

# YAO-HUNG HUBERT TSAI

🌐 <https://yaohungt.github.io> 📞 (412) 736-2674 ✉ [yaohungt@cs.cmu.edu](mailto:yaohungt@cs.cmu.edu)

📍 GHC (Gates Hillman Centers) 8013, 5000 Forbes Ave, Pittsburgh, PA 15213, USA

## 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, and semi-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:1909.0237 (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<sup>†</sup>)*, 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<sup>†</sup>)*, 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

---

- |  |   |
|--|---|
| <b>Graduate Research Assistant</b> , Carnegie Mellon University  | <i>Aug 2016 - May 2021</i>                      |
| <ul style="list-style-type: none"> <li>• Researching in Deep Learning and its applications, especially on statistical machine learning, graph-based representation learning, multi-modal learning, and semi-supervised learning.</li> <li>• <i>Advisor: Dr. Ruslan Salakhutdinov and Dr. Louis-Philippe Morency</i></li> </ul> |   |
| <b>Visiting Scholar</b> , Kyoto University   | <i>Nov 2019</i>                                 |
| <ul style="list-style-type: none"> <li>• Researching in the topics of optimal transportation, alignments, and mutual information.</li> </ul>   |   |
| <b>Visiting Scholar</b> , RIKEN AIP  | <i>Dec 2017 - Jan 2018, Dec 2018 - Jan 2019</i> |
| <ul style="list-style-type: none"> <li>• Researching in the intersection between Kernel and Deep Learning.</li> </ul>  |   |
| <b>Graduate Research Intern</b> , Apple Inc.   | <i>May 2019 - Aug 2019</i>                      |
| <ul style="list-style-type: none"> <li>• Working on AI Applications</li> <li>• <i>Advisor: Dr. Nitish Srivastava &amp; Dr. Ruslan Salakhutdinov</i></li> </ul>   |   |
| <b>Graduate Research Intern</b> , Allen Institute for Artificial Intelligence  | <i>May 2018 - Aug 2018</i>                      |
| <ul style="list-style-type: none"> <li>• Working on Videos Common Sense Retrieval</li> </ul>   |   |

- Advisor: Dr. Santosh Kumar Divvala & Dr. Ali Farhadi

**Graduate Research Intern**, Microsoft Research

May 2017 - Aug 2017

- Working on Deep Generative Models
- Advisor: Dr. Nebojsa Jojic

**Research Assistant**, CITI, Academia Sinica

Aug 2015 - Aug 2016

- Working on Person Re-Identification, Domain Adaptation, and Transfer Learning
- Advisor: Dr. Yu-Chiang Frank Wang

**Undergraduate Research Assistant**, National Taiwan University

Sep 2012 - Jun 2014

- 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

---

**Head Teaching Assistant**, Carnegie Mellon University

Aug 2017 - Jan 2018

- Course: 10-716 Advanced Machine Learning (New Statistical Machine Learning)
- Instructor: Dr. Pradeep Ravikumar

**Teaching Assistant**, Carnegie Mellon University

Aug 2017 - Jan 2018

- 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: *TIP*

**Admission Committee:**

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

## SELECTED HONORS & AWARDS

---

**Facebook Fellowship**, Facebook

2020-2021(or 2022)

**Travel Award**, NeurIPS

2019

**AI2 Fellowship**, Allen Institute for Artificial Intelligence

2018-2019

**Government Scholarship to Study Abroad (GSSA)**, Taiwan Ministry of Education

2016-2018

**Undergraduate Ceremony Representative**, National Taiwan University

2014

**Presidential Awards**, National Taiwan University

2011/2012/2014

**Best Tourism App Award**, Chunghwa Telecom Hami Apps Competition

2014

**Bronze Medal & Outstanding Paper Award**, Altera Innovate Asia FPGA Design Competition

2013

<b>Direct Admission with Recommendation</b> , International Physics Olympiad Selection Camp	<i>2010</i>
<b>National Representative Honorable Mention</b> , International Physics Olympiad Selection Camp	<i>2009</i>
<b>1st Runner-Up/Third Prize</b> , Regional/National Physics Olympiad for Senior High School	<i>2009</i>
<b>Honorable Mention</b> , International Junior Science Olympiad Selection Camp	<i>2008</i>

## SKILLS

---

<b>Toolbox/Software</b>	PyTorch, TensorFlow, Theano, Keras, Torch, Caffe, CUDA, cuDNN, L <sup>A</sup> T <sub>E</sub> X
<b>Programming Languages</b>	Python, MATLAB, R, C/C++, Lua, C#, JAVA, Verilog, JavaScript, HTML5