

## Education

### Columbia University, New York, NY

PhD in Electrical Engineering at the Laboratory for the Recognition and Organization of Speech and Audio, advisor Dan Ellis, 4.1 cumulative GPA, 2012–2016 (expected)

### Stanford University, Stanford, CA

Master of Arts in Music, Science, and Technology at the Center for Computer Research in Music and Acoustics, 4.1 cumulative GPA, 2009–2010

### Oberlin College, Oberlin, OH

Bachelor of Arts in Mathematics with Physics minor and independent studies in audio circuit design, 3.7 cumulative GPA, 2005–2009

### Relevant Courses Taken

Advanced Machine Learning, Statistical Machine Learning, Introduction to Adaptive Signal Representations, Sparse Representations and High-Dimensional Geometry, Speech Recognition, Signal Processing Methods in Musical Acoustics, Audio Applications of the Fast Fourier Transform

## Publications

Colin Raffel and Daniel P. W. Ellis, “**Pruning Subsequence Search with Attention-Based Embedding**”, in *Proceedings of the 2016 IEEE International Conference on Acoustics, Speech and Signal Processing*, 2016 (to appear).

Colin Raffel and Daniel P. W. Ellis, “**Optimizing DTW-Based Audio-to-MIDI Alignment and Matching**”, in *Proceedings of the 2016 IEEE International Conference on Acoustics, Speech and Signal Processing*, 2016 (to appear).

Nikolai Yakovenko, Liangliang Cao, Colin Raffel, and James Fan, “**Poker-CNN: A Pattern Learning Strategy for Making Draws and Bets in Poker Games**”, in *Proceedings of the 30th AAAI Conference on Artificial Intelligence*, 2016 (to appear).

Colin Raffel and Daniel P. W. Ellis, “**Accelerating Multimodal Sequence Retrieval with Convolutional Networks**”, in *NIPS Multimodal Machine Learning Workshop*, 2015.

Colin Raffel and Daniel P. W. Ellis, “**Large-Scale Content-Based Matching of MIDI and Audio Files**”, in *Proceedings of the 16th International Society for Music Information Retrieval Conference*, 2015.

Brian McFee, Colin Raffel, Dawen Liang, Daniel P. W. Ellis, Matt McVicar, and Oriol Nieto, “**librosa: Audio and Music Signal Analysis in Python**”, in *Proceedings of the 14th Python in Science Conference*, 2015.

Colin Raffel, Brian McFee, Eric J. Humphrey, Justin Salamon, Oriol Nieto, Dawen Liang, and Daniel P. W. Ellis, “**mir\_eval: A Transparent Implementation of Common MIR Metrics**”, in *Proceedings of the 15th International Society for Music Information Retrieval Conference*, 2014.

Colin Raffel and Daniel P. W. Ellis, “**Estimating Timing and Channel Distortion Across Related Signals**”, in *Proceedings of the 2014 IEEE International Conference on Acoustics, Speech and Signal Processing*, 2014.

Colin Raffel, “**Using Noise Substitution for Backwards-Compatible Audio Codec Improvement**”, in *Proceedings of the 129th Convention of the Audio Engineering Society*, 2010.

Colin Raffel and Julius O. Smith, “**Practical Modeling of Bucket-Brigade Device Circuits**”, in *Proceedings of the 13th International Conference on Digital Audio Effects (DAFx-10)*, 2010.

Colin Raffel, Nick Krug, Diane Douglas, Edgar Berdahl, and Wendy Ju, “**The Lattice Harp: A New Hybrid Instrument and Controller**”, in *Proceedings of the 2010 International Computer Music Conference*, 2010.

## Technical Reports, Whitepapers, etc.

Colin Raffel and Daniel P. W. Ellis, “**Feed-Forward Networks with Attention Can Solve Some Long-Term Memory Problems**”, *arXiv:1512.08756 [cs.LG]*, 2015.

Andreas Jansson, Colin Raffel, and Tillman Weyde, “**This Is My Jam: Data Dump**”, *16th International Society for Music Information Retrieval Conference Late Breaking and Demo Papers*, 2015.

Colin Raffel, “**Learning Efficient Representations for Sequence Retrieval**”, *National Science Foundation Data Science Workshop*, 2015.

