Tomohiko Nakamura

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Research Interests

Audio signal processing, music information processing, machine learning, and image processing.

Job

Project Research Associate   **Sept. 2019–Present**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.

Researcher   **Apr. 2016–Aug. 2019**
Intelligent Systems Laboratory, SECOM, Japan.

Research Fellow (DC2)   **Apr. 2015–Mar. 2016**
Japan Society for the Promotion of Science (JSPS), Japan.

Education

Ph.D. degree in Information Science and Technology   **Mar. 2016**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.

Master's degree in Information Science and Technology   **Mar. 2013**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.

Bachelor's degree in Engineering   **Mar. 2011**
Faculty of Engineering, The University of Tokyo, Japan.

Teaching

Advanced Signal Processing   **21, June 2022**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.
I lecture about music information processing (in Japanese).

Applied Gaussian Process and Machine Learning   **6, Dec. 2021**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.
I lecture about machine learning techniques for music information processing (in Japanese).

Advanced Signal Processing   **23, June 2020**
Graduate School of Information Science and Technology, The University of Tokyo, Japan.
I lecture about music information processing (in Japanese).

Student Experiment   **Apr. 2020–Present**
Department of Mathematical engineering and information physics, The University of Tokyo, Japan.
I lecture active and passive measurement for 3D reconstruction from images (in Japanese).

Skills

Languages: English (basic), Japanese (native)
Programming: Python, C/C++, Golang, Javascript, Matlab

Competitive Funds

Publications

Journal Papers

[1] Koichi Saito, <u>Tomohiko Nakamura</u>, Kohei Yatabe, and Hiroshi Saruwatari, "Sampling-Frequency-Independent Convolutional Layer and Its Application to Audio Source Separation," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, Sep. 2022.

[2] <u>Tomohiko Nakamura</u>, Shihori Kozuka, and Hiroshi Saruwatari, "Time-Domain Audio Source Separation with Neural Networks Based on Multiresolution Analysis," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 29, pp. 1687–1701, Apr. 2021. **[The Itakura Prize Innovative Young Researcher Award]**

[3] <u>Tomohiko Nakamura</u> and Hirokazu Kameoka, "Harmonic-Temporal Factor Decomposition for Unsupervised Monaural Separation of Harmonic Sounds," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 29, pp. 68–82, Nov. 2020.

[4] <u>Tomohiko Nakamura</u>, Eita Nakamura, and Shigeki Sagayama, "Real-Time Audio-to-Score Alignment of

Music Performances Containing Errors and Arbitrary Repeats and Skips," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 24, no. 2, pp. 329–339, Feb. 2016.

[5] Tomohiko Nakamura, Yutaka Hori, and Shinji Hara, "Hierarchical Modeling and Local Stability Analysis for Repressilators Coupled by Quorum Sensing," *SICE Journal of Control, Measurement, and System Integration*, vol. 7, no. 3, pp. 133–140, May 2014. **[SICE Best Paper Award (Takeda Award)]**

[6] Eita Nakamura, Tomohiko Nakamura, Yasuyuki Saito, Nobutaka Ono, and Shigeki Sagayama, "Outer-Product Type Hidden Markov Model and Polyphonic MIDI Score Following," *Journal of New Music Research*, vol. 43, pp. 183–201, Apr. 2014.

Peer-Reviewed International Conferences..

