XINCHEN, DU

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EDUCATION BACKGROUND

UNIVERSITY OF CHICAGO — **CHICAGO, IL, USA**
Master of Science in Statistics — 09/2023 - 06/2025 (Expected)
- **GPA:** 3.97/4.0

YALE UNIVERSITY — **NEW HAVEN, CT, USA**
Visiting International Student in the department of statistics and data science — 01/2022 - 01/2023
- **GPA:** 4.0/4.0

SHANGHAITECH UNIVERSITY — **SHANGHAI, CHINA**
Bachelor of Science in Mathematics and Applied Mathematics — 09/2019 - 06/2023
- **GPA:** 3.77/4.0 (Overall); 3.95/4.0 (Mathematics)

Thesis: Feedback Alignment Algorithm in Two-Layer Neural Network

RESEARCH EXPERIENCES

ONLINE INFERENCE FOR PROJECTED SGD UNDER MARKOVIAN SAMPLING — **BERKELEY, CA, USA**
Research Assistant, ICSI, UC Berkeley, and University of Chicago, Advisors: Prof. Sen Na; Prof. Wei Biao Wu — 06/2024 – present
- This project aims to study statistical behaviors of Projected Stochastic Gradient Descent (Projected SGD), an algorithm that solves constrained stochastic optimization problems. The data stream in the algorithm is generated by a Markov chain.
- Introduced the smooth active manifold near the solution of the optimization problem. Introduced the shadow sequence by projecting algorithm iterates to the active manifold to address the nonlinearity of projection operator. Provided theoretical upper bound of the distance between Projected SGD iterates and shadow sequence and showed that the error is negligible. Therefore, the shadow sequence is locally an inexact Riemannian stochastic gradient sequence.
- Decomposed the gradient noise using Poisson Equation to address additional error terms arising from Markovian sampling scheme. Designed the auxiliary sequence to show that the influence of the additional error is negligible.
- Established asymptotic normality of averaged Projected SGD iterates by using properties of the shadow sequence and the auxiliary sequence. This appears to be the first asymptotic normality guarantee for Projected SGD under Markovian sampling scheme.
- Designed fully online asymptotic pivotal statistics and showed that its limiting distribution is free of any unknown parameters. Constructed asymptotic valid confidence intervals based on the statistic and the quantiles of its limiting distribution.
- This work is ongoing for performing numerical experiments under both synthetic data and real-world data.

ONLINE INFERENCE FOR AVERAGED SEQUENTIAL QUADRATIC PROGRAMMING — **CHICAGO, IL, USA**
Research Assistant, University of Chicago, Advisors: Prof. Sen Na; Prof. Wei Biao Wu — 09/2023 – present
- This project aims to perform online statistical inference for stochastic sequential quadratic programming (SSQP), an algorithm that solves equality-constrained stochastic optimization problems. The data stream in the algorithm is i.i.d. sampled from a distribution.
- Established the asymptotic normality result for averaged SSQP iterates. Showed that the averaged SSQP iterate has smaller asymptotic covariance than the last SSQP iterate, which indicated that averaging iterates reduces the uncertainty.
- Designed fully online asymptotic pivotal statistics and constructed asymptotic valid confidence intervals. The computation of our inference procedure avoids the matrix inversion, thus reduces huge computational costs.
- Performed numerical experiments on constrained linear regression and logistic regression problems to support the theory. Generated synthetic data and ran the SSQP algorithm to demonstrate the stability of averaged SSQP iterates. Ran 100 independent Monte-Carlo simulations and calculated the coverage rate. The empirical coverage rate matches the theoretical coverage probability.
- This work is ongoing for comparing different inference methods and performing experiments under real world data.

UNCERTAINTY QUANTIFICATION FOR SKETCHED SEQUENTIAL QUADRATIC PROGRAMMING — **CHICAGO, IL, USA**
Research Assistant, University of Chicago, Advisor: Prof. Sen Na — 07/2023 – 08/2023
- Conducted a comprehensive literature review on stochastic sequential quadratic programming (SSQP) algorithm. Learned the proof of the central limit theorem for the last SSQP iterate. Realized the limitation of the theorem that the asymptotic covariance of the last SSQP iterate cannot achieve minimax optimality.
- Developed a new technical lemma about positive sequences. Relaxed the step size condition for the central limit theorem using the new lemma, allowing the asymptotic covariance of the last SSQP iterate to achieve minimax optimality.

ACTIVITIES

UNIVERSITY OF CHICAGO — **CHICAGO, IL, USA**
Teaching assistant for STAT 24300 Numerical Linear Algebra — 09/2024 - Present
- Corrected and graded homework

SHANGHAITECH UNIVERSITY — **SHANGHAI, CHINA**
Teaching assistant for Mathematical Analysis I & II — 09/2020 – 06/2021
- Graded homework. Conducted tutorial sessions for students and assisted them in solving math exercises and preparing for exams

HONORS & AWARDS

- **Department Scholarship**, University of Chicago — 09/2023
- **President's Award**, Shanghaitech University *(Highest honor given to undergraduate students)* — 06/2023

SKILLS & INTERESTS

- **Languages:** Mandarin (Native); English (Fluent)
- **Programming Skills:** R, Python, C, C++, MATLAB
- **Interests:** Piano, Basketball, Swimming, Soccer