Curriculum Vitae

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Toshihiro Ota

Research Scientist, AI Lab, CyberAgent, Inc.
Visiting Scientist, iTHEMS, RIKEN
Email: toshihiro.ota12 at gmail.com
Phone: +81 - 80 - 7478 - 2875

Personal

- Current address: 2-24-12 Shibuya, Tokyo 150-6121, Japan
- Citizenship: Japan
- Born on May, 1991

Education

Apr. 2018 - Mar. 2021	Osaka University, Japan Ph.D. in Physics, March 2021 Dissertation: "Defects in Supersymmetric Gauge Theory and Integrable Lattice Models" Advisor: Professor Koji Hashimoto
Apr. 2016 - Mar. 2018	Osaka University, Japan M.S. in Theoretical Particle Physics, March 2018 Thesis: "QCD chaos from AdS/CFT" (in Japanese) Advisor: Professor Koji Hashimoto
Apr. 2012 - Mar. 2016	Kobe University, Japan B.S. in Physics, March 2016

Employment

Dec. 2022 - present	Research Scientist	CyberAgent, Inc.
Aug. 2021 - Nov. 2022	Research Scientist	Tokyo Institute of Technology
Apr. 2021 - July 2021	JSPS Research Fellow (PD)	Japan Society for the Promotion of Science
Apr. 2020 - Mar. 2021	JSPS Research Fellow (DC2)	Japan Society for the Promotion of Science
Apr. 2019 - Mar. 2020	Junior Research Associate	RIKEN
Apr. 2017 - Mar. 2019	Research Assistant	Osaka University

Visiting Appointment

Apr. 2021 - present	iTHEMS, RIKEN	Visiting Scientist
Apr. 2020 - Mar. 2021	iTHEMS, RIKEN	Student Trainee
Feb. 2019	YITP, Kyoto University	Visiting Student Researcher (the YITP atoms program)

Fellowship

Apr. 2021 - July 2021	Fellowship for Young Scientist (PD)	Japan Society for the Promotion of Science
Apr. 2020 - Mar. 2021	Fellowship for Young Scientist (DC2)	Japan Society for the Promotion of Science
Apr. 2017 - Mar. 2019	Honor course student	Faculty of Science, Osaka University

Teaching Experience

2023 Fall	Part-time Lecturer	Rikkyo University	Electromagnetism & Physical Mathematics Ⅱ
2022 Fall	Part-time Lecturer	Rikkyo University	Electromagnetism & Physical Mathematics Ⅱ
2018 Fall	Teaching Assistant	Osaka University	Classical & Quantum Chaos
2018 Spring	Teaching Assistant	Osaka University	Electromagnetism I
2016 Fall	Teaching Assistant	Osaka University	Mathematical Physics Ⅱ (Complex analysis)

Research Interests

I have been interested in fundamental issues on quantum field theory and string theory, and also the related topics in mathematical physics. My research uses mathematical tools developed by string theory to explore non-perturbative aspects of quantum field theories. My current focus is, in particular, on the study of integrable structure behind string theory and gauge theories.

Recently, I am also interested in the interaction between machine learning and practical problems in our real world. I believe that machine learning and deep learning are one of the most powerful tools to explore fundamental problems and pursue totally new developments that we could not reach ever. My particular interest in this direction is "theoretical physics for machine learning." (That is NOT "machine learning for theoretical physics"!)

Other Skills

- Coding: C, Python
- Language: Japanese (native), English (fluent), Chinese (intermediate)

Publications

[1] T. Ota, "Decision Mamba: Reinforcement Learning via Sequence Modeling with Selective State Spaces," arXiv:2403.19925 [cs.LG].

[2] T. Ota and M. Taki, "iMixer: hierarchical Hopfield network implies an invertible, implicit and iterative MLP-Mixer," arXiv:2304.13061 [cs.LG].

[3] T. Ota, I. Sato, R. Kawakami, M. Tanaka and N. Inoue, "Learning with Partial Forgetting in Modern Hopfield Networks," AISTATS 2023.