Colin Raffel and Daniel P. W. Ellis, “**Intuitive Analysis, Creation and Manipulation of MIDI Data with pretty\_midi**”, *15th International Society for Music Information Retrieval Conference Late Breaking and Demo Papers*, 2014.

Colin Raffel and Daniel P. W. Ellis, “**Reproducing Pitch Experiments in "Measuring the Evolution of Contemporary Western Popular Music"**”, *Technical Report*, 2013.

## Honors and Awards

**National Science Foundation Student Travel Grant**, 41st IEEE International Conference on Acoustics, Speech, and Signal Processing, 2016

**Best Student Paper**, 16th International Society for Music Information Retrieval Conference, 2015

**Travel Grant**, National Science Foundation Data Science Workshop, 2015

**Best Poster Presentation**, 15th International Society for Music Information Retrieval Conference, 2014

**Student Travel Award**, International Society for Music Information Retrieval, 2014

**Prize for Reproducibility in Audio and Music Research**, SoundSoftware.ac.uk, 2013

**National Science Foundation Integrative Graduate Education and Research Traineeship Grant**, 2012–2014

**Ableton Best Hack Award**, Music Hack Day San Francisco, 2012

**Best Educational App: Rock Prodigy**, Appy Awards, 2011

**Echo Nest Best Hack Award**, Music Hack Day Barcelona, 2010

**7Digital Best Hack Award**, Music Hack Day Barcelona, 2010

## Business Ventures

### Experimentalists Anonymous

Design, build, and sell custom electronic devices; host audio circuit schematic archive with over three million downloads served; maintain online message board with over fourteen thousand posts; provide

site hosting for do-it-yourself audio hardware enthusiasts; help individuals start successful independent businesses selling electronic audio devices, 2003–present

### **Noisette Audio, LLC**

Provide consulting services in the field of audio signal processing, analysis, and synthesis; develop software for electronic music composition, 2011–2012

## **Teaching**

### **Teacher's Assistant, Deep Learning for Computer Vision and NLP**

Advised students on software and final projects culminating in multiple conference submissions, 2015

### **Teacher's Assistant, Music Digital Signal Processing**

Evaluated projects, provided assistance, and held office hours for a Master's-level course, 2013–2014

### **Electronics**

Filled in for a professor on sabbatical and taught a recurring electronics course in the Oberlin College Physics Department, 2009

### **Circuit Bending**

Taught a course on modifying electronic music circuits and basic electronics as part of the Oberlin Experimental College program; developed a curriculum, lab activities, and lectures, 2006

## **Students Supervised**

**Rafael Valle**, visiting researcher at Columbia University, 2015

**Hilary Mogul**, undergraduate student at Columbia University, 2014

**Dylan Kario**, undergraduate student at Columbia University, 2014

**Zhengshan Shi**, visiting researcher at Columbia University, 2013

## **Talks**

**Accelerating Large-Scale Sequence Retrieval with Convolutional Networks** at *IIT Bombay Electrical Engineering Seminar*, 2015.

**Large-Scale Content-Based Matching of MIDI and Audio Files** at *16th International Society for Music Information Retrieval Conference*, 2015.

**Learning Efficient Representations for Sequence Retrieval** at *Boston Data Festival*, 2015.

**Using Convolutional Networks (with Attention) for Orders-of-Magnitude Speedup of DTW-Based Sequence Retrieval** at *Spotify Machine Learning Seminar*, 2015.

**Recurrent Networks in Lasagne** at *Mount Sinai Hammer Lab Seminar*, 2015.

**Lasagne Tutorial** at *Next.ml Boston*, 2015.

**Theano Tutorial** at *Next.ml Boston*, 2015.

**mir\_eval** at *Objective Evaluation in Semantic Audio Analysis and Processing Panel at the 138th Convention of the Audio Engineering Society*, 2015.

**MIR at LabROSA in 2014** at *NEMISIG 2015*, 2015.

**Large-Scale Content-Based Matching of Audio and MIDI Data** at *Stanford University DSP Seminar*, 2015.

**Advances and Challenges in Large-Scale Music Information Retrieval** at *Digital Music Research Network+8*, 2013.

**Quantifying Rhythmic Synchrony** at *Midwestern Music Cognition Symposium*, 2013.

**A Sequential Approach to Musical Event Detection** at *Carnegie Mellon University Music and Technology Seminar*, 2011.

**Using Noise Substitution for Backwards-Compatible Audio Codec Improvement** at *129th Convention of the Audio Engineering Society*, 2010.

