Dekun Zhou

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Education

University of Wisconsin-Madison (UW-Madison)	May 2025
Ph.D. in Industrial and Systems Engineering (ISYE)	GPA: 4.0/4.0
University of Wisconsin-Madison (UW-Madison)	Aug 2022
M.S. in Computer Sciences	GPA: 4.0/4.0
University of Science and Technology of China (USTC)	Jun 2019
B.S. in Mathematics	GPA: 90.7/100

Professional Experience

Wayfair   Boston, MA
Operations Research Scientist Intern   Jun 5 - Aug 11 2023

- Designed and implemented an Item Prioritization mixed-integer model that contains 70 million variables, resulting in a **28%** increase in 3-day deliveries within Wayfair Delivery Network over a three-month period

- Collaborated cross-functionally to determine key project requirements, ensuring precise alignment with stakeholder needs and enhancing project efficiency

Skills

Language: Python, SQL, Matlab, and C.
Framework: Python: Scipy, Scikit-learn, Numpy, Pandas, Gurobi, Keras, TensorFlow, Pytorch
                   Matlab: CVX and Statistics and Machine Learning Toolbox

Personal Summary

I am a diligent Ph.D. student in Industrial Engineering with a concentration in optimization and machine learning, immersed in enriching research experiences that reflect my strong academic record and profound interest in advancing technical disciplines. My proficiency in SQL, Python, and mastery in handling diverse, large-scale, and ambiguous datasets empower me to extract substantial business insights, driving impactful results. Adept at all phases of the modeling pipeline, I am a self-starter, keen on working independently to solve complex analytical problems and adaptively apply broad business principles for successful outcomes.

Research Experience

UW-Madison
Research Assistant, ISYE   Sep 2019 - present

- **Efficient Sparse PCA via Block-Diagonlization**   Advisor: Alberto Del Pia

    - Developing a general framework that allows the use of any known algorithm to help improve the computational speed of Sparse PCA

    - Numerically, when integrated Branch-and-Bound method, our framework leads to an average speedup factor of **93.77**, while maintaining an average approximation error of merely **2.15%**

- **Speeding up LP via Neural Networks** Advisor: Jelena Diakonikolas and Alberto Del Pia

- Developing a neural network model to help improve the solving speed of linear program (LP) and mixed-integer linear program (MILP)

- **Founder Diet Study**   Advisor: Alan D. Attie, Alberto Del Pia, and Mark Keller

  - Developed a Sparse Logistic Regression model to accurately predict diabete across different responsiveness to obesity in B6/BTBR mice.
  - Extending the model to Diversity Outbred (DO) mice, finding a subset of metabolites with distinct responsiveness to diets, sexes, and strains among thousands of traits

- **Solving Sparse PCA via basic SDP relaxation**   Advisor: Alberto Del Pia

  - Developed a randomized algorithm for Sparse PCA, achieving a $\log d$ approximation ratio in real-world datasets
  - Proved that basic SDP relaxation to Sparse PCA is robust against adversarial attack

- **SDP Relaxation for the Sparse Integer Least Square Problem**   Advisor: Alberto Del Pia

  - Designed polynomial-running time algorithms for some specific classes of quadratic integer program with sparsity constraint, and proved its solidity
  - Implemented Monte Carlo simulation and designed analysis in Matlab
  - Achieved correct results on **prohibited** models for existing sparse algorithms
  - The work was presented and given **Honorable Mention Poster Award** at Mixed Integer Programming Workshop 2022

USTC

Research Assistant, Department of Mathematical Sciences   Mar 2018 - Jun 2019

- **Improved stepsize for stochastic L-BFGS method**   Advisor: Zhouwang Yang

  - Improved a numerical optimization method for large-scale continuous problems, the stochastic L-BFGS method, based on its stepsize selection
  - Obtained convergence guarantee based on martingale analysis
  - Implemented numerical performance in Matlab, observed **sharp enhancement** both in descent rate and numerical robustness

Projects

University of Western Australia (UWA)   Jul 2018 - Aug 2018

- Splash detection on freeway   Advisor: Du Huynh and Mark Reynolds

  - Designed and developed Python programs to generate training data and test data directly from videos, enhancing the efficiency of training data acquiry
  - Built an Alexnet-like Convolutional Neural Network (CNN) on Keras for splash detection that is **robust** to illumination and location
  - Implemented the CNN for real-time predictions on videos with accuracy above **80%**

USTC   May 2018

- Person Re-Identification (ReId) in shopping malls   Final Project for Math Modeling

  - Developed a new method by combining state-of-the-art human detection technique, features engineering, principal component analysis, and hierarchical clustering to locate different people and classify all of them using data from cameras

  - Designed Matlab programs for principal component analysis and hierarchical clustering to read in big data sets generated in previous steps and output desired results. Reduced 10000s features to **10s**
  - The precision and recall are both higher than **78%** on Market 1501 dataset

Other Experience

UW-Madison
Teaching Assistant   Sep 2019 - present

- Provided feedback for students and assisted them by translating technical reasonings into easy and understandable terms in a professional manner

- Designed and delivered two 75-minute lectures for ISYE/CS/MATH/STATS 525: Linear Optimization and ISYE/CS/MATH 728: Integer Optimization

Award

Honorable Mention Poster Award at Mixed Integer Programming Workshop 2022
Student Travel Award at Mixed Integer Programming Workshop 2022

Presentation

Solving sparse PCA with basic SDP: on robustness and approximability

- (Poster) The 24th Conference on Integer Programming and Combinatorial Optimization, University of Wisconsin-Madison

- (Poster & lightning talk) UW-Madison Research Bazaar 2023, University of Wisconsin-Madison

An SDP Relaxation for the Sparse Integer Least Square Problem

- (Poster & lightning talk) Wisconsin Institute of Discovery Symposium 2022, UW-Madison

- (Poster) Mixed Integer Programming Workshop 2022, Rutgers University

- (Poster) Workshop on Optimization and Machine Learning: ACMNTW 2022, Northwestern University

Professional Service

Reviewer:

- (Journals) Mathematics of Operations Research, Mathematical Programming series A/B, Discrete Optimization

- (Conferences) The 21st & 25th Conference on Integer Programming and Combinatorial Optimization

Publication

Del Pia, Alberto, **Zhou, Dekun**, and Zhu, Yinglun. "Efficient Sparse PCA via Block-Diagonalization". Submitted to Neurips 2024
Del Pia, Alberto, and **Zhou, Dekun**. "Solving sparse PCA via basic SDP relaxation". Submitted to Neurips 2024
Del Pia, Alberto, and **Zhou, Dekun**. "An SDP Relaxation for the Sparse Integer Least Square Problem". Submitted to INFORMS Journal of Optimization.
Arxiv Version: https://arxiv.org/abs/2203.02607