

**Zafar Rafii**

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**EMPLOYMENT**

**2022-now** Research Scientist  
*Audible Magic, Los Gatos, CA, USA*

**2021-2022** Research Engineer Manager  
*Gracenote, Emeryville, CA, USA*

**2018-2021** Senior Research Engineer  
*Gracenote, Emeryville, CA, USA*

**2014-2017** Research Engineer  
*Gracenote, Emeryville, CA, USA*

**2013** PhD Intern (6 months)  
*Gracenote, Emeryville, CA, USA*

**2007-2008** Research Engineer (1+ year)  
*Mist Technologies (now Audionamix), Paris, France*

**2002-2004** Student Internship (3 months)  
*Dalkia, Paris, France*

**EDUCATION**

**2008-2014** PhD in Electrical Engineering and Computer Science  
*Northwestern University, Evanston, IL, USA*  
Thesis: Source Separation by Repetition

**2008-2011** Certificate in Cognitive Science  
*Northwestern University, Evanston, IL, USA*

**2005-2006** Master of Science in Electrical Engineering  
*Illinois Institute of Technology, Chicago, IL, USA*

**2003-2006** Master of Electrical Engineering, Computer Science and Telecommunications  
*Ecole Nationale Supérieure d'Electronique et de ses Applications, Cergy, France*

**2001-2003** Classes Préparatoires aux Grandes Ecoles, Physics and Engineering Science  
*Jacques Decour, Paris, France*

**1998-2001** Baccalauréat in Sciences  
*Louis-le-Grand, Paris, France*

**TEACHING**

**2014** Machine Perception of Music and Audio (course evaluation: 5.4/6)

**2012** Machine Perception of Music and Audio (course evaluation: 5.0/6)

**2010** Introduction to Electrical Engineering (course evaluation: 5.2/6)

**FELLOWSHIPS**

**2014** Terminal Year Fellowship

**2012** Advanced Cognitive Science Fellowship

**2008** Walter P. Murphy Fellowship

**VOLUNTEERING****Organizer**

**2023-now** Women in Music Information Retrieval (WiMIR) mentoring program

**2015-now** Bay Innovative Signal Hackers (BISH) Bash meetup group

**2015-2017** Community-based Signal Separation Evaluation Campaign (SiSEC)

**Chair**

**2019-now** IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) session chair

**2019-now** IEEE ICASSP reviewer chair

**2021-2023** IEEE Audio and Acoustic Signal Processing (AASP) Technical Committee industry subcommittee chair  
**2021** IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA) industry liaison chair

#### **Associate Editor**

**2023-now** IEEE Transactions on Audio, Speech and Language Processing (TALSP)  
**2023-now** EURASIP Journal on Audio, Speech, and Music Processing (JASMP)

#### **Journal Reviewer**

**2023-now** Transactions of the International Society for Music Information Retrieval (TISMIR)  
**2017-now** EURASIP JASMP  
**2014-now** IEEE Signal Processing Letters  
**2021** IEEE Signal Processing Magazine  
**2015-2021** Journal of the Audio Engineering Society (JAES)  
**2010-2020** IEEE TASLP  
**2018** EURASIP Journal on Advances in Signal Processing (JASP)  
**2017** IEEE Access

#### **Conference Reviewer**

**2015-now** IEEE WASPAA  
**2014-now** European Signal Processing Conference (EUSIPCO)  
**2013-now** IEEE ICASSP  
**2009-now** International Society for Music Information Retrieval (ISMIR)  
**2018** International Conference on Latent Variable Analysis and Signal Separation (LVA/ICA)  
**2013-2016** ACM International Multimedia Conference  
**2013** International Conference on Digital Audio Effects (DAFx)

#### **Other**

**2020-now** WiMIR mentor  
**2012-now** IEEE Senior member  
**2017-2023** IEEE AASP Technical Committee member  
**2023** IEEE WASPAA meta-reviewer

