HAIZHAO YANG

Department of Mathematics
National Universify of Singapore
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CURRENT POSITION

Assistant Professor   2017 - Now
Department of Mathematics
Affiliate, Institute of Data Science   2019 - Now
National University of Singapore, Singapore

PREVIOUS POSITION

Visiting Assistant Professor, Duke University, US   2015 - 2017
Mentors: Ingrid Daubechies and Jianfeng Lu

EDUCATION

Ph.D. in Mathematics, Stanford University, US   2015
Thesis: Oscillatory data analysis and fast algorithms for integral operators
Advisor: Lexing Ying
M.S. in Mathematics, University of Texas at Austin, US   2012
B.S. in Mathematics, Shanghai Jiao Tong University, China   2010

GRANTS

Awarded

1. Randomized and Structured Computation for High-Frequency Phenomenon. MOE Tier 2 grant. Role: single PI. Amount: SGD 436,980. Duration: 2018-2021.

2. Mathematical Analysis and Computational Challenges in Data Science. Role: single PI. Amount: SGD 120,000. Duration: 2017-2020.

3. AMS Simons Travel Award, USD 4,000. Duration: 2015-2017.

PUBLICATIONS

Preprints

1. Hadrien Montanelli, Haizhao Yang, Qiang Du, Deep ReLU Networks Overcome the Curse of Dimensionality for Bandlimited Functions. In preparation.

2. Katherine R. Phillips, Ting Yang, Cathy Tao Zhang, Theresa Kay, Chao Gao, Soren Brandt, Lei Liu, Haizhao Yang, Yaning Li, Joanna Aizenberg, Ling Li. Fabrication of Photonic Microbricks via Crack Engineering of Colloidal Crystals. Preprint.

3. Zuowei Shen, Haizhao Yang, Shijun Zhang. Nonlinear Approximation via Compositions. Submitted.

4. Tao Zhang, Ling Li, Haizhao Yang. 3D Atomic Crystal Analysis via Fast Synchrosqueezed Transform. arXiv:1811.05186 [math.NA]. Submitted.

5. Yang Liu, Haizhao Yang. A Hierarchical Butterfly LU Preconditioner for Two-Dimensional Electromagnetic Scattering Problems Involving Open Surfaces. arXiv:1901.11371 [math.NA]. Submitted.

6. Senwei Liang, Yuehaw Kwoo, Haizhao Yang. Drop-Activation: Implicit Parameter Reduction and Harmonic Regularization. arXiv:1811.05850 [cs.LG]. Submitted.

7. James Bremer, Qiyuan Pang, Haizhao Yang. Fast Algorithms for Multi-Dimensional Jacobi Polynomial Transformations. arXiv:1901.07275 [math.NA]. Submitted.

8. Qiyuan Pang, Kenneth L. Ho, Haizhao Yang. Interpolative Decomposition Butterfly Factorization. arXiv:1809.10573 [math.NA]. Submitted.

9. Jieren Xu, Yitong Li, David Dunson, Ingrid Daubechies, Haizhao Yang. Non-Oscillatory Pattern Learning for Non-Stationary Signals. arXiv:1805.08102 [stat.ML]. Submitted.

10. Haizhao Yang, A Unified Framework for Oscillatory Integral Transform: When to Use NUFFT or Butterfly factorization? arXiv:1803.04128 [math.NA]. Submitted.

11. James Bremer, Haizhao Yang, Fast algorithms for Jacobi expansions via nonoscillatory phase functions. arXiv:1803.03889 [math.NA]. Submitted.

12. Gao Tang, Haizhao Yang, A Fast Algorithm for Multiresolution Mode Decomposition. arXiv:1712.09338 [math.NA]. Submitted.

13. Haizhao Yang. Multiresolution Mode Decomposition for Adaptive Time Series Analysis. arXiv:1709.06880 [math.NA]. Submitted.

14. Ling Li, Haizhao Yang, Jinjin Zhong, Katherine R. Phillips, Jianfeng Lu, Joanna Aizenberg. Microscopic Origins of the Crystallographic Growth in Colloidal Self-assemblies. Submitted.

15. Yingzhou Li, Haizhao Yang, Interior Eigensolver for Sparse Hermitian Definite Matrices Based on Zolotarevs Functions. arXiv:1701.08935v1 [math.NA]. Submitted.

