Jiaji Huang

CONTACT INFORMATION

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RESEARCH STATEMENT

My PhD dissertation focuses on **statistical signal processing** and **machine learning**, with a special interest in understanding how **geometry of high dimensional space** impacts various tasks, including signal reconstruction, representation and classification.

My recent research interest lies in the intersection of **machine learning** and **natural language processing**. I am interested in understanding and improving the representations learned under weak supervision. Examples are pre-trained language models, their contextual embeddings and various language understanding tasks.

I usually formalize problems with a mathematical language, seek their solutions, and then work on performance guarantees.

EMPLOYMENT

July, 2016 — Aug., 2019 **Research Scientist, Baidu Research**
Aug., 2019 — Now **Senior Research Scientist and Research Lead, Baidu Research**

Representative Research Projects (inverse chronological order)

- Language models: methods, analysis and applications
  Key Results:
  1. Generalizing language models to unseen tasks: up to **13%** improvement on token level tasks. Paper accepted at **Neurips 2021**; open source at task_space
  2. Zero-shot pruning method, reducing $\sim$ **70**% attention head, with performance loss $<$ **5**% on GLUE.
  3. Detection of Alzheimer's Disease via speaker's transcription. **1-st** place in Interspeech ADReSS challenge
  4. Identify and visualize clusters and isotropy in contextualized word embeddings
- Bilingual Lexicon Induction
  Key results: *State-of-art* on MUSE benchmark by facebook; open source at HNN
- Large Margin Neural Language Models
  Key results: *1.11 WER reduction* for speech recognition and *0.96 BLEU improvement* for machine translation
- Improved optimization of CTC loss
  Key results: smaller CTC loss by using estimated alignments
- Active learning for speech recognition
  Key results: *50% fewer labels*, but comparable accuracy

EDUCATION

April, 2016 **PhD, Electrical and Computer Engineering, Duke University**

Thesis Advisor: *Claude E. Shannon Award Recipient* Robert Calderbank

July, 2011 **B.S., Electrical Engineering, University of Science and Technology of China**

with Honor: Distinguished graduate, National Scholarship

CONFERENCE (SELECTED)

J. Huang, Q. Qiu, K. Church. Exploiting a Zoo of Checkpoints for Unseen Tasks. Neural Information Processing Systems (Neurips) 2021.

Y. Bian, **J. Huang**, X. Cai, J. Yuan, K. Church. On Attention Redundancy: A Comprehensive Study. North American Chapter of the Association for Computational Linguistics: Human Language Technologies (NAACL) 2021.

X. Cai, **J. Huang**, Y. Bian, K. Church. Isotropy in the contextual embedding space: Clusters and manifolds. International Conference on Learning Representations (ICLR) 2020.

J. Yuan, Y. Bian, X. Cai, **J. Huang**, Z. Ye, K. Church. Disfluencies and Fine-Tuning Pre-Trained Language Models for Detection of Alzheimer's Disease. In Interspeech 2020.

J. Huang, X. Cai and K. Church. Improving Bilingual Lexicon Induction for Low Frequency Words. In Empirical Methods in Natural Language Processing (EMNLP) 2020.

J. Huang, Q. Qiu and K. Church. Hubless Nearest Neighbor Search for Bilingual Lexicon Induction. In Proceedings of the 57th Conference of the Association for Computational Linguistics (ACL) 2019.

J. Huang, Y. Li, P. Wei and L. Huang. Large Margin Neural Language Model. In Empirical Methods in Natural Language Processing (EMNLP) 2018.

W. Wang , Z. Gan, W. Wang, D. Shen, **J. Huang**, W. Ping, S. Satheesh, and L. Carin. Topic Compositional Neural Language Model. International Conference on Artificial Intelligence and Statistics (AISTATS) 2018.

W. Zhu, Q. Qiu, **J. Huang**, R. Calderbank, G. Sapiro, and I. Daubechies, LDMNet: low dimensional manifold regularized neural networks. IEEE Conference on Computer Vision and Pattern Recognition (CVPR) 2018.

J. Huang, Q. Qiu, R. Calderbank and G. Sapiro. Discriminative Robust Transformation Learning. Neural Information Processing Systems (NIPS), 2015.

J. Huang, Q. Qiu, R. Calderbank and G. Sapiro. Geometry-aware Deep Transform. International Conference on Computer Vision (ICCV), 2015.