#### **PUBLICATIONS**

##### **Patents**

- Zafar Rafii. "Methods and Apparatus for Harmonic Source Enhancement," 18/052,481, March 2023.
- Markus Cremer, Zafar Rafii, Robert Coover, and Prem Seetharaman. "Automated Cover Song Identification," 17/946,915, January 2023.
- Markus Cremer, Robert Coover, Zafar Rafii, Aneesh Vartakavi, Andreas Schmidt, Todd Hodges. "Methods and Apparatus to Control Lighting Effects," 17/780,938, December 2022.
- Zafar Rafii, Markus Cremer, and Bongjun Kim. "Methods and Apparatus to Identify Sources of Network Streaming Services using Windowed Sliding Transforms," 11,430,454, August 2022.
- Alexander Berrian, Todd Hodges, Robert Coover, Matthew Wilkinson, and Zafar Rafii. "Audio Content Recognition Method and System," 17/315,820, June 2022.
- Xiaochen Liu, Joseph Renner, Joshua Morris, Todd Hodges, Robert Coover, and Zafar Rafii. "Cover Song Identification Method and System," 17/335,657, June 2022.
- Zafar Rafii. "Audio Matching based on Harmonogram," 11,366,850, June 2022.
- Zafar Rafii. "Methods and Apparatus to Improve Detection of Audio Signatures," 17/541,020, March 2022.
- Zafar Rafii, Markus Cremer, and Bongjun Kim. "Methods, Apparatus and Articles of Manufacture to Identify Sources of Network Streaming Services," 17/360,605, October 2021.
- Zafar Rafii. "Methods and Apparatus to Extract a Pitch-independent Timbre Attribute from a Media Signal," 17/157,780, May 2021.
- Zafar Rafii and Prem Seetharaman. "Audio Identification based on Data Structure," 16/927,577, October 2020.
- Zafar Rafii. "Methods and Apparatus to Perform Windowed Sliding Transforms," 10,726,852, July 2020.

- Rober Coover and Zafar Rafii. "Methods and Apparatus to Fingerprint an Audio Signal via Normalization," 16/453,654, March 2020.
- Bryan Pardo and Zafar Rafii. "Audio Separation System and Method," 13/612,413, July 2015.

#### Journal Articles

- Zafar Rafii. "The Constant-Q Harmonic Coefficients: A Timbre Feature Designed for Music Signals," *IEEE Signal Processing Magazine*, vol. 39, no. 3, May 2022.
- Zafar Rafii. "Sliding Discrete Fourier Transform with Kernel Windowing," *IEEE Signal Processing Magazine*, vol. 35, no. 6, November 2018.
- Zafar Rafii, Antoine Liutkus, Fabian-Robert Stöter, Stylianos Ioannis Mimilakis, Derry FitzGerald, and Bryan Pardo. "An Overview of Lead and Accompaniment Separation in Music," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 26, no. 8, August 2018.
- Zafar Rafii, Zhiyao Duan, and Bryan Pardo. "Combining Rhythm-based and Pitch-based Methods for Background and Melody Separation," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 22, no. 12, December 2014.
- Antoine Liutkus, Derry FitzGerald, Zafar Rafii, Bryan Pardo, and Laurent Daudet. "Kernel Additive Models for Source Separation," *IEEE Transactions on Signal Processing*, vol. 62, no. 16, August 2014.
- Zafar Rafii and Bryan Pardo. "REpeating Pattern Extraction Technique (REPET): A Simple Method for Music/Voice Separation," *IEEE Transactions on Audio, Speech, and Language Processing*, vol. 21, no. 1, January 2013.
- Andrew Todd Sabin, Zafar Rafii, and Bryan Pardo. "Weighting-Function-Based Rapid Mapping of Descriptors to Audio Processing Parameters," *Journal of the Audio Engineering Society*, vol. 59, no. 6, June 2011.

