ETHAN MANILOW

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web: ethman.github.io ⋄ **github**: github.com/ethman

RESEARCH INTERESTS

Music Information Retrieval, Machine Listening, Audio Signal Processing, Open Source Software & Data, Audio Source Separation, Automatic Music Transcription

EDUCATION

Northwestern University, Evanston, IL — *2015 - Present*
Ph.D. in Computer Science & Communication

University of Michigan, Ann Arbor, MI — *2008 - 2013*
Bachelor of Science in Physics

University of Michigan, Ann Arbor, MI — *2008 - 2013*
Bachelor of Fine Arts in Jazz Studies (Guitar)

PROFESSIONAL EXPERIENCE

Northwestern University — Evanston, IL
Research Assistant — *Sept 2015 - Present*
Interactive Audio Lab
Advisor: Bryan Pardo

Google Brain — Mountain View, CA
Student Researcher (Remote) — *Oct 2020 - Present*
Research Intern (Remote) — *June 2020 - Oct 2020*
Magenta Project
Mentors: Jesse Engel and Curtis "Fjord" Hawthorne

Mitsubishi Electric Research Labs (MERL) — Cambridge, MA
Research Consultant (Remote) — *April 2019 - Jan 2020*
Research Intern — *Sept 2018 - April 2019*
Speech and Audio Group
Mentors: Jonathan Le Roux and Gordon Wichern

National Instruments — Austin, TX
Software Engineer — *Nov 2013 - Aug 2015*
LabVIEW Core/Compiler Team

University of Michigan — Ann Arbor, MI
Research Assistant — *April 2011 - Jan 2013*
Physics Department, ATLAS Group, Large Hadron Collider (LHC)
Mentor: Dan Levin

University of Michigan — Ann Arbor, MI
Research Assistant — *Summer 2012*
Department of Mechanical Engineering, Mechanosynthesis Group
Mentors: Justin Beroz and A. John Hart

HONORS AND AWARDS

Best Video Presentation Oct 2020
International Society of Music Information Retrieval (ISMIR)

Best Poster Presentation Oct 2020
International Society of Music Information Retrieval (ISMIR)

Merit-Based Travel Grant Oct 2017
Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)

Segal Design Cluster Fellowship Winter 2017
Northwestern University

SXSW Music Hackathon Winner March 2015
3 Awards: Best Use of Rdio, Best Use of MusicGraph, & Best Use of Kinect. $1k in Prizes.

University Honors Winter 2008, Winter 2009, Fall 2011
University of Michigan

PUBLICATIONS

13. Curtis Hawthorne, Ian Simon, Rigel Swavely, **Ethan Manilow**, Jesse Engel. Sequence-to-Sequence Piano Transcription with Transformers. In *Proceedings of the International Society of Music Information Retrieval (ISMIR)*, 2021. (Forthcoming)

12. Hugo Flores Garcia, Aldo Aguilar, **Ethan Manilow**, Bryan Pardo. Leveraging Hierarchical Structures for Few-Shot Musical Instrument Recognition. In *Proceedings of the International Society of Music Information Retrieval (ISMIR)*, 2021. (Forthcoming)

11. **Ethan Manilow**, Gordon Wichern, Jonathan Le Roux. Hierarchical Musical Instrument Separation. In *Proceedings of the International Society of Music Information Retrieval (ISMIR)*, 2020. Winner: **Best Poster Presentation**, and **Best Video Presentation**
Poster, video, and paper: `https://program.ismir2020.net/poster_3-07.html`

10. **Ethan Manilow**, Bryan Pardo. Bespoke Neural Networks for Score-Informed Source Separation. Late-Breaking Demo at *International Society of Music Information Retrieval (ISMIR)*, 2020.
Demo: `https://ethman.github.io/bespoke-demo`

9. Verena Haunschmid, **Ethan Manilow**, Gerhard Widmer. audioLIME: Listenable Explanations Using Source Separation. *13th International Workshop on Machine Learning and Music*, 2020.
Paper: `arxiv/2008.00582`.

8. Verena Haunschmid, **Ethan Manilow**, Gerhard Widmer. Towards Musically Meaningful Explanations Using Source Separation. *Preprint*, 2020. Paper: `arxiv/2009.02051`.