L. Wang, **J. Huang**, X. Yuan, V. Cevher, M. Rodrigues, R. Calderbank, L. Carin. A concentration-of-measure inequality for multiple-measurement models, IEEE International Symposium on Information Theory (ISIT) 2015.

J. Huang, Q. Qiu, R. Calderbank, M. Rodrigues and G. Sapiro. Alignment with Intra-class Structure can imporve classification. 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015.

J. Huang, X. Yuan, and R. Calderbank. Multiscale bayesian reconstruction of compressive X-Ray image. 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015.

J. Huang, X. Yuan, and R. Calderbank. Collaborative compressive X-Ray Image reconstruction. 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015.

X. Yuan and **J. Huang**. Polynomial-phase signal direction-finding and source-tracking with a single accoustic vector sensor. 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2015.

J. Huang and X. Ning. Latent Space Tracking from Heterogeneous Data with an Application for Anomaly Detection. Pacific-Asia Conference on Knowledge Discovery and Data Mining 2015.

Journal Publications

J. Huang, Q. Qiu and R. Calderbank. The Role of Principal Angles in Subspace Classification. IEEE Transaction on Signal Processing, vol. 64, no. 8, 2016, 1933-1945.

J. Huang, Q. Qiu, R. Calderbank and G. Sapiro. *GraphConnect*: A Regularization Framework for Neural Networks. arXiv preprint arXiv:1512.06757, 2015.

L. Wang*, **J. Huang***, X. Yuan*, K. Krishnamurthy, J. Greenberg, V. Cevher, M. Rodrigues, D. Brady, R. Calderbank, and L. Carin. Signal Recovery and System Calibration from Multiple Compressive Poisson Measurements, SIAM Journal on Imaging Sciences (SIIMS), vol. 8, no. 3, 1923-1954, 2015. (∗: equal contribution)

Y. Xie, **J. Huang**, and R. Willett. Changepoint detection for high-dimensional time series with missing data, IEEE Journal of Selected Topics on Signal Processing (J-STSP), vol. 7, no. 1, pp. 12-27. 2013.

Y. Zhou, Z. Ye, and **J. Huang**. Improved decision-based detail-preserving variational method for removal of random-valued impulse noise, IET Image Processing, Vol. 6, no. 7, pp. 976-985, 2012.

Workshops

J. Huang, R. Child, V. Rao, H. Liu, S. Satheesh and A. Coates, Active Learning for Speech Recognition: the Power of Gradients. Workshop of Neural Information Processing Systems on Continual Learning and Deep Networks (NIPS-CLDL), 2016.

J. Huang and R. Calderbank, Modulator design for binary classification of poisson measurements. UCL-Duke Workshop on Sensing and Analysis of High-Dimensional Data (SAHD) 2014.

Y. Xie, **J. Huang**, and R. Willett. Multiscale online tracking of manifolds, 2012 IEEE Statistical Signal Processing Workshop (SSP).

Patent

E. Battenberg, R. Child, A. Coates, C Fougner, **J. Huang**, J. Heewoo, A. Kannan, M. Kliegl, A. Kumar, H. Liu, V. Rao, S. Satheesh, D. Seetapun, A. Sriam, Z. Zhu. Systems and methods for principled bias reduction in production speech models. U.S. Patent No. 10,657,955.

X. Ning, **J. Huang**, and G. Jiang, Online sparse regularized joint analysis for heterogeneous data, US20150095490 A1, 2015.

Professtional Experience

Senior Program Committee

- Association for the Advancement of Artificial Intelligence (AAAI)

Reviewer for Journals and Conferences

- IEEE Transactions on Signal Processing
- Neural Information Processing Systems (Neurips)
- International Conference on Machine Learning (ICML)
- Association for Computational Linguistics (ACL)
- Conference on Empirical Methods in Natural Language Processing (EMNLP)
- International Conference on Acoustics, Speech and Signal Processing (ICASSP)

Research Intern at NEC Labs America
May — Aug. 2013 Anomaly detection on heterogeneous time series (Advisor: Prof. Xia Ning)

Awards

Outstanding Researcher Award, Baidu Research, 2019
Duke graduate school Fellowship, 2011-2012
Distinguished Graduate, University of Science and Technology of China, 2011
National Scholarship, 2011

SKILLS Python, C\C++, Matlab, deep learning frameworks (Tensorflow, pyTorch, Paddle-Paddle), LaTeX