#### Conference Proceedings

- Aneesh Vartakavi, Amanmeet Garg, and Zafar Rafii. "Audio Summarization for Podcasts," *29<sup>th</sup> European Signal Processing Conference*, Dublin, Ireland, August 23-27, 2021.
- Bongjun Kim and Zafar Rafii. "Lossy Audio Compression Identification," *26<sup>th</sup> European Signal Processing Conference*, Rome, Italy, September 3-7, 2018.
- Prem Seetharaman and Zafar Rafii. "Cover Song Identification with 2d Fourier Transform Sequences," *42<sup>nd</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, New Orleans, USA, March 5-9, 2017.
- Derry FitzGerald, Zafar Rafii, and Antoine Liutkus. "User Assisted Separation of Repeating Patterns in Time and Frequency using Magnitude Projections," *42<sup>nd</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, New Orleans, USA, March 5-9, 2017.
- Antoine Liutkus, Fabian-Robert Stöter, Zafar Rafii, Daichi Kitamura, Bertrand Rivet, Nobutaka Ito, Nobutaka Ono, and Lujie Fontecave. "The 2016 Signal Separation Evaluation Campaign," *13<sup>th</sup> International Conference on Latent Variable Analysis and Signal Separation*, Grenoble, France, February 21-23, 2017.
- Nobutaka Ono, Zafar Rafii, Daichi Kitamura, Nobutaka Ito, and Antoine Liutkus. "The 2015 Signal Separation Evaluation Campaign," *12<sup>th</sup> International Conference on Latent Variable Analysis and Signal Separation*, Liberec, Czech Republic, August 25-28, 2015.
- Zafar Rafii, Antoine Liutkus, and Bryan Pardo. "A Simple User Interface System for Recovering Patterns Repeating in Time and Frequency in Mixtures of Sounds," *40<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Brisbane, Australia, April 19-24, 2015.
- Antoine Liutkus, Derry FitzGerald, and Zafar Rafii. "Scalable Audio Separation with Light Kernel Additive Modelling," *40<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Brisbane, Australia, April 19-24, 2015.
- Derry FitzGerald, Antoine Liutkus, Zafar Rafii, Bryan Pardo, and Laurent Daudet. "Harmonic/Percussive Separation using Kernel Additive Modelling," *25<sup>th</sup> IET Irish Signals and Systems Conference*, Limerick, Ireland, June 26-27, 2014.
- Antoine Liutkus, Zafar Rafii, Bryan Pardo, Derry FitzGerald, and Laurent Daudet. "Kernel Spectrogram Models for Source Separation," *4<sup>th</sup> Joint Workshop on Hands-free Speech Communication and Microphone Arrays*, Nancy, France, May 12-14, 2014.
- Zafar Rafii, Bob Coover, and Jinyu Han. "An Audio Fingerprinting System for Live Version Identification using Image Processing Techniques," *39<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Florence, Italy, May 4-9, 2014.

- Zafar Rafii, François G. Germain, Dennis L. Sun, and Gautham J. Mysore. "Combining Modeling of Singing Voice and Background Music for Automatic Separation of Musical Mixtures," *14<sup>th</sup> International Society for Music Information Retrieval*, Curitiba, PR, Brazil, November 4-8, 2013.
- Zafar Rafii and Bryan Pardo. "Online REPET-SIM for Real-time Speech Enhancement," *38<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Vancouver, BC, Canada, May 26-31, 2013.
- Zafar Rafii and Bryan Pardo. "Music/Voice Separation using the Similarity Matrix," *13<sup>th</sup> International Society for Music Information Retrieval*, Porto, Portugal, October 8-12, 2012.
- Antoine Liutkus, Zafar Rafii, Roland Badeau, Bryan Pardo, and Gaël Richard. "Adaptive Filtering for Music/Voice Separation Exploiting the Repeating Musical Structure," *37<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Kyoto, Japan, March 25-30, 2012.
- Mark Cartwright, Zafar Rafii, Jinyu Han, and Bryan Pardo. "Making Searchable Melodies: Human vs. Machine," *3<sup>rd</sup> Human Computation Workshop*, San Francisco, CA, USA, August 8, 2011.
- Zafar Rafii and Bryan Pardo. "A Simple Music/Voice Separation Method based on the Extraction of the Repeating Musical Structure," *36<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Prague, Czech Republic, May 22-27, 2011.
- Zafar Rafii and Bryan Pardo. "Degenerate Unmixing Estimation Technique using the Constant Q Transform," *36<sup>th</sup> IEEE International Conference on Acoustics, Speech and Signal Processing*, Prague, Czech Republic, May 22-27, 2011.
- Zafar Rafii and Bryan Pardo. "Learning to control a Reverberator using Subjective Perceptual Descriptors," *10<sup>th</sup> International Society for Music Information Retrieval*, Kobe, Japan, October 26-30, 2009.