[4] T. Ota and R. Karakida, "Attention in a family of Boltzmann machines emerging from modern Hopfield networks," Neural Computation 35 (8), 1463-1480, arXiv:2212.04692 [cs.LG].

[5] K. Maruyoshi, T. Ota and J. Yagi, "Wilson–'t Hooft lines as transfer matrices," JHEP **01** (2021) 072, arXiv:2009.12391 [hep-th].

[6] T. Ota, "Comments on holographic entanglements in cutoff AdS," arXiv:1904.06930 [hep-th].

[7] T. Akutagawa, K. Hashimoto, K. Murata and T. Ota, "Chaos of QCD string from holography," Phys. Rev. D**100** (2019) no.4, 046009, arXiv:1903.04718 [hep-th].

[8] T. Akutagawa, K. Hashimoto, T. Miyazaki and T. Ota, "Phase diagram of QCD chaos in linear sigma models and holography," PTEP **2018** (2018) no.6, 063, arXiv:1804.01737 [hep-th].

In the field of theoretical high energy physics, the author names are in alphabetical order, independent of the contribution.

Patent

1. T. Ota, I. Sato, R. Kawakami, N. Inoue, M. Tanaka and K. Ishikawa. 2021. Information processing equipment, information processing methods and programs. Japan Patent 2022-148317, filed September 16, 2021. Patent pending.

Presentation

Oral

1. "Hopfield/Mixer correspondence: towards a better understanding of MetaFormers architecture design"
   Seminar at Sophia University, Tokyo, Japan, Dec. 8, 2023
2. "Hopfield/Mixer correspondence: towards a better understanding of MetaFormers architecture design"
   Seminar at University of Tokyo, Tokyo, Japan, Dec. 5, 2023
3. "iMixer: hierarchical Hopfield network implies an invertible, implicit and iterative MLP-Mixer"
   Conference: The 5th Workshop of Quantum Gravity Gatherings (RIKEN, Saitama, Japan, Oct. 18-20, 2023)
4. "Learning with Partial Forgetting in Modern Hopfield Networks"
   Conference: The 22nd Forum on Information Technology (Osaka Metropolitan University, Osaka, Japan, Sept. 6-8, 2023)
5. "iMixer: invertible, implicit, and iterative MLP-Mixer from modern Hopfield networks"
   Conference: The 26th Meeting on Image Recognition and Understanding (Shizuoka, Japan, July 25-28, 2023)

6. "Towards 'knowing that don't know' in neural network"
   Conference: The 4th Joint Research Workshop of TokyoTech and Denso IT Laboratory (Tokyo Institute of Technology, Tokyo, Japan, Mar. 15, 2022)

7. "Wilson–'t Hooft lines as transfer matrices"
   Conference: KEK Theory Workshop 2020 (KEK, Tsukuba, Japan, Dec. 15-18, 2020)

8. "Wilson–'t Hooft lines as transfer matrices"
   Conference: YITP conference "Strings and Fields 2020" (YITP, Kyoto University, Kyoto, Japan, Nov. 16 - 20, 2020)

9. "TQFT, integrable lattice model, and quiver gauge theories"
   Seminar at iTHEMS, RIKEN, Saitama, Japan, Oct. 2, 2020

10. "Wilson–'t Hooft lines as transfer matrices"
    Conference: Particle Physics Online Meeting for Young Researchers (Kyoto University, Kyoto, Japan, Aug. 26-28, 2020)

11. "On the relation between line operators in class S theories and integrable lattice models"
    Conference: 75th JPS Annual Meeting (Nagoya University, Aichi, Japan, Mar. 16-19, 2020)

12. "Chaos of QCD string from holography"
    Seminar at Tokyo Institute of Technology, Tokyo, Japan, July 17, 2019

13. "QCD chaos and the Gauge/Gravity correspondence"
    Seminar at Rikkyo University, Tokyo, Japan, May 28, 2019

14. "On the analysis and verification of $T\bar{T}$ deformed AdS/CFT correspondence"
    Conference: 74th JPS Annual Meeting (Kyushu University, Fukuoka, Japan, Mar. 14-17, 2019)

