## Yong Sheng Soh


CONTACT INFORMATION

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RESEARCH INTERESTS

Mathematical Optimization, Mathematics of Data Science

EDUCATION

**California Institute of Technology**, Pasadena, CA, USA

Ph.D. in Applied and Computational Mathematics, Sep 2018

- Thesis: Fitting Convex Sets to Data: Algorithms and Applications
- Awarded the W.P. Carey & Co. Prize in Applied Mathematics and the Ben P.C. Chou Doctoral Prize in Information Science and Technology
- Advisor: Venkat Chandrasekaran

**University of Cambridge**, Cambridge, UK

B.A., Mathematics, Jun' 11

EMPLOYMENT HISTORY

**National University of Singapore**,

*Assistant Professor* **Jan '21 – Present**
*Adjunct Assistant Professor* **Jan '19 – Dec '20**

**Institute of High Performance Computing**,

*Research Scientist (25%-joint appointment)* **Jan '21 – Dec '22**
*Research Scientist* **Nov '18 – Dec '20**

**Institute for Infocomm Research**,

*Research Engineer* **Aug '11 – Aug '12**

PUBLICATIONS

*Listed in order of first appearance.*

1. Sum-of-Squares Hierarchy for the Gromov-Wasserstein Problem, HA Tran, BT Nguyen, YS Soh, pre-print, Feb '25
2. Evaluating Policy Effects through Network Dynamics and Sampling, ETY Ang, YS Soh, pre-print, Jan '25
3. Exactness Conditions for Semidefinite Relaxations of the Quadratic Assignment Problem, J Chen, YS Soh, pre-print, Sep '24
4. The Star Geometry of Critic-Based Regularizer Learning, O Leong, E O'Reilly, YS Soh, NeurIPS '24
5. The Lovasz Theta Function for Recovering Planted Clique Covers and Graph Colorings, J Hou, YS Soh, A. Varvitsiotis, SIAM Journal on Optimization (to appear), Oct '23
6. Semidefinite Relaxations of the Gromov-Wasserstein Distance, J Chen, BT Nguyen, YS Soh, NeurIPS '24 (posted Sep '23)
7. Dictionary Learning under Symmetries via Group Representations, S. Ghosh, AYR Low, YS Soh, Z Feng, BKY Tan, pre-print, Jun '23

8. Optimal Convex and Nonconvex Regularizers for a Data Source, O Leong, E O'Reilly, YS Soh, and V Chandrasekaran, Foundations of Computational Mathematics, Dec '22
9. Multiplicative Updates for Symmetric-cone Factorizations, Y. S. Soh and A. Varvitsiotis, Mathematical Programming Series A, Sep '24 (posted Aug '21)
10. A Novel Modelling Approach of Integrated Taxi and Transit Mode and Route Choice using City-scale Emerging Mobility Data, R. M. Mepparambath, Y. S. Soh, V. Jayaraman, H. E. Tan, M. A. Ramli, Transportation Research Part A: Policy and Practice, Apr '23
11. A Non-commutative Extension of Lee-Seung's Algorithm for Positive Semidefinite Factorizations, Y. S. Soh and A. Varvitsiotis, NeurIPS, 2021
12. Group Invariant Dictionary Learning, Y. S. Soh, Transactions on Signal Processing, Jun '21
13. A Note on Convex Relaxations for the Inverse Eigenvalue Problem, U. Candogan, Y. S. Soh, and V. Chandrasekaran, Optimization Letters, Jan '21
14. Derivation of Train Arrival Timings Through Correlations From Individual Passenger Farecard Data, H. E. Tan, D. W. Soh, Y. S. Soh, and M. A. Ramli, Transportation, Jan '21
15. Collaborative Inference for Efficient Remote Monitoring, C. Zhang, Y. S. Soh, L. Feng, T. Zhou, and Q. Li, pre-print, Feb '20
16. Fitting Tractable Convex Sets to Support Function Evaluations, Y. S. Soh and V. Chandrasekaran, Discrete and Computational Geometry, Jan '21
17. Learning Semidefinite Regularizers, Y. S. Soh and V. Chandrasekaran, Foundations of Computational Mathematics, Mar '18

    *Awarded the INFORMS 2018 Optimization Society Student Paper Prize*
18. High-Dimensional Change-Point Estimation: Combining Filtering with Convex Optimization, Y. S. Soh and V. Chandrasekaran, Applied and Computational Harmonic Analysis, Nov '15
19. Energy Efficient Heterogeneous Cellular Networks, Y. S. Soh, T. Q. S. Quek, M. Kountouris, and H. Shin, IEEE Journal on Selected Areas in Communications, Apr '13
20. Cognitive Hybrid Division Duplex for Two-Tier Femtocell Networks, Y. S. Soh, T. Q. S. Quek, M. Kountouris, and G. Caire, IEEE Transactions on Wireless Communications, Sep '13