#### Book Chapters

- Bryan Pardo, Zafar Rafii, and Zhiyao Duan. "Audio Source Separation in a Musical Context," *Handbook of Systematic Musicology*, Springer, Berlin, Heidelberg, 2018.
- Zafar Rafii, Antoine Liutkus, and Bryan Pardo. "REPET for Background/Foreground Separation in Audio," *Blind Source Separation*, Springer, Berlin, Heidelberg, 2014.

#### Technical Reports

- Zafar Rafii and Bryan Pardo. "A Digital Reverberator Controlled through Measures of the Reverberation," Northwestern University, EECS Department Technical Report NWU-EECS-09-08, 2009.

#### Data Sets

- Zafar Rafii, Antoine Liutkus, Fabian-Robert Stöter, Stylianos Ioannis Mimilakis, and Rachel Bittner. "MUSDB18-HQ – an uncompressed version of MUSDB18," <https://doi.org/10.5281/zenodo.3338373>, 2019.
- Zafar Rafii, Antoine Liutkus, Fabian-Robert Stöter, Stylianos Ioannis Mimilakis, and Rachel Bittner. "The MUSDB18 corpus for music separation," <https://doi.org/10.5281/zenodo.1117372>, 2017.

#### PRESENTATIONS

##### Tutorials

- Josh McDermott, Bryan Pardo, and Zafar Rafii. "Leveraging Repetition to Parse the Auditory Scene," *13<sup>th</sup> International Society for Music Information Retrieval*, Porto, Portugal, October 8-12 2012.

##### Workshops

- Zafar Rafii. "An Audio Fingerprinting System for Live Version Identification using Image Processing Techniques," *Midwest Music Information Retrieval Gathering*, Northwestern University, Evanston, IL, USA, June 14, 2014.
- Zafar Rafii. "REPET," *Midwest Music Information Retrieval Gathering*, Northwestern University, Evanston, IL, USA, June 24, 2011.
- Zafar Rafii, Raphael Blouet, and Antoine Liutkus. "Discriminant Approach within Non-negative Matrix Factorization for Musical Components Recognition," *DMRN+2: Digital Music Research Network One-day Workshop 2007*, Queen Mary University of London, London, UK, December 18, 2007.

##### Talks

- Zafar Rafii. "Sliding DFT with Kernel Windowing," Tokyo-BISH Bash, Tokyo, Japan, March 30, 2021.
- Zafar Rafii. "Identifying Video Sources by Identifying Audio Compression," Télécom ParisTech, Paris, France, April 13, 2018.

- Zafar Rafii. "Source Separation by Repetition," Center for Computer Research in Music and Acoustics, Stanford University, Stanford, CA, USA, July 15, 2015.
- Zafar Rafii. "Source Separation by Repetition," Center for New Music and Audio Technologies, University of California at Berkeley, Berkeley, CA, USA, May 11, 2015.
- Zafar Rafii. "A Simple Music/Voice Separation Method based on the Extraction of the Underlying Repeating Structure," Télécom ParisTech, Paris, France, July 29, 2011.

#### **Lectures**

- Zafar Rafii. "Audio Fingerprinting," EECS 352: Machine Perception of Music and Audio, Northwestern University, 2014.
- Zafar Rafii. "REpeating Pattern Extraction Technique (REPET)," EECS 352: Machine Perception of Music and Audio, Northwestern University, 2014.
- Zafar Rafii. "Rhythm Analysis in Music," EECS 352: Machine Perception of Music and Audio, Northwestern University, 2014.
- Zafar Rafii. "Time-frequency Masking," EECS 352: Machine Perception of Music and Audio, Northwestern University, 2014.

#### **PERSONAL**

##### **Languages**

- English (fluent), French (native), German (beginner), Persian (beginner), Italian (beginner), Vietnamese (beginner).

##### **Hobbies**

- Biking, brewing, cooking, eating, learning, reading, running, traveling.

##### **Travel**

- Andorra, Australia, Austria, Belgium, Canada, China, Czech Republic, France, Germany, Greece, Hungary, Indonesia, Italy, Iran, Japan, Malta, Netherlands, Portugal, South Korea, Spain, United Kingdom, United States, Vietnam.