YIKUN BAI

CONTACT INFORMATION

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EDUCATION

University of Delaware   01/2019 - Present
Ph.D. candidate Electrical and Computer Engineering   GPA: 4.0/4.0
Thesis: Optimal transport meets information theory: from measure concentration, to information theory, to machine learning

University of Delaware   09/2016 - 12/2018
M.S. Applied Mathematics (Ph.D. Transferred)   GPA: 4.0/4.0
Qualifying exams passed:
- Functional analysis, Stochastic process, Hypothesis test

Marshall University   09/2014 - 09/2016
M.A. Mathematics   GPA: 4.0/4.0

Mudanjiang Medical University (China)   09/2007 - 06/2012
B.S. Medical Imaging   Grade: 83/100

SKILLS

Programming: Experience of OOP with Python, Matlab, Mathematics, MySQL.
Machine learning : Experience of DNN, GAN. Projecive expercience with Pytorch, Keras.

COURSE WORK

Mathematics: Optimal transport, Stochastic process, Measure concentration, Large deviation, Riemannian geometry, Functional analysis, Numerical analysis, Numerical PDE, Stochastic calculus, Topology, Vector space (Linear algebra), Graph theory, Combinatories, Abstract algebra

Statistics: Empirical process, Statistic network analysis, Time series analysis, Hypothesis test

Communication science: Signal processing, Channel coding, Information theory, Quantum information theory

Machine learning: Learning theory, Convex optimization, Regression, Dimension reduction, clustering, Decision tree, random forest, Neural networks, Reinforcement learning, Learning theory

Computer Science: Data structure, Algorithm, Objective Oriented Programming

RESEARCH EXPERIENCE

University of Delaware
Department of Electrical and Computer Engineering   01/2019 - Present
Advisor: Dr. Xiugang Wu
- Information constraint optimal transport (OT) in information theory.

- Proposed strenthening and generalization of the celebrated Talagrand's transportation inequality and provided its connection in measure concentration.
- Recover a recent result which solves a long-standing open problem "The Capacity of Relay Channel" in network information theory by the new transportation inequality.

- Understanding entropic Generative Adversarial networks (GANs)
  - Derived the close form of population solution of entropic GAN in Gaussian setting and shown the entropic regularization promotes sparsification of the solution.
  - Proved the regularization techniques remove the curse of dimensionality for empirical solution which suffered in the original framework.

Marshall University
Department of Mathematics   09/2015 – 12/2016
Advisor: Dr. Scott Sarra
- A rational radial basis function method for resolving discontinuities and steep gradients.
  - Proposed a new rational RBF method that remove the oscillations induced by the classical RBF methods and applied the new method for solving several PDEs.
  - Discussed a modified partition of unity method to implement the new RBF method in higher dimensions.

TEACHING EXPERIENCE

Teaching Assistant	**University of Delaware**
Advanced Machine Learning (ELEG 867, ELEG 602)	Spring 2019, Fall 2020
Convex Optimization (ELEG 667)	Fall 2019
Random Signals and Probability (ELEG 310)	Spring 2020, Spring 2021
Statistics (MATH 210)	Spring 2018, Fall 2018
Calculus and Analytic Geometry (MATH 241, MATH 221)	Fall 2016, Spring 2017

PUBLICATIONS

Conference
- Daria Reshetova, Yikun Bai, Xiugang Wu, and Ayfer Özgür. Understanding entropic regularization in gans. In *2021 IEEE International Symposium on Information Theory (ISIT)*. IEEE, 2021
- Yikun Bai, Xiugang Wu, and Ayfer Özgür. Information constrained optimal transport: From talagrand, to marton, to cover. In *2020 IEEE International Symposium on Information Theory (ISIT)*, pages 2210–2215. IEEE, 2020

Journal
- Daria Reshetova, Yikun Bai, Xiugang Wu, and Ayfer Özgür. Understanding entropic regularization in gans. In *Journal of Machine Learning Research*, 2021 (pre-print)
- Yikun Bai, Xiugang Wu, and Ayfer Özgür. Information constrained optimal transport: From talagrand, to marton, to cover. In *2021 IEEE Transactions on Information Theory*, pages 2210–2215. IEEE, 2021 (pre-print)
- Scott A Sarra and Yikun Bai. A rational radial basis function method for accurately resolving discontinuities and steep gradients. *Applied Numerical Mathematics*, 130:131–142, 2018

AWARDS AND HONORS

- Winner of ECE Research Day 2021 poster sessions   2021
- GEMS project fund at the University of Delaware   2017