Joseph T. Colonel

Electrical Engineering and Computer Science, Ph.D.

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Education

2019–2023 **Queen Mary University of London**, *Ph.D.*, Electrical Engineering and Computer Science
Dissertation: *Music Production Behaviour Modelling*, advised by Joshua Reiss

2017–2018 **Cooper Union**, *M.E.*, Electrical Engineering, Full Scholarship, 2 year Program
Thesis: *Neural Network Autoencoders as Musical Audio Synthesizers*, advised by Sam Keene

2011–2015 **Cooper Union**, *B.E.*, Electrical Engineering with Math Minor, Full Scholarship, 4 year program
Focused on analog and digital Signal Processing

Research Interests

Machine learning for singing voice synthesis, music production, and audio effects; text-to-speech applications; differentiable digital signal processing; interdisciplinary approaches to art and AI

Journal Publications

Jul 2021 Colonel, J. T., and Reiss, J. Reverse engineering of a recording mix with differentiable digital signal processing. *The Journal of the Acoustical Society of America*, 150(1), 608-619.

Conference Publications

Oct 2022 Colonel, J., Comunità, M., and Reiss, J. Reverse Engineering Memoryless Distortion Effects with Differentiable Waveshapers. *Audio Engineering Society Convention 153*. Audio Engineering Society.

Oct 2022 Colonel, J., and Reiss, J. Approximating Ballistics in a Differentiable Dynamic Range Compressor. *Audio Engineering Society Convention 153*. Audio Engineering Society.

Oct 2021 Colonel, J.T., Steinmetz, C.J., Michelen, M. and Reiss, J.D. Direct design of biquad filter cascades with deep learning by sampling random polynomials. *ICASSP 2022*. (pp. 3104-3108). IEEE.

Oct 2020 Colonel, J., and Keene, S. Low Latency Timbre Interpolation and Warping using Autoencoding Neural Networks. *Audio Engineering Society Convention 149*. Audio Engineering Society.

Jul 2020 Colonel, J. T., and Keene, S. Conditioning Autoencoder Latent Spaces for Real-Time Timbre Interpolation and Synthesis. *2020 International Joint Conference on Neural Networks*. (pp. 1-7). IEEE.

Sep 2019 Colonel, J., and Reiss, J. D. Exploring Preference for Multitrack Mixes Using Statistical Analysis of MIR and Textual Features. *Audio Engineering Society Convention 147*. Audio Engineering Society.

Sep 2018 Colonel, J., Curro, C., and Keene, S. Neural network autoencoders as musical audio synthesizers. *Proceedings of the 21st International Conference on Digital Audio Effects*. Aveiro, Portugal, 2018.

Oct 2017 Colonel, J., Curro, C., and Keene, S. Improving neural net auto encoders for music synthesis. *Audio Engineering Society Convention 143*. Audio Engineering Society.

Work Experience

2023 - Present Icahn School of Medicine at Mount Sinai — Postdoc Research Fellow
Developing machine learning models for natural language processing and automated speech recognition to identify older adults with cognitive impairment.

Summer 2022 iZotope Internship — Intelligent Audio Engineering
Three month placement working within iZotope's research group. Developed novel machine learning techniques related to intelligent audio engineering. Position was held remote from NYC while core team worked in Boston.

Winter 2022 Yamaha Internship – Singing Voice Synthesis
Three month placement working within Yamaha's Vocaloid research group. Developed novel machine learning techniques related to improving and expanding singing voice synthesis. Position was held remote from London while core team worked in Hamamatsu, Japan.

2015-2017 Citibank – Enterprise Operations and Technology
Two year program that placed recently graduated engineers in two one-year rotations within Citibank's back office EO&T. First rotation involved managing infrastructure for Citi's global real estate division as a project manager. Second rotation was a placement within Citi's datacenter strategy & engineering team which required simulating datacenters' airflow in CFD software, optimizing Citi's NYC datacenters, and helping develop financial models for potential new datacenters.

Selected Exhibits and Projects

Jun 2022 Unsound presents Ephemera — Models
See Ina GRM below

Oct 2021 Ina GRM — Akousma x PRÉSENCES Électronique
Collaborated with musician Lee Gamble on the piece "Models (in the style of?) type beat." Advised on machine learning concepts, researched state-of-the-art models for singing voice synthesis, collated datasets, trained models, and maintained Colab notebook for Lee Gamble to generate singing voices.
Models (in the style of?) type beat is a prototype of a performance that deals with mimicry and simulation, conjuring the auras and moods of pop through a series of artificially synthesized vocal invocations.

Dec 2019 CAC x Hyperdub | The 3rd Ear Cat Meets The Nøtel
Collaborated with Kode9, musician and founder of experimental music label Hyperdub, for a gallery show at Chronus Art Center in Shanghai celebrating Hyperdub's 15th birthday. Advised on machine learning concepts and music representations, trained bespoke neural network on Hyperdub's catalogue, generated audio for use in a 3D printed maneki-neko.
The 3rd Ear Cat is feeding on (machine learning) the Hyperdub catalogue and spitting it out in strange sonic mutations. Its original blueprint dates back to the 1960s, when Nguyen Van Phong developed experimental techniques for opening the 3rd ear, allowing subjects to listen to the voices of the dead and not yet living.

May 2018 Data Science for Social Good — Recidivism Study
Partnered with the Center for Employment Opportunities in NYC to explore latent factors predicting employment for previously incarcerated people. Sonified data tracking participant's desired employment field and progress through CEO's program. Used Google's geocoding API to visualize participants' commutes and applied logistic regression to measure how commutes affected success in the program.

2017–Ongoing CANNe Synthesizer and Audio Effect
Developed a lightweight, autoencoder-based neural network for use in music synthesis and production. Implementations include a VST plugin and standalone python application. Training and usage of the network has been tested on the personal laptops of professional musicians.

Teaching Experience and Invited Lectures

Sep 2020 AES Virtual Symposium: Applications of Machine Learning in Audio
"Deep Learning Approaches to Multitrack Mixing" — Discussed past and present machine learning applications in music production and mixing, including knowledge-engineered and end-to-end systems.

Sep 2019 Invited lectures at Queen Mary University of London and the Cooper Union
"Exploring Preference for Multitrack Mixes Using Statistical Analysis of MIR and Textual Features" — Presented MIR feature extraction and embedding techniques to a group of graduate and undergraduate students, using multitrack mixes as the example domain. Demonstrated how semantic notions of audio can be mathematically calculated and visualized in three dimensions for inspection.

Skills

Expert Python (Tensorflow, Keras, DDSP, Scikit-Learn, Pandas, Matplotlib), VSCode, MATLAB (MIRtoolbox, Simulink), REAPER

Intermediate Git, Pytorch, LaTeX, Google Colab/iPython Notebooks, TKinter for GUI design

Professional Societies

Audio Engineering Society Student Member (Technical Committee for Machine Learning and Artificial Intelligence), IEEE Student Member