Journal Publications

16. Jianfeng Lu, Haizhao Yang. Phase Space Sketching for Crystal Image Analysis Based on Synchrosqueezed Transforms. SIAM Journal on Imaging Science, 11(3), 1954-1978, 2018.

17. John Harlim, Haizhao Yang. Diffusion Forecasting Model with Basis Functions from QR Decomposition. Journal of Nonlinear Science, 2017. https://doi.org/10.1007/s00332-017-9430-1.

18. Victor Wen-zhe Yu, Fabiano Corsetti, Alberto García, William P. Huhn, Mathias Jacquelin, Weile Jia, Björn Lange, Lin Lin, Jianfeng Lu, Wenhui Mi, Ali Seifitokaldani, Álvaro Vázquez-Mayagoitia, Chao Yang, Haizhao Yang, Volker Blum, ELSI: A Unified Software Interface for Kohn-Sham Electronic Structure Solvers. Compute Physics Communications, Volume 222, January 2018, Pages 267-285.

19. Jieren Xu, Haizhao Yang, and Ingrid Daubechies, Recursive Diffeomorphism-Based Regression for Shape Functions. SIAM Journal on Mathematical Analysis, 50(1), 5-32, 2018.

20. Yingzhou Li, Haizhao Yang and Lexing Ying. Multidimensional Butterfly Factorization. Applied and Computational Harmonic Analysis, Volume 44, Issue 3, May 2018, Pages 737-758.

21. Jianfeng Lu and Haizhao Yang. A Cubic Scaling Algorithm for Excited States Calculations in Particle-Particle Random Phase Approximation. Journal of Computational Physics, Volume 340, 1 July 2017, Pages 297-308.

22. Haizhao Yang. Statistical Analysis of Synchrosqueezed Transforms. Applied and Computational Harmonic Analysis, Volume 45, Issue 3, November 2018, Pages 526-550.

23. Yingzhou Li, and Haizhao Yang. Interpolative Butterfly Factorization. SIAM Journal on Scientific Computing, 39(2), A503-A531, 2017.

24. Jianfeng Lu and Haizhao Yang. Preconditioning Orbital Minimization Method for Planewave Discretization. SIAM Multiscale Modeling and Simulation, 15(1), 254-273, 2017.

25. Bruno Cornelis, Haizhao Yang, Alex Goodfriend, Noelle Ocon, Jianfeng Lu, and Ingrid Daubechies, Removal of Canvas Patterns in Digital Acquisitions of Painting. IEEE Transactions on Image Processing, 26(1):160-171, 2017.

26. Jianfeng Lu, Benedikt Wirth and Haizhao Yang. Combining 2D Synchrosqueezed Wave Packet Transform with Optimization for Crystal Image Analysis. Journal of the Mechanics and Physics of Solids, 89:194-210, 2016.

27. Haizhao Yang, Jianfeng Lu and Lexing Ying. Crystal Image Analysis Using 2D Synchrosqueezed Transforms. Multiscale Modeling and Simulation, 13(4), 1542-1572, 2015.

28. Yingzhou Li, Haizhao Yang, Eileen Martin, Kenneth L. Ho and Lexing Ying. Butterfly factorization. Multiscale Modeling and Simulation, 13(2), 714-732, 2015.

29. Yingzhou Li, Haizhao Yang and Lexing Ying. A Multiscale Butterfly Algorithm for Multidimensional Fourier Integral Operators. Multiscale Modeling and Simulation, 13(2), 614-631, 2015.

30. Haizhao Yang, Jianfeng Lu, William P. Brown, Ingrid Daubechies, and Lexing Ying, Quantitative Canvas Weave Analysis Using 2D Synchrosqueezed Transforms: Application of Time-Frequency Analysis to Art Investigation. Signal Processing Magazine, IEEE, 32(4):55-63, July 2015.

31. Haizhao Yang. Synchrosqueezed Wave Packet Transforms and Diffeomorphism Based Spectral Analysis for 1D General Mode Decompositions, Applied and Computational Harmonic Analysis, 39(1):33-66, 2015.

32. Haizhao Yang and Lexing Ying. Synchrosqueezed Curvelet Transform for Two-Dimensional Mode Decomposition, SIAM Journal on Mathematical Analysis, 46(3):2052-2083, 2014.

