Tomohiko Nakamura

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http://tomohikonakamura.github.io/Tomohiko-Nakamura/
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Research Interests

Signal-Processing-Inspired deep learning, 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.

M.S. degree in Information Science and Technology **Mar. 2013**
Graduate School of Information Science and Technology,
The University of Tokyo, Japan.

B.S. degree in Engineering **Mar. 2011**
Faculty of Engineering, The University of Tokyo, Japan.

Teaching

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

Funds (Research Representative)

Sampling-Frequency-Independent Deep Learning for Audio Media Processing
JST ACT-X (Frontier of Mathematics and Information Science) *Oct. 2021–Mar. 2024*

Research on Acoustic Scene Analysis by Integrating Time-Domain Deep Learning and Multiresolution Analysis
JSPS KAKENHI *Apr. 2020–Mar. 2023*

Time-Domain Audio Source Separation Based on Wavelet Analysis and Deep Learning
Research Grant (A), The Tateisi Science and Technology Foundation *Apr. 2020–Mar. 2021*

Automatic Design of Wavelet Basis Functions for End-to-End Audio Source Separation
Kawai Foundation for Sound Technology and Music *Apr. 2020–Mar. 2021*

Autonomous Audio Signal Processing Based on Imitating Human Auditory System
JSPS KAKENHI *Apr. 2015–Mar. 2016*

Funds (Co-researcher)

Research and Development on Acoustic Information Processing and Voice Conversion
JST Moonshot Research and Development Program *Oct. 2020–Mar. 2025*

Enhancement of Acoustic Virtual Reality and Sound Communication Capability Based on Small Data Machine Learning Theory
JSPS KAKENHI *Apr. 2020–Mar. 2023*

Travel Grants

Grants for Researchers Attending International Conferences
The Tateishi Science and Technology Foundation *Oct. 2014.*

Grants for Researchers Attending International Conferences
The Hara Research Foundation *Sept. 2014.*

Grants for Researchers Attending International Conferences
The Telecommunications Advancement Foundation *Aug. 2013.*

Publications

Journal Papers

[1] Tomohiko Nakamura, 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.

[2] Tomohiko Nakamura 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.

[3] Tomohiko Nakamura, 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, issue 2, pp. 329–339, Feb. 2016.

[4] 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. **[Best Paper Award (Takeda Award) from the Society of Instrument and Control Engineers]**

[5] 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, issue 2, pp. 183–201, Apr. 2014.

Peer-Reviewed International Conferences

[1] 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," *Proc. 13th Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC 2021)*, pp. 1226–1233, Dec. 2021.

[2] 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," *Proc. 13th Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC 2021)*, pp. 578–584, Dec. 2021.

[3] 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," *Proc. 13th Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC 2021)*, pp. 651–658, Dec. 2021.

[4] 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," *Proc. 29th European Signal Processing Conference (EUSIPCO2021)*, pp. 321–325, Aug. 2021.

[5] Naoki Narisawa, Rintaro Ikeshita, Norihiro Takamune, Daichi Kiramura, Tomohiko Nakamura, Hiroshi Saruwatari, and Tomohiro Nakatani, "Independent Deeply Learned Tensor Analysis for Determined Audio Source Separation," *Proc. 29th European Signal Processing Conference (EUSIPCO2021)*, pp. 326–330, Aug. 2021.

[6] 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," *Proc. 29th European Signal Processing Conference (EUSIPCO2021)*, pp. 331–335, Aug. 2021.

[7] Shihori Kozuka, Tomohiko Nakamura, and Hiroshi Saruwatari, "Investigation on Wavelet Basis Function of DNN-based Time Domain Audio Source Separation Inspired by Multiresolution Analysis," *Proc. 49th International Congress and Exposition on Noise Control Engineering (INTERNOISE2020)*, Aug. 2020.

[8] Tomohiko Nakamura and Hiroshi Saruwatari, "Time-domain Audio Source Separation based on Wave-U-Net Combined with Discrete Wavelet Transform," *Proc. 45th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP2020)*, pp. 386–390, May 2020.

