Curriculum Vitae ENG Public

Tomohiro Hayase Ph.D. (Mathematical Sciences)

Researcher @ Fujitsu Artificial Intelligence Laboratories

Part-time Lecturer @ Ochanomizu University

https://thayafluss.github.io/

I have been studying machine learning and deep learning with a mathematical approach and its application to computer vision. Aiming at the rich fusion of physical space and information space (CG space) through information processing, I am advancing into the research and development of XR, starting with virtual reality.

Education

1. 2019, Mar. Ph.D. (Mathematical Science) Graduate School of Mathematical Sciences , The University of Tokyo (Supervisor: Yasuyuki, Kawahigashi)
2. 2014, Mar. Bachelor (Science) The University of Tokyo

Grant

2019~ JST ACT-X Research of Deep Learning via Free Probability Theory

(Co-investigator) 2020~ JSPS Sakura Program Application of Random matrices and random tensors to quantum information and machine learning （Principal investigator : Motohisa Fukuda）

Award

The Mathematical Society of Japan, Cross-disciplinary and Cross-industrial Research Exchange Meeting 2018, Best Poster Award.

Overview of Projects

Computer Vision

- Parameter compression of neural networks for object recognition & detection for edge devices. (@Morpho). In particular, dimension-estimation / reduction with variational Bayesian matrix decomposition or random matrix theory [5].
- Detection of domain shift (@ Fujitsu Lab.) . The algorithm is based on MCD (Maximum Classifier Discrepancy) and Bayesian Regression, and we got a patent.
- Research of unsupervised contrastive Learning（@ Fujitsu Lab.）
- cvpaper.challenge survey-team.

Deep Learning Theory

- Theoretical research of learning dynamics of neural networks（@ PFN・JST ACT-X） . Mean field theory, neural tangent kernel, information geometry [3].
- Continual Learning (@ Fujitsu Lab.）[4]

Virtual Reality

- Viewpoint Planning of Projector Placement for Spatial Augmented Reality using Star-Kernel Decomposition (JST ACT-X）[1]
- Development of open-source virtual blackboard for a VRSNS [github, booth]
- Provision of VR blackboard to the Virtual Conference 2020 and poster presentation [Poster, PB4-1].
- A staff of virtual conference 2021.
- Contributed to the Journal of Virtual Reality Society of Japan [C3].
- Generation of avatar motions

Work Experience

2019, May — Now, Researcher, Fujitsu Artificial Intelligence Laboratories.

Theoretical & applied research about deep learning. Assistance in infrastructure preservation (Docker & Nginx & Grafana & k8s). Mentoring of interns.

1. Detection of domain shift with maximum classifier discrepancy and Bayesian regression. (A patent） .

2. Selective forgetting of deep neural network for continual learning with information geometry[2].
3. Continual Learning[4].

In theoretical researches, we got grants JST ACT-Xと JSPS Sakura Program and studied mean field theory, neural tangent kernel, information geometry of deep neural networks:

1. Learning rate[3]
2. Identity initialization and interpretability [2]

In addition, we studied VR[1].

2020, Nov. — Now, Part-time Lecturer, Department of Information Science, Ochanomizu University.

Lectures on entropy, codes, and communication in information theory

2019, Mar. ~ Aug. Collaborative Research Fellow, Graduate School of Mathematical Sciences, The University of Tokyo.

The research of deep learning theory.

2018, Jul. ~ Sep. Intern, Preferred Networks, inc.

The research of deep learning theory. Dimensionality-Reduction, Generative model of images, Network Architecture Search.

2017, Sep. ~ Nov. Institute Henri Poincare Student Researcher.

Application of random matrices to quantum information and machine learning.

2016 Apr. ~ 2017, Jul. Morpho, inc. Research Assistant.

Image Recognition, Object Detection, and Compression of DNN.

2014 ~ 2015 Teaching Assistant, Department of Mathematics, Faculty of Science, The University of Tokyo.

Fourier Analysis.

Peer-reviewed International Conference and Journal Papers

1. Takefumi Hiraki, Tomohiro Hayase, Yuichi Ike, Takashi Tsuboi, Michio Yoshiwaki,"Viewpoint Planning of Projector Placement for Spatial Augmented Reality using Star-Kernel Decomposition", IEEE VR 2021 (Link to Paper)
2. Kubota Shohei, Hideaki Hayashi, Tomohiro Hayase, Seiichi Uchida, "Layer-wise Interpretation of deep neural networks using identity initialization" accepted into ICASSP 2021. (arXiv:2102.13333)
3. Tomohiro Hayase, Ryo Karakida, "The Spectrum of Fisher Information of Deep Networks Achieving Dynamical Isometry", accepted into AISTATS2021. (arXiv:2006.07814)
4. Tomohiro Hayase, Suguru Yasutomi, Takashi Kato, "Selective Forgetting of Deep Networks at a Finer Level than Samples", accepted into AAAI RSEML2021, (arXiv:2012.11849)
5. Tomohiro Hayase, "Cauchy noise loss for stochastic optimization of random matrix models via free deterministic equivalents", Journal of Mathematical Analysis and Applications Vol. 483, Issue 2, 123597 (2020). (arXiv:1804.03154 [stat.ML])
6. T. Hayase, "Identifiability of parametric random matrix models",Infinite Dimensional Analysis, Quantum Probability and Related Topics Vol. 22, No. 03, 1950018 (2019).(arXiv:1812.10678 [math.PR])
7. T. Hayase, "Free deterministic equivalent Z-scores of compound Wishart models: A goodness of fit test of 2DARMA models", RMTA, No.08, Issue No. 02. (2019) (arXiv:1710:09497 [math.ST]).
8. T. Hayase, "De Finetti theorem for a Boolean anaolgue of easy quantum groups", J. Math. Sci., vol. 24, no. 03, pp. 355~398, 2017 (arXiv:1507.05563 [math.OA]).

The Other works

- [C1] VR Blackboard (github, booth)
- [C2] How to implement a blackboard for a comfortable seminar in VRChat, The virtual conference 2020 (Poster, PB4-1)
- [C3]Takayuki Kameoka, Lcamu, Takato, Fuji, Katayu, Stera Amano, "Virtual Conference 2020", Virtual Reality Society of Japan Journal 2021, Vol. 26, No. 2, p. 14-20. (https://www.jstage.jst.go.jp/article/jvrsj/26/2/26_14/_pdf/-char/ja)