

YAO-HUNG HUBERT TSAI

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RESEARCH INTERESTS

My goal is to understand computational and statistical principals in human multimodal language modeling. Then, use these principals to enhance representation interpretability and improve data efficiency. I am particularly interested in statistical machine learning, graph-based representation learning, multimodal learning, semi-supervised learning, and self-supervised learning.

EDUCATION

Carnegie Mellon University, Pittsburgh, PA, USA

Aug 2016 - May 2021

- Ph.D. in Machine Learning Department within School of Computer Science
- Advised by Dr. Ruslan Salakhutdinov and Dr. Louis-Philippe Morency
- GPA: 4.0/4.0

National Taiwan University, Taipei, Taiwan

Aug 2010 - Jun 2014

- B.S. in Electrical Engineering (graduated with Department Honors)
- Undergraduate Ceremony Representative
- Advised by Dr. Yu-Chiang Frank Wang and Dr. Shao-Yi Chien
- GPA: 4.17/4.3

SELECTED PUBLICATIONS

Conference Publications

- [1] Muqiao Yang*, Martin Q. Ma*, Dongyu Li*, **Yao-Hung Hubert Tsai**, Ruslan Salakhutdinov. “Complex Transformer: A Framework for Modeling Complex-Valued Sequence”, *International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2020. (*equal contributions)
- [2] **Yao-Hung Hubert Tsai**, Nitish Srivastava, Hanlin Goh, Ruslan Salakhutdinov. “Capsules with Inverted Dot-Product Attention Routing”, *International Conference on Learning Representations (ICLR)*, 2020.
- [3] Han Zhao*, **Yao-Hung Hubert Tsai***, Ruslan Salakhutdinov, Geoff Gordon. “Learning Neural Networks with Adaptive Regularization”, *Neural Information Processing Systems (NeurIPS)*, 2019. (*equal contributions)
- [4] **Yao-Hung Hubert Tsai**, Shaojie Bai, Makoto Yamada, Louis-Philippe Morency, Ruslan Salakhutdinov. “Transformer Dissection: A Unified Understanding of Transformer’s Attention via the Lens of Kernel”, *Empirical Methods in Natural Language Processing (EMNLP)*, 2019.
- [5] **Yao-Hung Hubert Tsai***, Shaojie Bai*, Paul Pu Liang, J. Zico Kolter, Louis-Philippe Morency, Ruslan Salakhutdinov. “Multimodal Transformer for Unaligned Multimodal Language Sequences”, *Association for Computational Linguistics (ACL)*, 2019. (*equal contributions)
- [6] Paul Pu Liang, Zhun Liu, **Yao-Hung Hubert Tsai**, Qibin Zhao, Ruslan Salakhutdinov, Louis-Philippe Morency. “Learning Representations from Imperfect Multimodal Time Series Data via Tensor Rank Regularization”, *Association for Computational Linguistics (ACL)*, 2019.
- [7] **Yao-Hung Hubert Tsai**, Santosh Kumar Divvala, Louis-Philippe Morency, Ruslan Salakhutdinov, Ali Farhadi. “Video Relationship Reasoning using Gated Spatio-Temporal Energy Graph”, *Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019.
- [8] Paul Pu Liang*, Yao Chong Lim*, **Yao-Hung Hubert Tsai**, Ruslan Salakhutdinov, Louis-Philippe Morency. “A Strong and Simple Baseline for Multimodal Utterance Embeddings”, *North American Chapter of the Association for Computational Linguistics (NAACL)*, 2019. (*equal contributions) (**Oral Presentation**)
- [9] **Yao-Hung Hubert Tsai***, Paul Pu Liang*, Amir Zadeh, Louis-Philippe Morency, Ruslan Salakhutdinov. “Learning Factorized Multimodal Representations”, *International Conference on Learning Representations (ICLR)*, 2019. (*equal contributions)
- [10] Makoto Yamada*, Denny Wu*, **Yao-Hung Hubert Tsai**, Ichiro Takeuchi, Ruslan Salakhutdinov, Kenji Fukumizu. “Post Selection Inference with Incomplete Maximum Mean Discrepancy Estimator”, *International Conference on Learning Representations (ICLR)*, 2019. (*equal contributions)

- [11] **Yao-Hung Hubert Tsai**, Liang-Kang Huang, and Ruslan Salakhutdinov. “Learning Robust Visual-Semantic Embeddings”, *International Conference on Computer Vision (ICCV)*, 2017.
- [12] Wei-Yu Chen, Tzu-Ming Harry Hsu, **Yao-Hung Hubert Tsai**, Yu-Chiang Frank Wang, and Ming-Syan Chen. “Transfer Neural Trees for Heterogeneous Domain Adaptation”, *European Conference on Computer Vision (ECCV)*, 2016.
- [13] **Yao-Hung Hubert Tsai**, Yi-Ren Yeh, and Yu-Chiang Frank Wang. “Learning Cross-Domain Landmarks for Heterogeneous Domain Adaptation”, *Computer Vision and Pattern Recognition (CVPR)*, 2016.
- [14] **Yao-Hung Hubert Tsai**, Cheng-An Hou, Wei-Yu Chen, Yi-Ren Yeh, and Yu-Chiang Frank Wang. “Domain-Constraint Transfer Coding for Imbalanced Unsupervised Domain Adaptation”, *Association for the Advancement of Artificial Intelligence (AAAI)*, 2016.
- [15] Tzu-Ming Harry Hsu, Wei-Yu Chen, Cheng-An Hou, **Yao-Hung Hubert Tsai**, Yi-Ren Yeh, and Yu-Chiang Frank Wang. “Unsupervised Domain Adaptation with Imbalanced Cross-Domain Data”, *International Conference on Computer Vision (ICCV)*, 2015.