7. **Ethan Manilow**, Prem Seetharaman, Bryan Pardo. Simultaneous Separation and Transcription of Mixtures with Multiple Polyphonic and Percussive Instruments. In *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2020.
Demo: `https://interactiveaudiolab.github.io/demos/cerberus`

6. **Ethan Manilow**, Gordon Wichern, Prem Seetharaman, Jonathan Le Roux. Cutting Music Source Separation Some Slakh: A Dataset to Study the Impact of Training Data Quality and Quantity. In *Proceedings of the IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2019. Dataset website: `www.slakh.com`

5. Gordon Wichern, Joe Antognini, Michael Flynn, Licheng Richard Zhu, Emmett McQuinn, Dwight Crow, **Ethan Manilow**, Jonathan Le Roux. WHAM!: Extending Speech Separation to Noisy

Environments. In *Proceedings of the 20th Annual Conference of the International Speech Communication Association (InterSpeech)*, 2019. Dataset website: `http://wham.whisper.ai/`

4. **Ethan Manilow**, Prem Seetharaman, and Bryan Pardo. The Northwestern University Source Separation Library. In *Proceedings of the International Society of Music Information Retrieval (ISMIR)*, 2018.
Demo: `https://interactiveaudiolab.github.io/demos/nussl.html`

3. **Ethan Manilow***, Prem Seetharaman*, Fatemeh Pishdadian*, and Bryan Pardo. Predicting Algorithm Efficacy for Adaptive Multi-Cue Source Separation. In *Proceedings of the IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2017. (*Authors contributed equally.) **Merit-based Travel Grant Recipient**
Demo: `https://interactiveaudiolab.github.io/demos/multicue.html`

2. **Ethan Manilow** and Bryan Pardo. Leveraging Repetition to Do Audio Imputation. In *Proceedings of the IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2017.

1. N. Amram, et al. (**ATLAS Group**). Streamlined Calibrations of the ATLAS Precision Muon Chambers for Initial LHC Running. In *Nuclear Instruments and Methods in Physics Research Section A*, April 2012.

PATENTS

1. **Ethan Manilow**, Gordon Wichern, Jonathan Le Roux. "System and Method for Hierarchical Audio Source Separation." US Patent Filed, Oct. 2020.

PRESENTATIONS

9. Programming MIR Baselines from Scratch: Three Case Studies. Rachel Bittner, Mark Cartwright, **Ethan Manilow**. *International Society of Music Information Retrieval (ISMIR)*, Virtual. November 7, 2021. Tutorial. (Forthcoming)

8. Open Source Tools & Data for Music Source Separation: A Pragmatic Guide for the MIR Practitioner. **Ethan Manilow**, Prem Seetharaman, Justin Salamon. *International Society of Music Information Retrieval (ISMIR)*, Montreal, ON (Virtual). October 11, 2020. Tutorial.

7. Synthesize, Separate, and Repeat: Some Notes on Incorporating Notes into Source Separation. *Audio Engineering Society (AES) Virtual Symposium: Applications of Machine Learning in Audio*. September 28-29, 2020. Talk.

6. Cutting Music Source Separation Some Slakh: A Dataset to Study the Impact of Training Data Quality and Quantity. *Speech and Audio in the Northeast (SANE)*, New York, NY. October 24, 2019. Poster.

5. Libraries and Datasets to Power the Next Generation of Source Separation Research, *Midwest Music and Audio Day (MMAD)*, Bloomington, IN. June 17, 2019. Talk.

4. The Northwestern University Source Separation Library, *Speech and Audio in the Northeast (SANE)*, Google, Cambridge, MA. October 18, 2018. Poster.

3. WUT? A New Interface for Interactive Audio Source Separation, *Human Computer Interaction Consortium (HCIC)*, Pajaro Dunes, Watsonville, CA. June 24 - June 28, 2018. Poster.

2. Leveraging Repetition to Do Audio Imputation, *Speech and Audio in the Northeast (SANE)*, Google, New York, NY. October 19, 2017. Poster.

1. nussl: A Flexible Python Audio Source Separation Library, *Midwest Music and Audio Day (MMAD)*. Evanston, IL. June 23, 2017. Talk.

