

Tatsunori Taniai, Ph.D.

Senior Researcher, Knowledge Computing Group, OMRON SINIC X Corporation

Nagase Hongo Bld., 3F,

5-24-5 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

Mobile phone: +81-90-9149-2019 (international)

E-mail: tatsunori.taniai{at}sinicx.com

Personal website: <http://taniai.space/>

Professional Employment

Apr 2019 – present: **Senior Researcher, OMURON SINIC X Corp., JAPAN**
Jul 2019 – Nov 2020: **Visiting Researcher, RIKEN AIP, JAPAN**
Apr 2017 – Mar 2019: **Special Postdoctoral Researcher, RIKEN AIP, JAPAN**
Apr 2014 – Mar 2017: **JSPS Young Research Fellow, The University of Tokyo, JAPAN**
(also employed as research interns at Microsoft in 2012, 2015 and 2016)

Education

The University of Tokyo, JAPAN (Apr 2009 – March 2017)

March 2017: **Ph.D.** in Information Science and Technology

Advisor: Yoichi Sato

March 2014: **Master of Science** in Information Science and Technology

Advisor: Takeshi Naemura

March 2012: **Bachelor of Engineering** in Information and Communication Engineering

Advisor: Takeshi Naemura

National Institute of Technology, Tokyo College (a.k.a. Tokyo Kosen), JAPAN (2003-2009)

Mar 2009: **Associate of Engineering** in Information Engineering

Advisor: Tetsuya Kojima

Research Interests

In the era of deep learning, I am interested in tackling mid- and low-level problems by leveraging hidden and established principles underlying various phenomena. I refer to this approach as “**Principled AI**” and pursue it through research in the following areas:

- **3D geometry and low-level computer vision**
- **Molecules and materials**
- **Physics-informed machine learning**
- **Autonomy, control, and planning**

Awards & Honors

- March 2019: **2018 IPSJ Yamashita SIG Research Award** from Information Processing Society of Japan (IPSJ).
- March 2017: **Dean's Award for Best Doctoral Thesis** from the Graduate School of Information Science and Technology, the University of Tokyo.
- October 2015: **Microsoft Research Asia Ph.D. Fellowship** from Microsoft Research Asia, as one of thirteen winners among 100 applicants from Asian universities (with research fund of 10,000 USD.)
- 2014 - 2017: **JSPS Young Research Fellowship (DC1)** from the Japan Society for the Promotion of Science with research fund of approximately 10,000 USD / year for three years. Acceptance rate: 23%.
- March 2014: **Dean's Award for Best Master Thesis** from the Graduate School of Information Science and Technology, the University of Tokyo.
- March 2012: **Dean's Award for Best Bachelor Thesis** from the Faculty of Engineering, the University of Tokyo.
- Others: **Outstanding Reviewer Recognitions** from CVPR 2023, 2020, 2018, ECCV 2020.

Publications

◆ Books and Chapters

- [1] Tatsunori Taniai: “Binocular Stereo”, In *Ikeuchi K. (eds) Computer Vision*. Springer, Cham, 2020.

◆ Journals

- [2] Naoya Chiba, Yuta Suzuki, Tatsunori Taniai, Ryo Igarashi, Kotaro Saito, Yoshitaka Ushiku, Kanta Ono: “Neural structure fields with application to crystal structure autoencoders”, In *Communication Materials*, vol. 4, no. 1, pages 106 (Dec. 2023).
- [3] Yuta Suzuki, Tatsunori Taniai, Kotaro Saito, Yoshitaka Ushiku, Kanta Ono: “Self-supervised learning of materials concepts from crystal structures via deep neural networks”, In *Machine Learning: Science and Technology*, vol. 3, no. 4, pages 045034 (Dec. 2022).
- [4] Tatsunori Taniai, Yasuyuki Matsushita, Yoichi Sato, and Takeshi Naemura: “Continuous 3D Label Stereo Matching using Local Expansion Moves”, In *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, vol. 40, no. 11, pp. 2725–2739 (Nov. 2018). (An extended version of [16])
- [5] Tatsunori Taniai, Viet-Quoc Pham, Keita Takahashi, and Takeshi Naemura: “Image Segmentation using Simultaneous Matching of Foreground-Background Color Distributions”, *IEICE Transactions on Information and Systems (Japanese edition)*, vol. J96-D, no. 8, pp. 1764–1777 (Aug. 2013).

