Tatsunori Taniai, Ph.D.

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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] Yuta Suzuki, Tatsunori Taniai, Ryo Igarashi, Kotaro Saito, Naoya Chiba, Yoshitaka Ushiku, and Kanta Ono: "**Bridging Text and Crystal Structures: Literature-driven Contrastive Learning for Materials Science**", In *Machine Learning: Science and Technology*, vol. **, no. **, pages ** (June 2025).

[3] 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).

[4] 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).

[5] 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 [17])

[6] Tatsunori Taniai, Viet-Quoc Pham, Keita Takahashi, and Takeshi Naemura: *"***Image**

Segmentation using Simultaneous Matching of Foreground-Background Color Distributions", In *IEICE Transactions on Information and Systems (Japanese edition)*, vol. J96-D, no. 8, pp. 1764–1777 (Aug. 2013).

♦ **International Conference Papers**

[7] 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.)

[8] 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%)

[9] 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%)

[10] 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%)

[11] 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.)

[12] 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%)

[13] 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)

[14] 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%)

[15] 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%)

[16] 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%)

[17] Tatsunori Taniai, Yasuyuki Matsushita, 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%)

[18] 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%)

♦ **Unrefereed Technical Reports, Review & Commentary Articles, etc.**

[19] Tatsunori Taniai: "**Geometric Deep Learning in Application to Molecule and Crystal Analysis**", (in Japanese), In *Mathematical sciences*, no. 748 (Oct. 2025).

[20] Tatsunori Taniai: "**A participation report on ICLR 2024**" (in Japanese), In *Nikkei Tech Foresight*, online arcticle (Jul. 2024).

[21] Tatsunori Taniai and Ryo Yonetani: "**Path Planning using Machine Learning**" (in Japanese), In *OMRON TECHNICS*, vol. 53, no. 2, pp. 184–193 (Jul. 2024).

[22] Tatsunori Taniai: "**Binocular Stereo: From the Basics to the State of the Art**" (in Japanese), In *OMRON TECHNICS*, vol. 53, no. 2, pp. 246–260 (Jul. 2024).

[23] Tatsunori Taniai and Rei Kawakami: "**A participation report on CVPR 2018**" (in Japanese), In *IPSJ Magazine*, vol. 59, no. 11, pp. 1044–1046 (Oct. 2018).

♦ **Invited Talks**

[24] Tatsunori Taniai†: "**Principled AI: A Methodology for Problem Solving in the Deep Learning Era**", In *The 2025 IEICE General Conference (PRMU Invited Task Session)*, at Tokyo City University (Setagaya Campus), Tokyo, Japan (Mar. 27th, 2025).

[25] 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).

[26] 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).

[27] 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).

[28] 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)

[29] 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).

[30] 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).

[31] 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)

Three 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 [14].

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 [15].

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 [17].

Skills

- **Deep Learning Algorithm Development** in Python and PyTorch
- **CUDA Programming** for accelerating deep learning algorithms (applied in research [7][8])
- **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 [14])
- **Academic Writing Proficiency** (Authored multiple first-author papers [5][8][12][14]-[18] and actively edited to improve co-authored manuscripts [2][4][7][9]-[11])
- **English Proficiency** in academic literacy and conversation (TOEIC 930/990 in May 2011)