OPEN SOURCE PROJECTS

Audacity (Audio Editor) 2021 - Present
Advisor
Advising a 2021 Google Summer of Code project to add neural network-based Machine Listening models into Audacity, including Source Separation and Sound Event Detection models.
More info at `https://www.audacityteam.org/category/gsoc/gsoc-2021-source-separation/`

Open Source Tools and Data for Music Source Separation 2020 - Present
Lead Developer

An online, interactive book providing a practical approach to training deep learning models for music source separation. Complete with explanations of key concepts, animations, and interactive, runnable code, this gives users the conceptual and practical tools for making their own source separation systems. October 2020 stats: **10k visitors** (8k unique). Reached **#2 on Hacker News** on October 11th 2020!
View tutorial at `https://source-separation.github.io/tutorial/`

DDSP: Differentiable Digital Signal Processing 2020 - Present
Contributing Developer
DDSP is a library of differentiable signal processing functions (synthesizers, reverbs, filters, etc) that enables them to be used with deep learning systems for audio generation or analysis.
More info at `https://github.com/magenta/ddsp/`

Slakh 2019 - Present
Lead Developer
Slakh2100 is an open dataset of 2,100 audio files and mixtures, synthesized from MIDI data using professional-grade virtual instruments. The first release contains an order of magnitude more data (in terms of hours of mixture data) than comparable datasets for source separation, and contains time-aligned transcription data for many more instruments than previously released datasets. Code to generate virtually unlimited amounts of data also available.
More info at `http://www.slakh.com/`

nussl 2015 - Present
Lead Developer
nussl is a flexible, object oriented Python audio source separation library that contains implementations of many classic and state-of-the-art source separation algorithms and models. Users can train their own models with the included hooks for common datasets, or download pretrained models from our zoo.
More info at `https://github.com/nussl/nussl/`

TEACHING

Teaching Assistant Fall 2016, Spring 2019
Northwestern University
EECS 349 – Intro to Machine Learning

Course Designer and **Teaching Assistant** Spring 2018
Northwestern University
EECS 397/SAI 402 – Digital Luthier
Article/Video: `http://bitly.com/2A9jprL`

SERVICE

Mentor 2021
Women in Music Information Retrieval (WiMIR) Mentoring program.

Member - Organizing Committee 2020
Music Demixing Challenge – Signal Separation Evaluation Campaign 2021 (SiSEC).

Board Member Summer 2017 - Fall 2019
Northwestern University Computer Science PhD Advisory Counsel (CSPAC).

Organizing Staff Summer 2017
Midwest Music and Audio Day (MMAD), Evanston, IL.

Student Volunteer Summer 2012
New Interfaces for Musical Expression (NIME), Ann Arbor, MI.

Peer Reviewer

- IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP). 2017-2021.
- IEEE Signal Processing Letters. 2021.
- International Society for Music Information Retrieval (ISMIR). 2021.
- Transactions of the International Society for Music Information Retrieval (TISMIR). 2020-2021.
- IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA). 2017, 2019, 2021.
- IEEE Signal Processing Magazine. 2018.
- European Signal Processing Conference (EUSIPCO). 2018, 2021.
- ACM International conference on Tangible, Embedded and Embodied Interaction (TEI). 2018.

SKILLS

Programming Languages: *Expert:* Python, *Past Experience:* C++, Javascript, C#
Machine Learning: *Expert:* Tensorflow 2, Keras, PyTorch, Chainer, Scikit-learn, Scipy, Numpy *Intermediate:* Apache Beam, hdf5, AWS, GCP
Web: *Intermediate:* Flask, Django, jQuery, Redis, PHP

AS A MUSICIAN

Freelance Musican 2008 - Present
Performed as a professional guitarist across the U.S. and Mexico playing in dance ensembles, pit orchestras, jazz combos, and rock groups. I have worked with Woody Goss (Vulfpeck), Diane McIntyre, Christine Hucal (Woman Believer), Jeremy Daly (Lou Breed), as well as on my own projects.

RECORDINGS

Dreams for Days – LP Forthcoming
Woman Believer
Composer on 2 songs.

Technicolor – EP 2015
The Voluptuous Neighbors
Lead Guitar.
`https://thevoluptuousneighbors.bandcamp.com/album/technicolor`

Stoned Out Two: Morning of the Way to Love – LP 2013
Lou Breed
Guitar on 2 songs.
`https://loubreed.bandcamp.com/album/stoned-out-two-morning-of-the-way-to-love`

Senior Recital – Live Recording 2013
Ethan Manilow
Guitar & Composer.
`http://ethanmanilow.bandcamp.com/`

AAURAL II – Compilation 2012
Composer on 1 song.
`http://grlmtn.com/album/aaural-ii`