33. Haizhao Yang and Lexing Ying. Synchrosqueezed Wave Packet Transform for 2D Mode Decomposition, SIAM Journal on Imaging Science, 6(4):1979-2009, 2013.

34. Haizhao Yang and Lexing Ying. A Fast Algorithm for Multilinear Operators, Applied and Computational Harmonic Analysis, 33(1):148-158, 2012.

35. Zhenli Xu, Xiaolin Cheng and Haizhao Yang. Treecode-Based Generalized Born Method, J. Chem. Phys., 134(6):064-107, 2011.

Conference Proceedings

1. L Li, H Yang, K Phillips, J Zhong, J Lu, J Aizenberg. Crystallographically Preferred Growth in Self-assembled Colloidal Crystals: A Mechanistic Study. Bulletin of the American Physical Society, 2018.

2. William Huhn, Alberto Garcia, Luigi Genovese, Ville Havu, Mathias Jacquelin, Weile Jia, Murat Keceli, Raul Laasner, Yingzhou Li, Lin Lin, Jianfeng Lu, Stephan Mohr, Nkwe Monama, Happy Sithole, Alvaro Vazquez-Mayagoitia, Chao Yang, Haizhao Yang, Victor Yu, Volker Blum. Unified Access To Kohn-Sham DFT Solvers for Different Scales and HPC: The ELSI Project. Bulletin of the American Physical Society, 2018.

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TEACHING EXPERIENCE

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- National University of Singapore   Term II 2017-2019
  Instructor in **Mathematical Theory and Applications of Deep Learning (graduate level)**: Part I: machine learning basics; deep feedforward networks; convolutional networks; advanced network design; Part II: approximation theory of deep neural networks; stochastic optimization methods; regularization for deep learning; generalization error of deep neural networks; Part III: sparse and structured computation; sequence modeling: recurrent and recursive nets; deep reinforcement learning; deep generative models; distributed and decentralized learning.

- National University of Singapore   Term II 2018-2019
  Instructor in **Modeling and Numerical Simulation (graduate level)**: This module is designed for graduate students in mathematics. It focuses on modelling problems in real life and other disciplines into mathematical problems and simulating their solutions by scientific computing methods. Major

topics covered include modelling and numerical simulations in selected areas of physical and engineering sciences, biology, finance, imaging and optimisation.

- National University of Singapore   Term I 2018-2019
  Instructor in **Convex Optimization (undergraduate level)**: modeling examples and basic concepts of optimization; convex functions and properties; gradients and subgradients; gradient methods; sub-gradient methods; Newton-type algorithms and the Barzilai-Borwein method; constrained optimization; accelerated proximal gradient methods; stochastic block coordinate descent methods; convex conjugacy and duality; splitting algorithms and implementations; CVX Matlab software for convex programming.

- National University of Singapore   Term I 2017-2018
  Instructor in **Matrix Computation (undergraduate level)**: QR factorization, singular value decomposition, condition numbers, stability, perturbation analysis, least squares problems, eigen value problems.

- Duke University   Spring 2017
  Instructor in **Math 532**: **Basic analysis II (undergraduate level)**: Fourier and wavelet analysis, differential and integral calculus in R^n, low-dimensional manifolds, inverse and implicit function theorems.

- Duke University   Fall 2016
  Instructor in **Math 561**: **Scientific computing I (graduate level)**: direct and iterative solvers for dense and sparse linear systems, QR factorization, eigen decomposition, sparse matrix factorizations, basic parallel computation.

- Duke University   Autumn 2015 and Spring 2016
  Instructor in **Math 353 Ordinary differential equations and partial differential equations.**

- Stanford University   Winter 2014 and Spring 2015
  TA in **Math 53 Ordinary differential equations.**

- Stanford University   Autumn 2014
  TA in **Math 104 Applied matrix theory.**

- Stanford University   Fall 2013
  TA in **Math 118 Mathematics of computation**: Notions of analysis and algorithms central to modern scientific computing.

- Stanford University   Spring 2013
  TA in **Math 21 Calculus**: Applications of integral calculus, introduction to differential equations, infinite series.

- Stanford University   Winter 2013
  TA in **Math 20 Calculus**: Applications of differential calculus; introduction to integral calculus of functions of one variable.

- University of Texas at Austin   Fall 2012
  TA in **M408C Calculus**: Differential and integral calculus.