[1] Futa Nakashima, Tomohiko Nakamura, Norihiro Takamune, Satoru Fukayama, and Hiroshi Saruwatari, "Hyperbolic Timbre Embedding for Musical Instrument Sound Synthesis Based on Variational Autoencoders," in *Proceedings of Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, Nov. 2022. (to appear)

[2] Yuki Ito, Tomohiko Nakamura, Shoichi Koyama, and Hiroshi Saruwatari, "Head-Related Transfer Function Interpolation from Spatially Sparse Measurements Using Autoencoder with Source Position Conditioning," in *Proceedings of International Workshop on Acoustic Signal Enhancement*, Sep. 2022. (to appear) **[Finalist of Best Paper Award of IWAENC 2022]**

[3] Kazuhide Shigemi, Shoichi Koyama, Tomohiko Nakamura, and Hiroshi Saruwatari, "Physics-Informed Convolutional Neural Network with Bicubic Spline Interpolation for Sound Field Estimation," in *Proceedings of International Workshop on Acoustic Signal Enhancement*, Sep. 2022. (to appear)

[4] Takaaki Saeki, Shinnosuke Takamichi, Tomohiko Nakamura, Naoko Tanji, and Hiroshi Saruwatari, "SelfRemaster: Self-Supervised Speech Restoration with Analysis-by-Synthesis Approach Using Channel Modeling," in *Proceedings of Annual Conference of the International Speech Communication Association*, Sep. 2022. (to appear)

[5] Masaya Kawamura, Tomohiko Nakamura, Daichi Kitamura, Hiroshi Saruwatari, Yu Takahashi, and Kazunobu Kondo, "Differentiable Digital Signal Processing Mixture Model for Synthesis Parameter Extraction from Mixture of Harmonic Sounds," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2022, pp. 941–945.

[6] Takuya Hasumi, Tomohiko Nakamura, Norihiro Takamune, Hiroshi Saruwatari, Daichi Kitamura, Yu Takahashi, and Kazunobu Kondo, "Multichannel Audio Source Separation with Independent Deeply Learned Matrix Analysis Using Product of Source Models," in *Proceedings of Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, Dec. 2021, pp. 1226–1233.

[7] Sota Misawa, Norihiro Takamune, Tomohiko Nakamura, Daichi Kitamura, Hiroshi Saruwatari, Masakazu Une, and Shoji Makino, "Speech Enhancement by Noise Self-Supervised Rank-Constrained Spatial Covariance Matrix Estimation via Independent Deeply Learned Matrix Analysis," in *Proceedings of Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, Dec. 2021, pp. 578–584.

[8] Yusaku Mizobuchi, Daichi Kitamura, Tomohiko Nakamura, Hiroshi Saruwatari, Yu Takahashi, and Kazunobu Kondo, "Prior Distribution Design for Music Bleeding-Sound Reduction Based on Nonnegative Matrix Factorization," in *Proceedings of Asia Pacific Signal and Information Processing Association Annual Summit and Conference*, Dec. 2021, pp. 651–658.

[9] Koichi Saito, Tomohiko Nakamura, Kohei Yatabe, Yuma Koizumi, and Hiroshi Saruwatari, "Sampling-Frequency-Independent Audio Source Separation Using Convolution Layer Based on Impulse Invariant Method," in *Proceedings of European Signal Processing Conference*, Aug. 2021, pp. 321–325.

[10] Naoki Narisawa, Rintaro Ikeshita, Norihiro Takamune, Daichi Kitamura, Tomohiko Nakamura, Hiroshi Saruwatari, and Tomohiro Nakatani, "Independent Deeply Learned Tensor Analysis for Determined Audio Source Separation," in *Proceedings of European Signal Processing Conference*, Aug. 2021, pp. 326–330.

[11] Takuya Hasumi, Tomohiko Nakamura, Norihiro Takamune, Hiroshi Saruwatari, Daichi Kitamura, Yu Takahashi, and Kazunobu Kondo, "Empirical Bayesian Independent Deeply Learned Matrix Analysis

for Multichannel Audio Source Separation," in *Proceedings of European Signal Processing Conference*, Aug. 2021, pp. 331–335.

[12] Shihori Kozuka, <u>Tomohiko Nakamura</u>, and Hiroshi Saruwatari, "Investigation on Wavelet Basis Function of DNN-Based Time Domain Audio Source Separation Inspired by Multiresolution Analysis," in *Proceedings of International Congress and Exposition on Noise Control Engineering*, Aug. 2020, pp. 4013–4022.