Workshop or Preprints

- [16] **Yao-Hung Hubert Tsai**, Han Zhao, Makoto Yamada, Louis-Philippe Morency, Ruslan Salakhutdinov. “Neural Methods for Point-wise Dependency Estimation”, *arXiv:2006.05553 (arXiv)*, 2020.
- [17] **Yao-Hung Hubert Tsai**, Yue Wu, Ruslan Salakhutdinov, Louis-Philippe Morency. “Demystifying Self-Supervised Learning: An Information-Theoretical Framework”, *arXiv:2006.05576 (arXiv)*, 2020.
- [18] Mathis Petrovich*, Chao Liang*, Yanbin Liu, **Yao-Hung Hubert Tsai**, Linchao Zhu, Yi Yang, Ruslan Salakhutdinov, Makoto Yamada. “Feature Robust Optimal Transport for High-dimensional Data”, *arXiv:2005.12123 (arXiv)*, 2020. (*equal contributions)
- [19] **Yao-Hung Hubert Tsai***, Martin Q. Ma*, Muqiao Yang*, Ruslan Salakhutdinov, Louis-Philippe Morency. “Interpretable Multimodal Routing for Human Multimodal Language”, *arXiv:2004.14198 (arXiv)*, 2020. (*equal contributions)
- [20] Yanbin Liu*, Makoto Yamada*, **Yao-Hung Hubert Tsai**, Tam Le, Ruslan Salakhutdinov, Yi Yang. “LSMI-Sinkhorn: Semi-supervised Squared-Loss Mutual Information Estimation with Optimal Transport”, *arXiv:1909.02377 (arXiv)*, 2019. (*equal contributions)
- [21] **Yao-Hung Hubert Tsai**, Han Zhao, Ruslan Salakhutdinov, and Nebojsa Jojic. “Learning Markov Chain in Unordered Dataset”, *arXiv:1711.03167 (arXiv)/NeurIPS Time Series Workshop (NIPS TSW[†])*, 2017. ([†]**Oral Presentation**)
- [22] **Yao-Hung Hubert Tsai** and Ruslan Salakhutdinov. “Improving One-Shot Learning through Fusing Side Information”, *arXiv:1710.08347 (arXiv)/NIPS Learning with Limited Labeled Data: Weak Supervision and Beyond (NIPS LLD)*, 2017/*Bay Area Machine Learning Symposium (BayLearn[†])*, 2017. ([†]**Best Poster**)

Journal Publications

- [23] Wei-Yu Chen, Tzu-Ming Harry Hsu, **Yao-Hung Hubert Tsai**, Yu-Chiang Frank Wang, and Ming-Syan Chen. “Transfer Neural Trees: Heterogeneous Domain Adaptation and Beyond”, *IEEE Transactions on Image Processing (TIP)*, 2019.
- [24] Cheng-An Hou, **Yao-Hung Hubert Tsai**, Yi-Ren Yeh, and Yu-Chiang Frank Wang. “Unsupervised Domain Adaptation with Label and Structural Consistency”, *IEEE Transactions on Image Processing (TIP)*, 2016.

RESEARCH & WORK EXPERIENCES

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- | | |
|--|---|
| Graduate Research Assistant , Carnegie Mellon University | <i>Aug 2016 - May 2021</i> |
| <ul style="list-style-type: none"> • Researching in Deep Learning and its applications, especially on statistical machine learning, graph-based representation learning, multi-modal learning, and semi-supervised learning. • <i>Advisor: Dr. Ruslan Salakhutdinov and Dr. Louis-Philippe Morency</i> | |
| Visiting Scholar , Kyoto University | <i>Nov 2019</i> |
| <ul style="list-style-type: none"> • Researching in the topics of optimal transportation, alignments, and mutual information. | |
| Visiting Scholar , RIKEN AIP | <i>Dec 2017 - Jan 2018, Dec 2018 - Jan 2019</i> |
| <ul style="list-style-type: none"> • Researching in the intersection between Kernel and Deep Learning. | |
| Graduate Research Intern , Facebook AI Research | <i>May 2020 - Aug 2020</i> |
| <ul style="list-style-type: none"> • Working on self-supervised speech representation learning. • <i>Advisor: Dr. Abdelrahman Mohamed</i> | |