◆ International Conference Papers

- [6] Yusei Ito*, Tatsunori Taniai*, Ryo Igarashi, Yoshitaka Ushiku, Kanta Ono: “Rethinking the role of frames for SE(3)-invariant crystal structure modeling”, In *Proc. of the Thirteenth International Conference on Learning Representations (ICLR 2025)*, Singapore. (April 2025). (Acceptance rate: 32.1%) (* equal contributions.)
- [7] Tatsunori Taniai, Ryo Igarashi, Yuta Suzuki, Naoya Chiba, Kotaro Saito, Yoshitaka Ushiku, Kanta Ono: “Crystalformer: Infinitely Connected Attention for Periodic Structure Encoding”, In *Proc. of the Twelfth International Conference on Learning Representations (ICLR 2024)*, Vienna, Austria. (May 2024). (Acceptance rate: 2260/7262 = 31.1%)
- [8] Masafumi Endo, Tatsunori Taniai, Ryo Yonetani, Genya Ishigami: “Risk-aware Path Planning via Probabilistic Fusion of Traversability Prediction for Planetary Rovers on Heterogeneous Terrains”, In *Proc. of the 2023 IEEE International Conference on Robotics and Automation (ICRA 2023)*, pp. 11852-11858, London, UK. (May 2023). (Acceptance rate: 1345/3125 = 43.0%)
- [9] Sotaro Katayama, Tatsunori Taniai, Kazutoshi Tanaka: “Quasistatic contact-rich manipulation via linear complementarity quadratic programming”, In *Proc. of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)*, pp. 203–210, Kyoto, Japan. (Jul. 2021). (Acceptance rate: 1740/3579 = 48.6%)
- [10] Ryo Yonetani*, Tatsunori Taniai*, Mohammadamin Barekatain, Mai Nishimura, Asako Kanezaki: “Path Planning using Neural A* Search”, In *Proc. of the 38th International Conference on Machine Learning (ICML 2021)*, a virtual conference (Jul. 2021). (Acceptance rate: 1184/5513 = 21.5%) (* equal contributions.)
- [11] Tatsunori Taniai and Takanori Maehara: “Neural Inverse Rendering for General Reflectance Photometric Stereo”, In *Proc. of the 35th International Conference on Machine Learning (ICML 2018)*, pp. 4864–4873, Stockholm, Sweden (Jul. 2018). (Acceptance rate: 618/2473 = 25.0%)
- [12] Daniel Scharstein, Tatsunori Taniai, Sudipta N. Sinha. “Semi-Global Stereo Matching with Surface Orientation Priors”. In *Proc. of the 5th International Conference on 3D Vision (3DV 2017)*, pp. 215–224, Qingdao, China, 2017. (Spotlight presentation)
- [13] Tatsunori Taniai, Sudipta Sinha, and Yoichi Sato: “Fast Multi-frame Stereo Scene Flow with Motion Segmentation”, In *Proc. of IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2017)*, pp. 6891–6900, Honolulu, Hawaii, USA (Jul. 2017). (Acceptance rate: 783/2620 = 29.9%)
- [14] Tatsunori Taniai, Sudipta Sinha, and Yoichi Sato: “Joint Recovery of Dense Correspondence and Cosegmentation in Two Images”, In *Proc. of IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2016)*, pp. 4246–4255, Las Vegas, NV, USA (Jun. 2016). (Acceptance rate: 643/2145 = 29.9%)
- [15] Tatsunori Taniai, Yasuyuki Matsushita, and Takeshi Naemura: “Superdifferential Cuts for Binary Energies”, In *Proc. of IEEE Conference on Computer Vision and Pattern Recognition (CVPR*

2015), pp. 2030–2038, Boston, MA, USA (Jun. 2015). (Acceptance rate: $602/2123 = 28.4\%$)

- [16] Tatsunori Taniai, Yasuyuki Matsushia, and Takeshi Naemura: “Graph Cut based Continuous Stereo Matching using Locally Shared Labels”, In *Proc. of IEEE Conference on Computer Vision and Pattern Recognition (CVPR 2014)*, pp. 1613–1620, Columbus, OH, USA (Jun. 2014). (Acceptance rate: $540/1807 = 29.8\%$)
- [17] Tatsunori Taniai, Viet-Quoc Pham, Keita Takahashi, and Takeshi Naemura: “Image Segmentation using Dual Distribution Matching”, In *Proc. of British Machine Vision Conference (BMVC 2012)*, pp. 74.1–74.11, Surrey, UK (Sep. 2012). (Oral presentation. Acceptance rate: $32/414 = 8\%$)