[9] Tomohiko Nakamura and Hirokazu Kameoka, "Shifted and Convolutive Source-Filter Non-Negative Matrix Factorization for Monaural Audio Source Separation," *Proc. 41st IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP2016)*, pp. 489–493, Mar. 2016.

[10] Tomohiko Nakamura and Hirokazu Kameoka, "L_p-Norm Non-Negative Matrix Factorization and Its Application to Singing Voice Enhancement," *Proc. 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP2015)*, pp. 2115–2119, Apr. 2015.

[11] Tomohiko Nakamura, Kotaro Shikata, Norihiro Takamune and Hirokazu Kameoka, "Harmonic-Temporal Factor Decomposition Incorporating Music Prior Information for Informed Monaural Source Separation," *Proc. 15th International Society for Music Information Retrieval Conference (ISMIR2014)*, pp. 623–628, Oct. 2014.

[12] Takuya Higuchi, Hirofumi Takeda, Tomohiko Nakamura, Hirokazu Kameoka, "A Unified Approach for Underdetermined Blind Signal Separation and Source Activity Detection by Multichannel Factorial Hidden Markov Models," *Proc. 15th Annual Conference of the International Speech Communication Association (Interspeech2014)*, pp. 850–854, Sept. 2014.

[13] Tomohiko Nakamura and Hirokazu Kameoka, "Fast Signal Reconstruction from Magnitude Spectrogram of Continuous Wavelet Transform based on Spectrogram Consistency," *Proc. 17th International*

Conference on Digital Audio Effects (DAFx-14), pp. 129–135, Sept. 2014.

[14] Tomohiko Nakamura, Hirokazu Kameoka, Kazuyoshi Yoshii and Masataka Goto, "Timbre Replacement of Harmonic and Drum Components for Music Audio Signals," *Proc. 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP2014)*, pp. 7520–7524, May, 2014.

[15] Takuya Higuchi, Norihiro Takamune, Tomohiko Nakamura and Hirokazu Kameoka, "Underdetermined Blind Separation and Tracking of Moving Sources based on DOA-HMM," *Proc. 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP2014)*, pp. 3215–3219, May, 2014.

[16] Shigeki Sagayama, Tomohiko Nakamura, Eita Nakamura, Yasuyuki Saito, Hirokazu Kameoka and Nobutaka Ono, "Automatic Music Accompaniment Allowing Errors and Arbitrary Repeats and Jumps," *Proc. Meetings on Acoustics (POMA)*, vol. 21, 035003, 2014.

[17] Tomohiko Nakamura, Eita Nakamura and Shigeki Sagayama, "Acoustic Score Following to Musical Performance with Errors and Arbitrary Repeats and Skips for Automatic Accompaniment," *Proc. Sound and Music Computing Conference (SMC2013)*, pp. 299–304, Aug. 2013.

[18] Masahiro Nakano, Jonathan Le Roux, Hirokazu Kameoka, Tomohiko Nakamura, Nobutaka Ono and Shigeki Sagayama, "Bayesian Nonparametric Spectrogram Modeling Based on Infinite Factorial Infinite Hidden Markov Model," *Proc. 2011 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA2011)*, pp. 325-328, Oct. 2011.

[19] Tomohiko Nakamura, Shinji Hara and Yutaka Hori, "Local Stability Analysis for a class of Quorum-Sensing Networks with Cyclic Gene Regulatory Networks," *Proc. SICE Annual Conference*, pp. 2111–2116, Sept. 2011. **[SICE Annual Conference 2011 International Award, SICE Annual Conference 2011 Finalist of Young Author Award]**

Ph.D. Thesis

[1] Tomohiko Nakamura, "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]**

Patents

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

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

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

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

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

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

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

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

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

Awards

Awards of My Papers

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

Awards Received by My Students and Collaborators

1. Encouragement Award, the 24th ASJ Kansai Branch Meeting for Young Researchers (Awardee: Rui Watanabe), Dec. 2021.
2. 2021 Otogaku Symposium Best Student Presentation Award (Awardee: Koichi Saito), Jun. 2021.
3. Best Student Presentation Award from ASJ (Awardee: Takuya Hasumi) , May 2021.