**ROW-mp3: An Enhanced MP3-Compatible Audio Codec** at *Stanford University DSP Seminar*, 2010.

**Practical Modeling of Bucket-Brigade Device Circuits** at *13th International Conference on Digital Audio Effects*, 2010.

**The Lattice Harp: A New Hybrid Instrument and Controller** at *2010 International Computer Music Conference*, 2010.

**An Effective Model of Bucket-Brigade Device-Based Audio Circuits** at *Stanford University DSP Seminar*, 2010.

**Voltage-Controlled Resistance: Modulate Anything** at *Circuitastrophe Circuit Bending Music Festival*, 2008.

## Poster Presentations

**Accelerating Multimodal Sequence Retrieval with Convolutional Networks** at *NIPS Multimodal Machine Learning Workshop*, 2015.

**Learning Efficient Representations for Sequence Retrieval** at *National Science Foundation Data Science Workshop*, 2015.

**Intuitive Analysis, Creation and Manipulation of MIDI Data with pretty\_midi** at *15th International Society for Music Information Retrieval Conference Late Breaking and Demo Papers*, 2014.

**mir\_eval: A Transparent Implementation of Common MIR Metrics** at *15th International Society for Music Information Retrieval Conference*, 2014.

**Estimating Timing and Channel Distortion Across Related Signals** at *39th IEEE International Conference on Acoustics, Speech and Signal Processing*, 2014.

## Employment

### The Way of H

Developed pitch detection and audio timescale modification algorithms for Rock Prodigy, an educational iPhone application for guitarists, 2011–2013

### Beat Kangz Electronics

Maintained and improved audio processing functionality for a hardware- and software-based music production system, 2011–2012

### Imagine Research

Helped develop a machine learning-based sound classification and identification system, 2010–2012

### SacredAgent

Created a musical event detection system which algorithmically demarcates beats and changes in instrumentation, dynamics, and melody, 2010

### WOBC, Oberlin College Radio

Worked as Engineer, 2007–2008, Station Manager, 2008–2009, and Web Administrator, 2009,

## **eBay**

Employed as summer intern in user interface design department and Musical Instrument category management team, 2004

## **Academic Service**

### **Columbia Neural Network Research Group and Seminar Series**

Organize and present paper discussions, tutorials, and seminars on neural networks, 2014–present

### **Crucial Python**

Organized a seminar series on obscure but useful aspects of the Python programming language, 2014

### **Hacking Audio and Music Research (HAMR)**

Started a series of hackathons where researchers rapidly prototype new ideas over the course of a weekend; past HAMRs have been held at Columbia University, Dartmouth College, Drexel University, and Academia Sinica, 2013–present

### **Intern Supervisor**

Oversee summer interns working on Music Information Retrieval research projects, 2013–present

### **KZSU, Stanford University Radio**

Developed web applications and a music fingerprinting system, 2009–2010

### **Mathematics Tutor**

Assisted students studying algebra and linear algebra, 2008–2009

### **Engineering People of Oberlin Club**

Served as the Electrical Engineering group coordinator and web administrator, 2008–2009

### **Oberlin Student Cooperative Association Website Coordinator**

Maintained the website for Oberlin's eating and living cooperative organization, 2006–2007

## **Reviewing**

16th International Society for Music Information Retrieval Conference, 2015

EURASIP Journal on Audio, Speech, and Music Processing, 2015

15th International Society for Music Information Retrieval Conference, 2014

IEEE International Symposium on Information Theory, 2014

## **Additional Coursework**

### **Music Information Retrieval Workshop, Stanford, CA**

Summer workshop covering machine learning and audio feature extraction, 2010

### **Rochester Community and Technical College, Rochester, MN**

Courses in studio recording and electronic music composition, 2002–2004

## **Software Libraries**

`mir_eval`, a simple-to-use reference implementation of many music information retrieval metrics.

`lasagne`, a library for constructing neural networks in Theano.

**pretty\_midi**, utility classes and functions for easily creating, manipulating, and analyzing MIDI data.

**librosa**, DSP routines for audio and music signal analysis.