Yuheng Bu

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Research Interests

Machine learning, information theory and signal processing, with applications to data science, sensor networks, and wireless communications.

Education

- Ph.D. in Electrical and Computer Engineering
  University of Illinois at Urbana-Champaign, USA — Jan. 2017 - Aug. 2019
  Advisor: Venugopal V. Veeravalli
  Thesis: "Information-theoretic Bounds in Learning Algorithms"
  GPA: 4.0/4.0
- Master in Electrical and Computer Engineering
  University of Illinois at Urbana-Champaign, USA — Aug. 2014 - Dec. 2016
  Thesis: "Estimation of KL Divergence: Optimal Minimax Rate"
- B.E. (**with honors**) in Electronic Engineering
  Tsinghua University, Beijing, China — Aug. 2010 - Jul. 2014
  Major GPA: 91.27/100, ranking **7** among 240 students
  Double Major in **Economics**

Academic Appointments

- **Postdoctoral Research Associate**, Massachusetts Institute of Technology — Sep. 2019 - present
  Advisor: Gregory W. Wornell
- **Research Assistant**, University of Illinois at Urbana-Champaign — Aug. 2014 - Aug. 2019
  Advisor: Venugopal V. Veeravalli
- **UGVR (Undergraduate Visiting Research)**, Stanford University — Jun. 2013 - Sep. 2013
  Only 18 students chosen from mainland and Taiwan
  Advisor: Tsachy Weissman
  Internship: Time-series forecaster based on Online Aggregation

Research Projects

- **Universal Features for Transfer Learning** — Sep. 2019 - present
  Massachusetts Institute of Technology
  Construct private and algorithmic-fair features for learning problem
  Applications in wireless communication and privacy preservation
- **Information-theoretical Understanding of Learning Algorithms**
  University of Illinois at Urbana-Champaign — Jan. 2018 - Aug. 2019
  Bounding generalization error of learning algorithm with mutual information

Neural networks compression can improve generalization performance based our information-theoretical understanding

- **Minimax Optimal Estimation of Information Measures**
  University of Illinois at Urbana-Champaign Aug. 2015 - Jan. 2017
  Kullback-Leibler divergence estimation between large-alphabet distributions
  Minimax optimal estimator based on plug-in approach and polynomial approximation
  Superior performance in applications such as data-driven anomaly detection
- **Data-Driven Outlying Sequence Detection**
  University of Illinois at Urbana-Champaign May 2014 - Jan. 2017
  Data-driven approaches for unstructured/structured outlying sequence detection
  Computationally efficient and (exponentially) consistent algorithms

Publications

Journal Papers and Preprints

[1] **Y. Bu**, J. Lu, V. V. Veeravalli. Active and Adaptive Sequential Learning, submitted to *IEEE Transactions on Information Theory*, Dec. 2019.

[2] **Y. Bu**, S. Zou, V. V. Veeravalli. Tightening Mutual Information Based Bounds on Generalization Error, submitted to *IEEE Journal on Selected Areas in Information Theory*, Oct. 2019.

[3] C. Wilson, **Y. Bu**, V. V. Veeravalli. Adaptive Sequential Machine Learning, to appear in, *Sequential Analysis*, Oct. 2019.

[4] **Y. Bu**, S. Zou, V. V. Veeravalli. "Linear-Complexity Exponentially-Consistent Tests for Universal Outlying Sequence Detection," *IEEE Transactions on Signal Processing*, vol. 67, no. 8, pp. 2115-2128, Apr. 2019.

[5] **Y. Bu**, S. Zou, Y. Liang, V. V. Veeravalli. "Estimation of KL Divergence: Optimal Minimax Rate," *IEEE Transactions on Information Theory*, vol. 64, no. 4, pp. 2648-2674, Apr. 2018.