- University of Texas at Austin   Fall 2011
  TA in **M316 Elementary methods of statistics**: Basic statistical techniques including descriptive statistics, probability, statistical modeling, and inferential statistics.

- University of Texas at Austin   Fall 2011
  Instructor for teaching Matlab in **An introduction to scientific computing and statistics**

CONTRIBUTED PACKAGES

Familiar with high performance computing with C/C++, Fortran, Matlab and Python in distributed and parallel computing environment.

- **ButterflyLab** 2014-now

  - Optimal complexity for evaluating multidimensional Fourier integral operators, special function transforms, and Green's functions in 1D to 3D integral equations for high-frequency wave propagation.

  - Optimal complexity preconditioners for high-frequency wave equations.

  - The latest version of ButterflyLab for solving large-scale dense linear systems is organized and coded by Haizhao Yang and is available at https://github.com/ButterflyLab/ButterflyLab.

- **ButterflyPACK** 2018-now

  - A mathematical software for rapidly solving large-scale dense linear systems that exhibit off-diagonal rank-deficiency. These systems arise frequently from boundary element methods, or factorization phases in finite-differenece/finite-element methods.

  - Relies on low-rank or butterfly formats under Hierarchical matrix, HODLR or other hierarhically nested frameworks to compress, factor and solve the linear system in quasi-linear time.

  - The butterfly format, originally inspired by the butterfly data flow in fast Fourier Transform, is a linear algebra tool well-suited for compressing matrices arising from high-frequency wave equations or highly oscillatory integral operators.

  - The distributed and parallel version is available at https://github.com/liuyangzhuan/ButterflyPACK by Yang Liu. The sequential MATLAB version is referred to ButterflyLab right above by Haizhao Yang.

- **ELSI** 2015-now

  - ELSI provides and enhances scalable, open-source software library solutions for electronic structure calculations in materials science, condensed matter physics, chemistry, molecular biochemistry, and many other fields. ELSI focuses on methods that solve or circumvent the Kohn-Sham eigenvalue problem in density-functional theory. The ELSI infrastructure should also be useful for other challenging eigenvalue problems.

  - One of the key design pillars of ELSI is portability and support for various computing environments, from laptop-type computers all the way to the most efficient massively parallel supercomputers and new architectures (GPU and manycore processors).

  - Available at https://wordpress.elsi-interchange.org/.

- **ZoloEig** 2016-now

  - Interior eigenvalue solver based on fast direct solver and the best high order rational function approximation to step functions.

  - Can be implemented in spectrum slicing libraries for full diagonalization.

  - Can also be used to compute leading eigenpairs.

  - Available at http://www.math.nus.edu.sg/~matyh/codes/ZoloEig.tar.gz.

- **PSP** 2015-now

  - The PSP is an extensible distributed-memory parallel library offering a basic set of linear algebra primitives.

  - It achieves scalability and load balance via its 2D block cyclic distribution.

- Routines for sparse data types includes (sparse) matrix (sparse) vector multiplication, (sparse) matrix (sparse) matrix multiplication, etc.
- Supports several sparse format, e.g. COO, CSC, and CSR.
- Similar user habits with Scalapack.
- Available at https://github.com/HaizhaoYang/PSP.

- **DeCom**   2014-2016
  - 1D to 3D Synchrosqueezed wave packet transforms for analyzing instantaneous/local properties of non-linear oscillatory signals in a superposition.
  - 2D synchrosqueezed curvelet transforms for analyzing local properties of banded textures in a superposition.
  - Application examples in atomic materials science, wave propagation in geophysics, biological and medical signals, and canvas painting art investigation.
  - Available at https://github.com/HaizhaoYang/DeCom.

- **SynCrystal**   2015-now
  - A MATLAB toolbox for atomic crystal analysis based on synchrosqueezed transforms and variational optimization.
  - Automatic tool for classifying crystal lattices, identifying grain boundaries, isolated defects, estimating grain orientation and elastic deformation.
  - Fast analysis for 2D and 3D atomic scale crystal data.
  - Available https://github.com/SynCrystal/SynCrystal.

