Muhan Zhao

http://kimukook.github.io

Email : muz021@ucsd.edu
Mobile : (858)-247-8311

Education

- **University of California, San Diego** — San Diego, CA
  Ph.D. in Computational Science, Mechanical and Aerospace Engineering; GPA: 3.88/4 — *Sep. 2018 – Present*
- **University of California, San Diego** — San Diego, CA
  M.S. in Computational Science, Mathematics and Engineering; GPA: 3.93/4 — *Sep. 2016 – Jun. 2018*
- **Tongji University** — Shanghai, China
  B.S. in Mathematics; GPA: 83.3/100 — *Sep. 2012 – Jun. 2016*

Publications

- **CDC 2018**: **M. Zhao**, S. R. Alimo and T. R. Bewley, *An Active Subspace Method for Accelerating Convergence in Delaunay-based Optimization via Dimension Reduction*, 2018 IEEE Conference on Decision and Control (CDC), FL, USA, 2018, pp. 2765-2770. doi: 10.1109/CDC.2018.8619219
- **CDC 2019**: **M. Zhao**, S. R. Alimo, P. Beyhaghi and T. R. Bewley, *Delauany-based Derivative-free Optimization via Global Surrogates with Exact and Safe Function Evaluation.* submitted to CDC 2019 and SCR Symposium 2019.

Research Experience

- **Flow & Control Lab, Mechanical and Aerospace Engineering Dept. UCSD** — San Diego, CA
  Graduate Research Assistant, Supervisor: Prof. Thomas R. Bewley — *Jan. 2017 - Present*
  - **Δ-DOGS**: **D**elaunay-based **D**erivative-free **O**ptimization via **G**lobal **S**urrogates algorithm for nonconvex problems.
    - *Dimension reduction of derivative-free optimizaiton using active subspace method.*
      - Extended the Δ-DOGS algorithm from low ($n \lessapprox 6$) to higher ($n \lessapprox 15$) dimensional nonconvex problems.
      - Applied the active subspace method to identify the dominate directions in the high-dimensional parameter space.
      - Proposed a new inverse mapping method that projects the lower-dimensional point of interest to full model.
    - *Safe-learning of the utility function with hidden constraints.*
      - Proposed a new algorithm, S-DOGS to optimize the utility function with hidden constraints always satisfied.
      - Automatically learns the underlying safe region and enables efficient and safe-guaranteed data sampling.
      - Optimized the nonlinear control system of parameters tuning in quadrotor trajectory following dynamic problem.
  - **α-DOGS**: Derivative-free optimization method for inexact and nonconvex functions.
    - *Optimized statistics computed from Lorenz system and presented in Research Expo 2017 in UCSD.*
    - *Multifidelity uncertainty quantification*
      - Reduced the cost of computing statistics of interest from a large number of model evaluations.
      - Leveraged the information from the lower fidelity model to convey the information on the target fidelity level.
- **Probability Methods for Reasoning & Decision-Making** — San Diego, CA
  Team Leader, UCSD — *Sep. 2016 - Dec. 2016*
  - **Belief Network**: Conducted exact inference in directed graphical models through probabilistic learning.
  - **Expectation Maximization**: Optimized the conditional probability using MLE, simulated the maximum likelihood measurement on C++ to make prediction on Markovian decision processes.
  - **Hidden Markov Model**: Constructed Viterbi algorithm to decode hidden states and applied to speech recognition.
- **Web Mining & Recommender System** — San Diego, CA
  Team Leader, UCSD — *Jan. 2017 - Apr. 2017*
  - **Supervised Learning**: Applied support vector machines to train a classifier minimizing the misclassification error.
  - **Recommender System**: Built recommender system using linear regression to predict based on Amazon reviews.
  - **Rating prediction**: Using latent factor models to reduce the dimension of features and improve the MSE.
- **Numerical Analysis of Differential Equations in Engineering** — San Diego, CA
  Team Leader, UCSD — *Jan. 2017 - Mar. 2017*
  - **ADI**: Solved 2D diffusion PDE using Alternating Direction Implicit method and performed stability analysis

- **Advection equation**: Numerically solved advection equations by marching time with RK3 and 2nd-order central scheme on space.
- **Poisson equations**: Applied multigrid and Gauss Seidel iterative methods to directly solve 2D Poisson equations.

- **Undergraduate Thesis** Shanghai, China
  School of Mathematical Sciences, Tongji University *Jan. 2016 - Jun.2016*
  - **Deblurring**: Recovered images from noisy observations by using the Fast Total Variation de-convolution algorithm.
  - **Image Processing**: Splited penalty into different norms and solved subproblems with regularization terms.

Work Experience

- **UC San Diego** San Diego, CA
  Teaching Assistant *Apr. 2016 - Dec. 2018*
  - **Mathematics**: MATH 11 Calculus-based Introductory Probability and Statistics, MATH 170A Numerical Linear Algebra, MATH 170B Introduction to Numerical Analysis: Approximation and Nonlinear Equations
  - **Mechanical and Aerospace Engineering**: MAE 200 Control (Graduate level)

- **GfK Consulting Inc.** Shanghai, China
  Solution Intern, Television Sales Team. Supervisor: Alex Wei *Mar. 2016 - Jun. 2016*
  - **Data Maintenance**: Built database of each week's sales for future analysis and record different model's price.
  - **Prediction**: Using exponential regression analysis to evaluate the future sales trend, assigned weight coefficients to compute the total retail sales of televisions associated with different brands in China.
  - **User Portrait**: Identify consumers' records and characteristics to make predictions on consumers' demands

Awards

- **Tongji University** Shanghai, China
  School of Mathematical Sciences *2014 - 2015*
  - 2015 Tongji Unviersity Scholarship of Social Practice Award.
  - 2014 Tongji Unviersity Scholarship of Social Practice Award.
  - 2014 Second Prize of Undergraduate Mathematical Contest in Modeling in Shanghai District.

Leadership activeties

- **Tongji University** Shanghai, China
  Vice President of Student Union in School of Mathematics Sciences *2014 - 2015*
  - **Organization**: Held the 2014 New Year Gala in School of Mathematical Sciences and Walking on Shanghai Bund.
  - **Practical Activities**: Organized the largest amount of donation in Charity Sale of Love($152.7).
  - **Voluntary Activities**: Set up the Voluntary Environment Protection Teaching Class in Yanji Street.

Software Skills

Python(primary), Matlab(secondary), C++, Latex, Linux

Academic Courses

Numerical Optimization, Statistical Learning, Gaussian Process in Machine Learning, Probabilistic Reason & Learning, Recommender System & Web Mining, Linear control Design, Optimal Control and Estimation, Numerical Linear Algebra, Numerical methods with Differential Equations, Stochastic Methods.