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| Graduate Research Intern , Apple Inc. | <i>May 2019 - Aug 2019</i> |
| <ul style="list-style-type: none"> Working on AI Applications Advisor: Dr. Nitish Srivastava & Dr. Ruslan Salakhutdinov | |
| Graduate Research Intern , Allen Institute for Artificial Intelligence | <i>May 2018 - Aug 2018</i> |
| <ul style="list-style-type: none"> Working on Videos Common Sense Retrieval Advisor: Dr. Santosh Kumar Divvala & Dr. Ali Farhadi | |
| Graduate Research Intern , Microsoft Research | <i>May 2017 - Aug 2017</i> |
| <ul style="list-style-type: none"> Working on Deep Generative Models Advisor: Dr. Nebojsa Jojic | |
| Research Assistant , CITI, Academia Sinica | <i>Aug 2015 - Aug 2016</i> |
| <ul style="list-style-type: none"> Working on Person Re-Identification, Domain Adaptation, and Transfer Learning Advisor: Dr. Yu-Chiang Frank Wang | |
| Undergraduate Research Assistant , National Taiwan University | <i>Sep 2012 - Jun 2014</i> |
| <ul style="list-style-type: none"> Working on Heterogeneous Face Recognition, Augmented Reality, and Real-Time Pose Tracking Advisor: Dr. Yu-Chiang Frank Wang and Dr. Shao-Yi Chien | |

TEACHING EXPERIENCES

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| Head Teaching Assistant , Carnegie Mellon University | <i>Aug 2017 - Jan 2018</i> |
| <ul style="list-style-type: none"> Course: 10-716 Advanced Machine Learning (New Statistical Machine Learning) Instructor: Dr. Pradeep Ravikumar | |
| Teaching Assistant , Carnegie Mellon University | <i>Aug 2017 - Jan 2018</i> |
| <ul style="list-style-type: none"> Course: 10-707 Topics in Deep Learning Instructor: Dr. Ruslan Salakhutdinov | |

ACADEMIC TALKS

- [1] **Yao-Hung Hubert Tsai**. "Transformer Dissection: A Unified Understanding for Transformer's Attention via the Lens of Kernel", *Kyoto University*, Nov 2019.
- [2] **Yao-Hung Hubert Tsai**. "Learning Factorized Multimodal Representations", *Kyoto University*, Jan 2019.
- [3] **Yao-Hung Hubert Tsai**. "Learning Factorized Multimodal Representations", *RIKEN Machine Learning Seminar*, Jan 2019.
- [4] **Yao-Hung Hubert Tsai**. "Discover Orders in Unordered Datasets: Generative Markov Networks", *NVIDIA GPU Technology Conference (GTC)*, Mar 2018.
- [5] **Yao-Hung Hubert Tsai**. "Improve Low-Shot Visual Recognition by Bridging Visual-Semantic Gap", *RIKEN Machine Learning Seminar*, Jan 2018.
- [6] **Yao-Hung Hubert Tsai**. "Discovering Order in Unordered Datasets: Generative Markov Networks", *Neural Information Processing Systems Time Series Workshop (NIPS TSW)*, Dec 2017.

PROFESSIONAL SERVICES

Reviewer:

- Conferences: *ICML, NIPS, ICLR, ICCV, CVPR, AISTATS, ACL, EMNLP*, etc.
- Journals: *TPAMI, TIP*

Admission Committee:

- CMU Machine Learning Department PhD Admission Committee
- CMU Machine Learning Department Master Admission Committee

SELECTED HONORS & AWARDS

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| Facebook Fellowship , Facebook | <i>2020-2021(or 2022)</i> |
| Travel Award , NeurIPS | <i>2019</i> |
| AI2 Fellowship , Allen Institute for Artificial Intelligence | <i>2018-2019</i> |

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| Government Scholarship to Study Abroad (GSSA) , Taiwan Ministry of Education | <i>2016-2018</i> |
| Undergraduate Ceremony Representative , National Taiwan University | <i>2014</i> |
| Presidential Awards , National Taiwan University | <i>2011/2012/2014</i> |
| Best Tourism App Award , Chunghwa Telecom Hami Apps Competition | <i>2014</i> |
| Bronze Medal & Outstanding Paper Award , Altera Innovate Asia FPGA Design Competition | <i>2013</i> |
| Direct Admission with Recommendation , International Physics Olympiad Selection Camp | <i>2010</i> |
| National Representative Honorable Mention , International Physics Olympiad Selection Camp | <i>2009</i> |
| 1st Runner-Up/Third Prize , Regional/National Physics Olympiad for Senior High School | <i>2009</i> |
| Honorable Mention , International Junior Science Olympiad Selection Camp | <i>2008</i> |

SKILLS

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| Toolbox/Software | PyTorch, TensorFlow, Theano, Keras, Torch, Caffe, CUDA, cuDNN, L ^A T _E X |
| Programming Languages | Python, MATLAB, R, C/C++, Lua, C#, JAVA, Verilog, JavaScript, HTML5 |