INVITED SEMINAR TALKS

Approximation Theory and Regularization in Deep Learning. Applied Math and Analysis Seminar, Duke University, February, 2019

$O(N \log^\alpha N)$ matvec and preconditioners for highly oscillatory kernels. Applied and Computational Mathematics Seminar, Department of Mathematics, National University of Singapore, February, 2019

$O(N \log^\alpha N)$ matvec and preconditioners for highly oscillatory kernels. Applied Math Colloquium, Department of Mathematics, Purdue University, January, 2019

$O(N \log N)$ algorithms for matrix multiplications from highly oscillatory phenomena, Applied Mathematics Seminar, School of Mathematics, Shanghai Jiao Tong University, December, 2018

$O(N \log N)$ algorithms for matrix multiplications from highly oscillatory phenomena, Applied Mathematics Colloquium, Department of Applied Physics and Applied Mathematics, Columbia University, October, 2018

A Unified Framework for Oscillatory Integral Transform: When to Use NUFFT or Butterfly factorization? Applied & Computational Math Seminar, Department of Mathematics, University of Wisconsin-Madison, February, 2018

A Unified Framework for Oscillatory Integral Transform: When to Use NUFFT or Butterfly factorization? Applied Math Colloquium, Department of Mathematics, Purdue University, February, 2018

Spectrum Slicing for Sparse Hermitian Definite Matrices Based on Zolotarevs Functions, Department of Mathematics, Hong Kong Baptist University, March, 2017

Scientific Computing in Imaging and Image Analysis at the Atomic Scale. Lawrence Berkeley National Laboratory, March, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Department of Mathematics, Johns Hopkins University, February, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Department of Mathematics, National University of Singapore, February, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Computational and Applied Mathematics Colloquium, Department of Mathematics, The Pennsylvania State University, February,

2017

Data-Sparse Structures and their Applications in the Electronic Structure Calculation, CCMA Luncheon Seminar, Department of Mathematics, The Pennsylvania State University, February, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Colloquium, Department of Mathematics, University of California, Davis, January, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Colloquium, Department of Mathematics, University of California, Irvine, January, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Department of Mathematics, Hong Kong University of Science and Technology, January, 2017

Data-Driven Mathematical Analysis and Scientific Computing for Oscillatory Data, Computational and Applied Math Seminar, Department of Mathematics, University of California, San Diego, December, 2016

A Cubic Scaling Algorithm to Calculate Excited States Based on PP-RPA, Research Colloquium, Department of Mathematics, Southern Methodist University, November, 2016

Data-Driven fast algorithms in Applied Harmonic Analysis and Numerical Linear Algebra, Applied Math and Analysis Seminar, Duke University, October, 2016

Variational Models for Crystal Image Analysis, Hong Kong University of Science and Technology, June, 2016

Preconditioning Orbital Minimization Method for Planewave Discretization, Shanghai Jiao Tong University, Shanghai, China, June, 2016.

Butterfly Algorithm and Butterfly Factorization. Shanghai Jiao Tong University, Shanghai, China, June, 2016

Butterfly Algorithm and Butterfly Factorization. Applied Mathematics Colloquium. University of North Carolina at Chapel Hill. March 4, 2016

INVITED CONFERENCE

Efficient Preconditioners for High-Frequency Wave Equations, Second Conference on Scientific and Engineering Computing for Young Chinese Scientists, Beijing, China, August, 2019

$O(N \log^{\alpha} N)$ matvec and preconditioners for highly oscillatory kernels, International Council for Industrial and Applied Mathematics (ICIAM), Spain, July, 2019

Fast Algorithms for Calculating Excited States in PP-RPA, International Council for Industrial and Applied Mathematics (ICIAM), Spain, July, 2019

Approximation Theory of Deep Learning in Scientific Computing. Workshop on Machine Learning Techniques in Scientific Computing. Wuhan University, China. June, 2019

$O(N \log N)$ algorithms for matrix multiplications from highly oscillatory phenomena, SIAM Conference on Computational Science and Engineering (CSE), Washington, US, February, 2019

Optimal Approximation Theory of Parallel Deep Learning, International Congress of Chinese Mathematicians - Consortium on Computational and Applied Mathematics (ICCM-CAM), Nanjing, China, December, 2018

Fast eigenvalue solvers for pp-RPA, ELSI Conference: Solving or Circumventing Eigenvalue Problems in Electronic Structure Theory, The Molecular Sciences Software Institute-Blacksburg, Virginia, August 15-17, 2018

The separation of signal components: geometric interpretation and random dynamics, SIAM Annual Meeting, Portland, 2018