Conference Papers

[1] **Y. Bu**, W. Gao, S. Zou, V. V. Veeravalli. Information-theoretic Understanding of Population Risk Improvement with Model Compression, to appear in, *AAAI Conference on Artificial Intelligence (AAAI)* **(acceptance rate: 20.6%)**, New York, Feb. 2020.

[2] **Y. Bu**, K. Small. Active Learning in Recommendation Systems with Multi-level User Preferences, to appear in, *AAAI Workshop on Interactive and Conversational Recommendation Systems (WICRS)*, New York, Feb. 2020.

[3] **Y. Bu**, J. Lu, V. V. Veeravalli. Active and Adaptive Sequential learning, in *Proc. IEEE Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, Nov. 2019.

[4] **Y. Bu**, S. Zou, V. V. Veeravalli. Tightening Mutual Information Based Bounds on Generalization Error, *Proc. IEEE International Symposium on Information Theory (ISIT)*, Paris, France, Jul. 2019.

[5] **Y. Bu**, J. Lu, V. V. Veeravalli. Model Change Detection with Application to Machine Learning, in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Brighton, UK, May 2019.

[6] **Y. Bu**, S. Zou, V. V. Veeravalli, "Linear-Complexity Exponentially-Consistent Tests for Universal Outlying Sequence Detection," in *Proc. IEEE International Symposium on Information Theory (ISIT)*, Aachen, Germany, Jun. 2017.

[7] **Y. Bu**, S. Zou, Y. Liang, V. V. Veeravalli. "Estimation of KL Divergence Between Large-Alphabet Distributions," in *Proc. IEEE International Symposium on Information Theory (ISIT)*, Barcelona, Spain, Jul. 2016.

[8] **Y. Bu**, S. Zou, Y. Liang, V. V. Veeravalli. "Universal Outlying Sequence Detection for Continuous Observations," in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Shanghai, China, Mar. 2016.

Professional Experiences

- Amazon.com Inc., Core machine learning group Jun. 2017 - Dec. 2017
  (Currently known as **Amazon AI Lab**)
  Title: Applied scientist intern
  - Built a conversational agent that can actively learn users interests to make recommendations.
  - Conducted extensive research on customer purchase history with Yelp data.

Teaching Experiences

- Teaching and developing contents for **MIT IDSS MicroMaster** program Fall 2019 - present, MIT
  MITx - 6.86x Machine Learning with Python-From Linear Models to Deep Learning
  MITx - 14.310x Data Analysis for Social Scientists (Hold live recitation and recording)
- Teaching assistant:
  ECE 365: Data Science and Engineering Spring 2019, UIUC
  ECE 398: Making Sense of Big Data Fall 2018, UIUC
- Grader:
  ECE 398: Making Sense of Big Data Spring 2017, UIUC
  ECE 598: Computational Inference and Learning Fall 2016, UIUC

Honors & Awards

- **Yi-Min Wang and Pi-Yu Chung** Research Award, UIUC 2019
- Nominee for Graduation Day at **IEEE ITA Workshop** 2019
- Student Travel Grant, **IEEE ISIT** 2016, 2017
- Student Travel Grant, **IEEE ICASSP** 2016
- **Outstanding graduate**, Tsinghua University 2014
- **Deputy President**, Student Association for Science and Technology,
  EE Department, Tsinghua University 2012-2014
- **National Scholarship** Granted by Ministry of Education of China (**top 2%**), 2012 and 2013
- **Third prize**, "Challenge Cup" the Tsinghua University
  Student extra-curricular academic science and technology competitions 2012
- **Second prize**, Shing-Tung Yau secondary school mathematics competition 2009

Service & Professional Activities

- **Membership:** IEEE, IEEE Information Theory Society, IEEE Communications Society, IEEE Signal Processing Society
- **Reviewer:** IEEE Transactions on Information Theory, IEEE Transactions on Signal Processing, IEEE Transactions on Vehicular Technology
  ISIT, ICASSP, ITW, IJCAI