[13] <u>Tomohiko Nakamura</u> and Hiroshi Saruwatari, "Time-Domain Audio Source Separation Based on Wave-U-Net Combined with Discrete Wavelet Transform," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2020, pp. 386–390.

[14] <u>Tomohiko Nakamura</u> and Hirokazu Kameoka, "Shifted and Convolutive Source-Filter Non-Negative Matrix Factorization for Monaural Audio Source Separation," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, Mar. 2016, pp. 489–493.

[15] <u>Tomohiko Nakamura</u> and Hirokazu Kameoka, "Lp-Norm Non-Negative Matrix Factorization and Its Application to Singing Voice Enhancement," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, Apr. 2015, vol., pp. 2115–2119.

[16] <u>Tomohiko Nakamura</u>, Kotaro Shikata, Norihiro Takamune, and Hirokazu Kameoka, "Harmonic-Temporal Factor Decomposition Incorporating Music Prior Information for Informed Monaural Source Separation," in *Proceedings of International Society for Music Information Retrieval Conference*, Oct. 2014, pp. 623–628. **[Travel Grant by the Tateishi Science and Technology Foundation]**

[17] <u>Tomohiko Nakamura</u> and Hirokazu Kameoka, "Fast Signal Reconstruction from Magnitude Spectrogram of Continuous Wavelet Transform Based on Spectrogram Consistency," in *Proceedings of International Conference on Digital Audio Effects*, Sep. 2014, pp. 129–135. **[Travel Grant by the Hara Research Foundation]**

[18] Takuya Higuchi, Hirofumi Takeda, <u>Tomohiko Nakamura</u>, and Hirokazu Kameoka, "A Unified Approach for Underdetermined Blind Signal Separation and Source Activity Detection by Multichannel Factorial Hidden Markov Models," in *Proceedings of Annual Conference of the International Speech Communication Association*, Sep. 2014, pp. 850–854.

[19] <u>Tomohiko Nakamura</u>, Hirokazu Kameoka, Kazuyoshi Yoshii, and Masataka Goto, "Timbre Replacement of Harmonic and Drum Components for Music Audio Signals," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2014, pp. 7520–7524.

[20] Takuya Higuchi, Norihiro Takamune, <u>Tomohiko Nakamura</u>, and Hirokazu Kameoka, "Underdetermined Blind Separation and Tracking of Moving Sources Based on DOA-HMM," in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*, May 2014, pp. 3215–3219.

[21] Shigeki Sagayama, <u>Tomohiko Nakamura</u>, Eita Nakamura, Yasuyuki Saito, Hirokazu Kameoka, and Nobutaka Ono, "Automatic Music Accompaniment Allowing Errors and Arbitrary Repeats and Jumps," in *Proceedings of Meetings on Acoustics, Acoustic Society of America*, May 2014, vol. 21, 35003.

[22] <u>Tomohiko Nakamura</u>, Eita Nakamura, and Shigeki Sagayama, "Acoustic Score Following to Musical Performance with Errors and Arbitrary Repeats and Skips for Automatic Accompaniment," in *Proceedings of Sound and Music Computing Conference*, Aug. 2013, pp. 299–304. **[Travel Grant by the Telecommunications Advancement Foundation]**

[23] Masahiro Nakano, Jonathan Le Roux, Hirokazu Kameoka, <u>Tomohiko Nakamura</u>, Nobutaka Ono, and Shigeki Sagayama, "Bayesian Nonparametric Spectrogram Modeling Based on Infinite Factorial Infinite Hidden Markov Model," in *Proceedings of IEEE Workshop on Applications of Signal Processing to Audio and Acoustics*, Oct. 2011, pp. 325–328.