Fast eigenvalue solvers for pp-RPA, SIAM Conference on Applied Linear Algebra, Hong Kong, 2018

Automatic information learning for atomistic structure, SIAM Conference on Mathematical Aspects of Materials Science, Portland, US, 2018

On the Convergence of Recursive Schemes for Wave Shape Functions. SIAM Annual Meeting, 2017

Recursive schemes for shape functions in the mode decomposition problem. The First International Conference on Mathematics of Data Science, Hong Kong Baptist University, March, 2017

Preconditioning Orbital Minimization Method for Planewave Discretization, 2016 Workshop on Optimization and Eigenvalue Computation, Peking University, Beijing, China.

Butterfly Factorization for a Class of Transforms in Harmonic Analysis, SIAM Annual Meeting, 2016

Variational Models for Crystal Image Analysis, SIAM Conference on Analysis of Partial Differential Equa-

tions, 2015
Butterfly Factorization, SIAM Conference on Applied Linear Algebra, 2015
Synchrosqueezed Transform and Variational Method for Crystal Image Analysis, ICIAM, 2015
Synchrosqueezed Transforms in Seismic Data/Image Analysis, 1st International Workshop on Mathematical Geophysics at Harbin Institute of Technology, China, Jan. 2015
Robustness Analysis of Synchrosqueezed Transforms, SEG 2014 Post Convention Workshop
Synchrosqueezed Wave Packet Transforms and Diffeomorphism Based Spectral Analysis for 1D General Mode Decompositions, SIAM Annual Meeting 2014
Synchrosqueezed Curvelet Transform for 2D mode decomposition, SIAM Conference on Imaging Science 2014
Synchrosqueezed Curvelet Transform for 2D mode decomposition, TCCS, March, 2014
Synchrosqueezed Wave Packet Transform for 2D mode decomposition, SIAM Annual Meeting 2013
Adaptive Data Analysis and Sparsity, IPAM workshop, UCLA, 2013
Synchrosqueezed Wave Packet Transform for 2D mode decomposition, TCCS, October, 2012
Fast computation for Multilinear Operators, TCCS, September, 2011

STUDENTS AND POSTDOCS

Postdocs

1. Simon Etter (Ph.D. University of Warwick), August 2019 to July 2021.

2. Sean Hon (Ph.D. University of Oxford), March 2019 to July 2020.

PhD students

Current:
1. Qiyuan Pang (Department of Mathematics, Tsinghua University), 2018-now.

2. Ze Chen (Department of Mathematics, National University of Singapore), 2018-now.

3. Senwei Liang (Department of Mathematics, National University of Singapore), 2018-now.

4. Shijun Zhang (Department of Mathematics, National University of Singapore), 2018-now, co-advised with Zuowei Shen.

5. Yihui Tu (Department of Mathematics, Shanghai Jiao Tong University), 2017-now, co-advised with Zhenli Xu and Weizhu Bao.

Thesis defense committee member:
1. Dr. Guodong Xu (2018)
   PhD in the Department of Mathematics, National University of Singapore.
   Thesis title: Sparsity based regularization for signal recovery and clustering.

2. Dr. Guan Yu (2018)
   PhD in the Department of Mathematics, National University of Singapore.
   Thesis title: Convergence Analysis on SVD-Based Algorithms for Tensor Low-Rank Approximations.

Master students

Current:
1. Linpo Guo (Department of Mathematics, National University of Singapore), 2019-now.

2. Yunrui Liu (Department of Mathematics, National University of Singapore), 2018-now.

3. Lin Chen (Department of Mathematics, National University of Singapore), 2018-now.

Past:
   1. Fan Yang (2018)
      M.Sc. in the Department of Mathematics, National University of Singapore.
      Thesis title: Single Channel Audio Classification and Source Separation Using Convolutional Neural Networks

   2. Yurui Chen (2018)
      M.Sc. in the Department of Mathematics, National University of Singapore.
      Thesis title: Time-Frequency Analysis in Fetal ECG Extraction

   3. Tao Zhang (2018)
      M.Sc. in the Department of Mathematics, National University of Singapore.
      Thesis title: 3D Atomic Crystal Analysis via Fast Synchrosqueezed Transform

   4. Han Wang (2018)
      M.Sc. in the Department of Mathematics, National University of Singapore.
      Thesis title: Interpolation and Approximation of Computationally Expensive Posterior Density
      Position after graduation: M.Sc. in statistics at University of Pennsylvania.