◆ Technical Reports

◆ Invited Talks

- [18] Tatsunori Taniai[†], Sudipta N. Sinha, and Yoichi Sato: “Fast Multi-frame Stereo Scene Flow with Motion Segmentation (CVPR 2017)”, In *The 20th Meeting on Image Recognition and Understanding (MIRU 2017)*, IT-16, at International Conference Center Hiroshima in Hiroshima, Japan (Aug. 10th, 2017).
- [19] Tatsunori Taniai[†]: “Joint Recovery of Dense Correspondence and Cosegmentation in Two Images”, In *The Workshop on Vision, Learning, and Cognition in Microsoft Research Asia Ph.D. Forum 2016*, Microsoft office, Beijing, China (Sep. 20th, 2016).
- [20] Tatsunori Taniai, Sudipta N. Sinha, and Yoichi Sato[†]: “Joint Recovery of Dense Correspondence and Cosegmentation in Two Images (CVPR 2016)”, In *The 19th Meeting on Image Recognition and Understanding (MIRU 2016)*, IS2-15, at Actcity Hamamatsu in Shizuoka, Japan (Aug. 4th, 2016).
- [21] Tatsunori Taniai[†]: “Solving Segmentation and Dense Correspondence Problems using Graph Cuts”, In *The 1st CREST Symposium on Random Fields and Deep Learning*, at Waseda University in Tokyo, Japan (Jan. 13th, 2016). (Organizers: Prof. Hiroshi Ishikawa & Prof. Takayuki Okatani)
- [22] Tatsunori Taniai[†]: “Joint Co-segmentation and Dense Correspondence”, In *The final interview of Microsoft Research Asia Ph.D. fellowships*, at Microsoft Research Asia in Beijing, China (Sep. 11th, 2015).
- [23] Tatsunori Taniai, Yasuyuki Matsushia[†], and Takeshi Naemura: “Superdifferential Cuts for Binary Energies (CVPR 2015)”, In *The 18th Meeting on Image Recognition and Understanding (MIRU 2015)*, IS1-10, at Hotel Hankyu Expo Park in Osaka, Japan (Jul. 28th, 2015).
- [24] Tatsunori Taniai[†], Yasuyuki Matsushia, and Takeshi Naemura: “Graph Cut based Continuous Stereo Matching using Locally Shared Labels (CVPR 2014)”, In *The 17th Meeting on Image Recognition and Understanding (MIRU 2014)*, IT1-1, at Okayama Convention Center in Okayama, Japan (Jul. 29th, 2014).

Names with [†] are the presenters.

◆ Domestic Conference Papers (in Japanese)

Two papers including one refereed paper.

Service

Conference Reviewers:

CVPR 2025-2022, 2020, 2018. ICCV 2017. ECCV 2020.
3DV 2018, 2017, 2014.

Journal Reviewers:

IEEE TPAMI 2023, 2019, 2018. IJCV 2018. IEEE TIP 2018, 2015.
CVIU 2017. IMAVIS 2016.

Committee:

SSII 2025, An Organizing Committee Member of Tutorial and Technical Talk Sessions.

Experiences

Research Internship at Microsoft Research (May 23th – Aug 26th, 2016 in Redmond, USA)

Supervisor: Dr. Sudipta Sinha

Part of the internship achievements has been published as a CVPR 2017 paper [13].

Visiting Research at Microsoft Research Asia (Jan 26th – Apr 25th, 2016 in Beijing, China)

Supervisor: Dr. David Wipf

Research Internship at Microsoft Research (June 1st – Sep 4th, 2015 in Redmond, USA)

Supervisor: Dr. Sudipta Sinha

Part of the internship achievements has been published as a CVPR 2016 paper [14].

Research Internship at Microsoft Research Asia (Dec 11th, 2012 – Apr 17th, 2013 in Beijing, China)

Supervisor: Dr. Yasuyuki Matsushita

Part of the internship achievements has been published as a CVPR 2014 paper [16].

Skills

- **Deep Learning Algorithm Development** in Python and PyTorch
- **CUDA Programming** for accelerating deep learning algorithms (applied in research [6][7])
- **Extensive Programming Experience** (20+ years) in C++, Python, C#, and Java
- **Visual Computing** with OpenCV and Python + NumPy
- **SIMD Code Optimization** using SSE and AVX (applied in research [13])
- **Academic Writing Proficiency** (Authored multiple first-author papers [4][7][11][13]-[17] and actively edited to improve co-authored manuscripts [2][3][6][8]-[10])
- **English Proficiency** in academic literacy and conversation (TOEIC 930/990 in May 2011)