

Nicole Cosme-Clifford

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SUMMARY

PhD candidate at Yale University studying how architectural affordances shape representational capacity in modern neural audio models. Experience includes reimplementing and reverse-engineering widely used models in Python (e.g., SampleCNN, EnCodec, NanoGPT), running proprietary intervention experiments to analyze learned features, and communicating results to diverse audiences.

EDUCATION

Yale University — New Haven, CT *Expected December 2026*
Ph.D., Music Theory | Dissertation: Architectural Constraints on Representational Ontology in Neural Audio Models
Selected Coursework: Probability Theory; Statistical Theory; Machine Learning; Deep Learning Theory; Natural Language Processing

Queens College — Flushing, NY May 2018
M.A., Music Theory | Thesis: Mathematical modeling of music via structured operator composition

Stony Brook University — Stony Brook, NY May 2014
B.A., Music; Minor in Applied Data Science

SELECTED RESEARCH EXPERIENCE

Yale University — Graduate Researcher, New Haven, CT August 2020 – Present

Dissertation: Architectural Constraints on Representational Ontology in Neural Audio Models

- Derived architectural constraints on feature stabilization in convolutional neural audio encoders.
- Conducted mechanistic interpretability experiments (feature emergence, semantic alignment) on neural audio encoders using custom intervention tools.
- Constructed minimal toy models to test hypotheses about feature stabilization and representational capacity.

AI and Music Research Group — Deep Learning Researcher, Remote June 2023 – Present

- Reimplemented and trained a NanoGPT-style transformer on symbolic music corpora.
- Analyzed representation geometry and activation dynamics to study emergence of harmonic structure in simple transformer models.
- Built intervention tools for tracing feature propagation and separability across layers.

Oxford Machine Learning Summer School — Research Project (Finance & NLP), Remote May 2023 – July 2023

- Fine-tuned a transformer-based language model for financial text classification in Python.
- Designed data preprocessing and hyperparameter optimization pipeline.
- Top performer in the program's text-classification competition (top 3 out of ~350 submissions).

TECHNICAL COMMUNICATION & CONSULTING

Yale Digital Humanities Lab — Deep Learning Specialist Consultant, New Haven, CT August 2022 – Present

- Advised AI and data science projects across domains, providing model debugging, architecture guidance, and interpretability support.
- Developed the "Deep Learning for Digital Humanists" workshop series, advancing an accessible approach to the use of deep neural networks in humanities research.

Yale Graduate Writing Lab — Consultant, New Haven, CT August 2023 – Present

- Co-developed and delivered "AI for Research & Writing" workshop series, educating graduate researchers on effective and responsible generative AI use.
- Provided individualized consultations and workshops on writing and research communication.

Yale Tsai Center for Innovative Thinking — AI Fellow, New Haven, CT

January 2024 – January 2025

- Advised development of AI curriculum for non-technical student founders and conducted research on AI adoption within academic institutions.

Yale Office of Strategic Analysis — Swensen Fellow in Strategic Analysis, New Haven, CT June 2024 – August 2024

- Used statistical modeling and strategic analysis to assess progress toward university sustainability targets and recommend strategic actions to institutional stakeholders.

PUBLICATIONS

N. Cosme-Clifford, “Decomposing Audio into Timbral Features with Convolutional Neural Networks”, *2024 IEEE International Conference on Big Data (BigData)*, Washington D.C., 2024, pp. 3168-3173.

N. Cosme-Clifford, J. Symons, K. Kapoor and C. W. White, "Musicological Interpretability in Generative Transformers," *4th International Symposium on the Internet of Sounds*, Pisa, Italy, 2023, pp. 1-9.

C.W. White, K. Kapoor, **N. Cosme-Clifford**, J. Symons, L. von Mutius, “Humans Perceive Ai-Generated Music as Less Expressive than Comparable Human-Made Content,” preprint, 2024, <http://dx.doi.org/10.2139/ssrn.5087035>

SELECTED PRESENTATIONS

Decomposing Audio Features with Deep Neural Networks

- IEEE BigData 2024, *Washington D.C. (Dec. 2024)*
- Acoustical Society of America Annual Meeting, *Virtual (Nov. 2024)*
- New England Conference of Music Theorists, *Boston University (Apr. 2024)* — Keynote panel

Musicological Interpretability in Generative Transformers

- Society for Music Perception and Cognition Annual Meeting, *BANFF, CA (Jul. 2024)*
- 4th International Symposium on the Internet of Sounds, *Pisa, It. (Oct. 2023)*

Generative AI & Music Systems (Jukebox and Beyond)

- Society for Music Theory Annual Meeting, *Denver CO (Nov. 2023)* — won Student Presentation Award
- Keystone Digital Humanities Conference, *Johns Hopkins University (Jun. 2023)*
- New England Conference of Music Theorists, *Yale University (Apr. 2023)*

SKILLS

Programming: Python, PyTorch, NumPy

Modeling: Transformers (decoder-only), convolutional architectures, representation geometry analysis

Interpretability: Activation hooks, intervention experiments, feature separability analysis, probing & visualization

Methods: Mechanistic interpretability, deep learning, machine learning, statistical modeling, signal processing