Thesis defense committee member:
   1. Renbo Zhao (2018)
      M.Sc. in the Department of Mathematics, National University of Singapore.
      Thesis title: Stochastic and Randomized Algorithms for Large-Scale Optimization in Machine Learning.

Undergraduate students

Current:
   1. Ong Yong Zheng (Department of Mathematics, National University of Singapore), 2018 - 2019

   2. Renjun Hu (Department of Mathematics, National University of Singapore), 2018 - 2019

   3. Yong Teck Xuan Ivan (Department of Mathematics, National University of Singapore), 2018 - 2019

   4. Lee Zhi Qiang Leonard (Department of Mathematics, National University of Singapore), 2018 - 2019

   5. Seow Yaxin Claudia (Department of Mathematics, National University of Singapore), 2018 - 2019

   6. Xueying Guo (Department of Mathematics, National University of Singapore), 2018 - 2019

Past:
   1. Mr. Mo Zhou (2018)
      B.S. in the Department of Mathematics, Tsinghua University.
      Thesis title: Advanced Mode Decomposition Algorithms in Siganl Processing.
      Position after graduation: Ph.D. in mathematics at Duke University, US.

   2. Shengtong Zhang (2018)
      B.S. in the Department of Mathematics, Tsinghua University.
      Thesis title: Approximation Theory of Deep Learning.
      Position after graduation: Ph.D. in industrial engineering & management sciences at Northwestern University, US.

3. Qiyuan Pang (2018)

    B.S. in the Department of Mathematics, Sun Yat-Sen University.
    Thesis title: Fast Algorithms for Non-Uniform Fourier Transformation.
    Position after graduation: Ph.D. in mathematics at Tsinghua University, China.

ACADEMIC SERVICE

Editorial Duties

Associate Editor, the Editorial Board of Mathematics of Computation and Data Science, 2016-Now

Journal and Book Refereeing

Applied and Computational Harmonic Analysis; Journal of Fourier Analysis and Applications; SIAM Journal on Mathematical Analysis; SIAM Journal on Scientific Computing; SIAM Multiscale Modeling and Simulation; Communications in Mathematical Sciences; Journal of Scientific Computing; Journal of Computational Physics; Journal of Computational Mathematics; Inverse Problems and Imaging; Philosophical Transactions of the Royal Society A; IEEE Signal Processing Magazine; IEEE Transactions on Signal Processing Letters; IEEE Transactions on Signal Processing; IEEE Transactions on Imagel Processing; IEEE Transactions on Geoscience and Remote Sensing; Geophysics; PLOS ONE; Journal of Neuroscience Methods; Terrestrial, Atmospheric and Oceanic Sciences

Minisymposium/Symposium Organized

Co-chair, Minisymposium on "Mathematical Theory and Applications of Deep Learning", The International Council for Industrial and Applied Mathematics (ICIAM), Spain, July, 2019
Co-chair, Minisymposium on "Fast and Accurate Integral Methods for Highly Oscillatory Phenomena", SIAM Conference on Computational Science and Engineering, 2019
Co-chair, Minisymposium on "Low-Dimensional Structures in Imaging Science", SIAM Conference on Imaging Science, 2018
Co-chair, Minisymposium on "Large-Scale Eigenvalue Problems and Applications", SIAM Conference on Applied Linear Algebra, 2018
Co-chair, Minisymposium on "Numerical Linear Algebra in Data Science", SIAM Annual Meeting, 2017
Co-chair, Minisymposium on "Hierarchical Structure and Randomness in Linear Algebra", SIAM Annual Meeting, 2016
Chair, Minisymposium on "Multidimensional Mode Decomposition and Applications", SIAM Conference on Imaging Science, 2016.
Co-chair, Minisymposium on "Structured Matrices and Applications", SIAM Conference on Applied Linear Algebra, 2015.

HONORS

SIAM Early Career Travel Award   2015

SIAM Student Travel Award	2013-15
Shanghai Outstanding Graduate, Shanghai Government	2010
First prize of senior thesis, Department of Mathematics, Shanghai Jiao Tong University	2010
National scholarship, Chinese Ministry of Education	2009
Scholarship of Chinese Academy of Sciences	2008