# Yu Bai

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## EDUCATION

***Ph.D. in Statistics*, Stanford University** Stanford, CA
Specialization in Machine Learning. Sep 2014 - Sep 2019
Advisor: Prof. John C. Duchi.
Thesis: *When do gradient methods work well in non-convex learning problems?*

***B.S. in Mathematics*, Peking University** Beijing, China
GPA: 3.9 / 4, *Honored Graduate* Sep 2010 - July 2014

## EXPERIENCE

**Research Scientist**, *Salesforce Research* Palo Alto, CA
Research on the foundations of deep learning and reinforcement learning. Oct 2019 - current

**Research Intern**, *Amazon AI* Palo Alto, CA
Host: Edo Liberty & Yu-Xiang Wang June 2018 - Sep 2018
Proposed ProxQuant, a prox-gradient method with quantization-inducing regularizers for training quantized neural networks. Paper published in ICLR 2019.

**Research Intern**, *Google Research* Mountain View, CA
Host: Li Zhang June 2016 - Sep 2016
Proposed adaptive sampling strategies for softmax in deep networks for extreme classification which achieved state-of-the-art accuracy on a large-scale Youtube benchmark dataset. Algorithm implemented in Tensorflow (`tf.contrib.nn.rank_sampled_softmax_loss`).

## RESEARCH INTERESTS

Theoretical foundations of deep learning; Reinforcement learning; Uncertainty quantification.

## PUBLICATIONS

**I. Conference and Journal Publications**

(1) **Towards Understanding Hierarchical Learning: Benefits of Neural Representations.**
Minshuo Chen, Yu Bai, Jason D. Lee, Tuo Zhao, Huan Wang, Caiming Xiong, Richard Socher.
*Neural Information Processing Systems* **(NeurIPS)** *2020.*

(2) **Near-Optimal Reinforcement Learning via Self-Play.**
Yu Bai, Chi Jin, Tiancheng Yu.
*Neural Information Processing Systems* **(NeurIPS)** *2020.*
*Oral presentation at ICML 2020 Workshop on Theoretical Foundations of Reinforcement Learning.*

(3) **Provable Self-Play Algorithms for Competitive Reinforcement Learning.**
Yu Bai, Chi Jin.
*International Conference on Machine Learning* **(ICML)** *2020.*

(4) **Beyond Linearization: On Quadratic and Higher-Order Approximation of Wide Neural Networks.**

Yu Bai, Jason D. Lee.
*International Conference on Learning Representations* **(ICLR)** *2020.*

(5) **Provably Efficient Q-Learning with Low Switching Cost.**
Yu Bai, Tengyang Xie, Nan Jiang, Yu-Xiang Wang.
*Neural Information Processing Systems* **(NeurIPS)** *2019.*

(6) **ProxQuant: Quantized Neural Networks via Proximal Operators**
Yu Bai, Edo Liberty, Yu-Xiang Wang.
*International Conference on Learning Representations* **(ICLR)** *2019.*

(7) **Subgradient Descent Learns Orthogonal Dictionaries.**
Yu Bai, Qijia Jiang, Ju Sun.
*International Conference on Learning Representations* **(ICLR)** *2019.*

(8) **Approximability of Discriminators Implies Diversity in GANs.**
Yu Bai, Tengyu Ma, Andrej Risteski.
*International Conference on Learning Representations* **(ICLR)** *2019.*

(9) **The Landscape of Empirical Risk for Non-convex Losses.**
Song Mei, Yu Bai, Andrea Montanari.
**The Annals of Statistics** *46 (6A), 2747-2774, 2018.*

**II. Preprints**

(1) **How Important is the Train-Validation Split in Meta-Learning?**
Yu Bai, Minshuo Chen, Pan Zhou, Tuo Zhao, Jason D. Lee, Sham Kakade, Huan Wang, Caiming Xiong.
arXiv preprint 2010.05843. *Submitted to ICLR 2021.*

(2) **A Sharp Analysis of Model-based Reinforcement Learning with Self-Play.**
Qinghua Liu, Tiancheng Yu, Yu Bai, Chi Jin.
arXiv preprint 2010.01604. *Submitted to ICLR 2021.*

(3) **Improved Uncertainty Post-Calibration via Rank Preserving Transforms.**
Yu Bai, Tengyu Ma, Huan Wang, Caiming Xiong.
*Submitted to ICLR 2021.*

(4) **Near Optimal Provable Uniform Convergence in Off-Policy Evaluation for Reinforcement Learning.**
Ming Yin, Yu Bai, Yu-Xiang Wang.
arXiv prepreint 2007.03760. *Submitted to AISTATS 2021.*

(5) **Taylorized Training: Towards Better Approximation of Neural Network Learning.**
Yu Bai, Ben Krause, Huan Wang, Caiming Xiong, Richard Socher.
arXiv preprint 2002.04010.

## TALKS & PRESENTATIONS

**How Important is the Train-Validation Split in Meta-Learning?**
One World Seminar on the Mathematics of Machine Learning, October 2020.

**Provable Self-Play Algorithms for Competitive Reinforcement Learning.**
ICML, July 2020.
Facebook AI Research, March 2020.

**Beyond Linearization: On Quadratic and Higher-Order Approximation of Wide Neural Networks.**
Simons Institute on the Theory of Computing, August 2020.
ICLR, April 2020.

**Provably Efficient Q-Learning with Low Switching Cost.**
NeurIPS, December 2019.

**Subgradient Descent Learns Orthogonal Dictionaries**
ICLR, May 2019.

**ProxQuant: Quantizing Neural Networks via Proximal Operators**
ICLR, May 2019.
Bytedance AI Lab, December 2018.
Amazon AI, September 2018.

**On the Generalization and Approximation in GANs**
ICLR, May 2019.
Google Brain, November 2018.
Salesforce Research, November 2018.
Stanford ML Seminar, October 2018.

**Optimization Landscape of Some Non-convex Learning Problems**
Stanford Theory Seminar, April 2018.
Stanford ML Seminar, April 2017.

## REVIEWING EXPERIENCE

Conference reviewing: NeurIPS (top 30% reviewer in 2018), ICML, ICLR, COLT, AISTATS, IEEE-ISIT.
Journal reviewing: The Annals of Statistics, Journal of the American Statistical Association (JASA), Journal of Machine Learning Research (JMLR), IEEE Transactions on Signal Processing (IEEE-TSP), SIAM Journal on Control and Optimization (SICON).

## SELECTED COURSEWORK

Reinforcement Learning (CS234).
Convolutional Neural Networks for Visual Recognition (CS231N).
Theories of Deep Learning (Stats385).
Numerical Linear Algebra (CME302).
Inference, Estimation, and Information Processing (EE378B).
Machine Learning Theory (CS229T).
Convex Optimization (EE364A).
Information Theory and Statistics (Stats311/EE377).
Theory of Statistics (Stats300A/B/C).
Theory of Probability (Stats310A/B/C).

## TEACHING EXPERIENCE

**As Instructor:**
Guest Lecturer, Nonparametric Statitics (Stats205), Fall 2019.
Guest Lecturer, Theory of Statistics (Stats300B), Spring 2018.
Session Instructor, Theory of Probability (Stats310A), Fall 2017.

**As Teaching Assistant (selected):**
Statistical Learning Theory (CS229T), as head TA.
Modern Markov Chains (Stats 318).
Theory of Probability (Stats310A/B/C).
Theory of Statistics (Stats300A/B).

Statistical Inference (Stats200).
Introduction to Stochastic Processes (Stats217).