[24] <u>Tomohiko Nakamura</u>, Shinji Hara, and Yutaka Hori, "Local Stability Analysis for a Class of Quorum-Sensing Networks with Cyclic Gene Regulatory Networks," in *Proceedings of SICE Annual Conference*, Sep. 2011, pp. 2111–2116. **[SICE Annual Conference 2011 International Award and Finalist of Young Author's Award]**

Patents

[1] <u>Tomohiko Nakamura</u>, "Object recognition device, method, and program," Japan Unexamined Patent Application JP2021-033374, Mar. 1, 2021.

[2] <u>Tomohiko Nakamura</u>, "Trained model and training device, method, and program," Japan Unexamined Patent Application JP2021-033395, Mar. 1, 2021.

[3] <u>Tomohiko Nakamura</u>, "Object recognition device, method, and program," Japan Unexamined Patent Application JP2021-026685, Feb. 22, 2021.

[4] <u>Tomohiko Nakamura</u>, Shohei Kunimatsu, Toshihiko Sakurai, and Ohnishi Ittoku, "Camera placement evaluation device, method, and program," Japan Unexamined Patent Application JP2021-10070, Jan. 28, 2021.

[5] <u>Tomohiko Nakamura</u>, "Object recognition device, method, and program." Japan Patent JP6773829, Oct. 21, 2020.

[6] <u>Tomohiko Nakamura</u>, "Training device, method, and program and object recognition device" Japan Patent JP6773825, Oct. 21, 2020.

[7] <u>Tomohiko Nakamura</u>, "Database integration device, method, and program, and data imputation device," Japan Patent JP6768101, Oct. 14, 2020.

[8] <u>Tomohiko Nakamura</u>, Tadahiko Ito and Masaki Shimaoka, "Certificate management device." Japan Patent JP6647259, Jan. 16, 2020.

[9] <u>Tomohiko Nakamura</u> and Hirokazu Kameoka, "Vocal tract spectrum estimation device, method, and program," Japan Patent JP6420781, Oct. 19, 2018.

Ph.D. Thesis

[1] <u>Tomohiko Nakamura</u>, "Source-Filter Representation and Phase Estimation in Continuous Wavelet Transform Domain for Monaural Music Audio Editing," *Ph.D. Thesis, The University of Tokyo,* Mar. 2016. **[Dean's Award, IPSJ recommended Ph.D thesis]**

Awards

Awards of My Papers

1. The Itakura Prize Innovative Young Researcher Award, ASJ, Mar. 2022.
2. 2021 Encouragement Award, Foundation of the Promotion of Engineering Research, Jul. 2021.
3. 2021 Otogaku Symposium Best Presentation Award, Jun. 2021.
4. IPSJ Recommended Ph.D. Thesis, Aug. 2016.
5. Dean's Award of Graduate School of Information Science and Technology, The University of Tokyo, Mar. 2016.
6. IPSJ Yamashita SIG Research Award, Mar. 2016.
7. SICE Best Paper Award (Takeda Award), Oct. 2015.
8. 2015 Otogaku Symposium Award, May 2015.
9. Best Student Presentation Award from ASJ, Mar. 2014.
10. IPSJ Certificate of Excellent Master's Thesis, Mar. 2013.
11. Student Encouragement Award of IPSJ National Convention, Mar. 2013.
12. SICE Annual Conference 2011 International Award, Sept. 2011.
13. SICE Annual Conference 2011 Finalist of Young Author Award, Sept. 2011.

Awards Received by My Students and Collaborators

1. 2022 Otogaku Symposium Best Student Presentation Award (Awardee: Futa Nakashima)
2. Dean's Award of Graduate School of Information Science and Technology, The University of Tokyo (Awardee: Takuya Hasumi), Mar. 2022.
3. Encouragement Award, the 24th ASJ Kansai Branch Meeting for Young Researchers (Awardee: Rui Watanabe), Dec. 2021.

4. 2021 Otogaku Symposium Best Student Presentation Award (Awardee: Koichi Saito), Jun. 2021.
5. Best Student Presentation Award from ASJ (Awardee: Takuya Hasumi) , May 2021.