15. "Integrable Lattice Models from Gauge Theory"
    Seminar at Osaka University, Osaka, Japan, Nov. 28, 2018

16. "Knots, Links, and Exactly Solvable Models"
    Conference: International Workshop on Theoretical Particle Physics (Osaka University, Osaka, Japan, Oct. 31 - Nov. 2, 2018)

17. "QCD chaos via the D-brane dynamics in higher dimensions"
    Conference: 73rd JPS Annual Meeting (Tokyo University of Science, Chiba, Japan, Mar. 22-25, 2018)

Poster

1. "iMixer: hierarchical Hopfield network implies an invertible, implicit and iterative MLP-Mixer"
   Conference: International Conference on Machine Learning Physics (YITP, Kyoto University, Kyoto, Japan, Nov. 13-18, 2023)

2. "iMixer: hierarchical Hopfield network implies an invertible, implicit and iterative MLP-Mixer"
   Conference: The 26th Information-Based Induction Sciences Workshop (Fukuoka, Japan, Oct. 29 - Nov. 1, 2023)

3. "iMixer: invertible, implicit, and iterative MLP-Mixer from modern Hopfield networks"
   Conference: The 26th Meeting on Image Recognition and Understanding (Shizuoka, Japan, July 25-28, 2023)

4. "Learning with Partial Forgetting in Modern Hopfield Networks"
   Conference: The 26th International Conference on Artificial Intelligence and Statistics (Valencia, Spain, Apr. 25-27, 2023)

5. "Attention in a family of Boltzmann machines emerging from modern Hopfield networks"
   Conference: Spring School on Computational Physics 2023 (Okinawa, Japan, March 13-15, 2023)

6. "Learning with Partial Forgetting in Modern Hopfield Networks"
   Conference: The 25th Meeting on Image Recognition and Understanding (Hyogo, Japan, July 25-28, 2022)

7. "Integrability from Line Defects in M-theory"
   Conference: 14th Kavli Asian Winter School on Strings, Particles and Cosmology (Tohoku University, Miyagi, Japan, Jan. 13-22, 2020)

8. "Robust and Transferable Adversarial Examples from Deep Image Prior"
   Conference: Deep Learning and Physics 2019 (YITP, Kyoto University, Kyoto, Japan, Oct. 31 - Nov. 2, 2019)

9. "Chaos of interquark force via holography"
   Conference: 13th Kavli Asian Winter School on Strings, Particles and Cosmology (Sogang University, Seoul, Korea, Jan. 7-17, 2019)

10. "Chaos of interquark force via holography"
    Conference: YITP – iTHEMS Joint Workshop "Nonequilibrium Physics" (YITP, Kyoto University, Kyoto, Japan, Dec. 26-28, 2018)

11. "Chaos of interquark force via holography"
    Conference: KEK Theory Workshop 2018 (KEK, Tsukuba, Japan, Dec. 17-20, 2018)

12. "Chaos of interquark force via holography"
    Conference: Nagoya – Osaka Joint Workshop 2018 (Nagoya University, Aichi, Japan, Sept. 25-27, 2018)

13. "Chaos of interquark force via holography"
    Conference: Thermal QFT and its applications (RIKEN, Saitama, Japan, Aug. 27-30, 2018)

14. "QCD chaos via the D-brane dynamics in higher dimensions"
    Conference: YITP conference "Strings and Fields 2018" (YITP, Kyoto University, Kyoto, Japan, July 30 - Aug. 3, 2018)

15. "QCD chaos via the D-brane dynamics in higher dimensions"
    Conference: Strings 2018 (Okinawa Institute of Science and Technology, Okinawa, Japan, June 25-29, 2018)

16. "On the Classical/Quantum Chaos in High Energy Physics"
    Conference: Kickoff Meeting on Quantum Information and Quantum Biology (Osaka University, Osaka, Japan, Jan. 31, 2018)

17. "Chaotic String in $AdS_5 \times T^{1,1}$"
    Conference: 21st APCTP Winter School on Fundamental Physics (APCTP, PoSTech, Pohang, Korea, Jan. 19-25, 2017)