Yeom, S. Hong, P. Voorhees, B. Blaiszik, and I. Foster, "Segmentation of tomography datasets using 3d convolutional neural networks," *Computational Materials Science*, vol. 216, p. 111847, 2023.

Presentations

[1] **N. Pruyne**, "Benchmarking and data scaling for automatic pop music transcription," in *Carnegie Mellon Speech Lunch*, September 2026.

[2] **N. Pruyne** and B. Pardo, "Allowing attribution for generative music models," in *Northwestern Undergraduate Research Showcase 2024*, October 2024.

[3] S. Rufer, J. Lake, A. Scourtas, J. James, **N. Pruyne**, M. Schwarting, B. Blaiszik, and K. Varanasi, "Machine learning guided interrogation of gas evolving electrode catalyst activity," in *MRS 2022: AI for Characterization*, August 2022.

[4] T. Stan, **N. Pruyne**, J. James, M. Schwarting, J. Yeom, P. Voorhees, B. Blaiszik, and I. Foster, "Analysis of in-situ x-ray tomography datasets of dendritic solidification using 2d and 3d machine learning algorithms," in *TMS 2022: Advanced Real Time Imaging Symposium*, February 2022.

Educational Modules

[1] T. Stan, J. James, **N. Pruyne**, M. Schwarting, J. Yeom, P. Voorhees, B. J. Blaiszik, I. Foster, and J. D. Emery, "Machine learning in materials science: Image analysis using convolutional neural networks in matcnn," Nov 2021. Available on nanoHUB.

Teaching Experience

CS 352: Machine Perception of Music and Audio — Northwestern University
Peer Mentor, Dr. Bryan Pardo — *Spring 2025*

CS 449: Deep Learning — Northwestern University
Peer Mentor, Dr. Bryan Pardo — *Spring 2024, Winter 2025*

CS 354: Computer System Security — Northwestern University
Peer Mentor, Dr. Yan Chen — *Winter 2024*

Awards & Honors

Northwestern Computer Science Outstanding Senior 2025
Robert and Barbara Feldmann Undergraduate Research Fellowship 2024
Tau Beta Pi Engineering Honor Society 2023
National Merit Scholarship 2020 - 2021

Extracurricular Activities

Songwriters Association at Northwestern Northwestern University
Co-President *2022 - 2025*

- Plan, promote, and run student music festivals, band showcases, guest speaker events, and student-written and produced original music compilations.
- Create environment for student musicians and songwriters to share and improve their work through feedback sessions, music production workshops, and band formation events.

Electronic Music Composition/Production *2016 - Present*