## Conference Proceedings

1. An Interpretable Intensive Care Unit Mortality Risk Calculator, E. T. Y. Ang, M. Nambiar, Y. S. Soh, and V. Y. F. Tan, 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, '21
2. Axon Arbor Trade-off Between Wiring Cost, Delay, and Synchronization in Neuronal Networks, Q. Liu, C. Kurniawan, C. Xu, S. Jagtap, X. Deng, K. Lou, Y. S. Soh, Y. Nakahira, 55th Annual Conference on Information Sciences and Systems, '21
3. High-Dimensional Change-Point Estimation: Combining Filtering with Convex Optimization, Y. S. Soh, V. Chandrasekaran, ISIT, Hong Kong, Jun '15
4. Dynamic Sleep Mode Strategies in Energy Efficient Cellular Networks, Y. S. Soh, T. Q. S. Quek, and M. Kountouris, IEEE International Conference on Communications, Budapest, Jun '13
5. Flexible Duplex for Cognitive Femtocells in Two-tier Networks, Y. S. Soh, T. Q. S. Quek, M. Kountouris, and G. Caire, Globecom, Anaheim, CA, Dec '12
6. Hybrid Division Duplex for Cognitive Small Cell Networks, T. Q. S. Quek, Y. S. Soh, and M. Kountouris, WPMC, Taipei, Sep '12

## Teaching Experience

**Instructor**

| | | |
|---|---|---|
| 1. | MA 4270 Data Modelling and Computation | Sem 1, AY 24/25 |
| 2. | MA 4270 Data Modelling and Computation | Sem 2, AY 23/24 |
| 3. | MA 5232 Modeling and Numerical Simulations (1/4 section) | Sem 2, AY 23/24 |
| 4. | MA 4254 Discrete Optimisation | Sem 1, AY 23/24 |
| 5. | MA 5232 Modeling and Numerical Simulations (1/4 section) | Sem 2, AY 22/23 |
| 6. | MA 4254 Discrete Optimisation | Sem 1, AY 22/23 |
| 7. | MA 5232 Modeling and Numerical Simulations (1/4 section) | Sem 2, AY 21/22 |
| 8. | MA 4260 Stochastic Operations Research | Sem 2, AY 21/22 |
| 9. | MA 4254 Discrete Optimisation | Sem 1, AY 21/22 |
| 10. | MA 4260 Stochastic Operations Research | Sem 2, AY 20/21 |

## Supervision

**Graduate students**

| | | |
|---|---|---|
| 1. | Junyu Chen | '22 – present |
| 2. | Eugene Ang (co-supervised Andrew Lim, NUS IORA) | '21–present |

**Postdoctoral Scholars**

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|---|---|---|
| 1. | Can Berk Saner (Ph.D. NUS ECE) | Dec '24 – present |
| 2. | Binh Tuan Nguyen (Ph.D. Paris-Sud) | Jun '23 –present |

**Undergraduate and Masters Thesis**, Term, Semester

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|---|---|---|
| 1. | Qinge Chi (B.Sc., current Ph.D. student at Rice University) | '24 |
| 2. | Jiaxin Hou (M.Sc., current Ph.D. student at USC) | '24 |
| 3. | Jiaming Xu (Tianjin University 2+3) | '24 |
| 4. | Chin Seang Ng (B.Sc.) | '23 |
| 5. | Yizhuo Dong (B.Sc., current Ph.D. student at UCLA) | '23 |
| 6. | Adrien Dugast Ronan (M.Sc, exchange student) | '23 |
| 7. | Zekun Shi (M.Sc., current Ph.D. student in NUS SOC) | '23 |
| 8. | Brendan Tan (B.Sc.) | '22 |
| 9. | Maurice Mok (B.Sc.) | '22 |
| 10. | Wee Siang See (B.Sc.) | '22 |
| 11. | Junyu Chen (M.Sc.) | '21 |
| 12. | Eugene Ang (B.Sc., co-sup. with Vincent Tan, current Ph.D. student at NUS IORA) | '21 |

Seminars, Conferences, Talks

**Workshop Organizer**

1. IMS Workshop: Optimization over Matrices: From Data Science to Quantum Computing, co-organizers: James Saunderson, Marco Tomamichel, Antonios Varvitsiotis, Dec '26

**Mini-Symposia Organizer**

1. ICCOPT, Jul '25
2. SIAM Conference on Mathematics of Data Science (with O. Leong, E. O'Reilly), Aug '24
3. Advances in Multiplicative Update Algorithms (with A. Varvitsiotis), SIAM Conference in Optimization, May '23
4. Conic Programming Methods for Statistics, SIAM Conference in Optimization, May '21
5. Algebraic Methods for Convex Sets (with D. Soon), SIAM Conference on Applied Algebraic Geometry, Jun '19
6. Lift-and-Project Methods in Data Analysis (with A. Taeb), SIAM Conference in Optimization, May '17

**Seminar Series Organizer**

1. One World MINDS Seminar (online), *joint-organizer*, Fall '23 – present

**Talks/Seminars**

1. HKU Law and Technology Seminar Series, University of Hong Kong, Jan '25
2. Research Group Talk (hosted by Ashwin Pananjady), Georgia Tech, Oct '24
3. International Symposium on Mathematical Theory of Networks and Systems, Cambridge UK, Aug '24
4. (High-school Outreach) Main seminar speaker at the (annual) Mathematics Seminar hosted by Ministry of Education (Singapore) Gifted Education Branch (pre-recorded), Jul '24
5. Symposium of SIAM Student Chapter @ NUS, May '24
6. IMS Young Mathematical Scientists Forum – Applied Mathematics: Jan '24
7. IMS Workshop: The Mathematics of Data, Jan '24
8. Oden Institute Seminar, UT Austin, USA, Jun '23
9. SIAM Conference on Optimization, Seattle, USA, May/June '23
10. IMS Workshop: Optimization in the Big Data Era, Dec '22
11. Research Group Talk (hosted by Joe Kileel), UT Austin (online), '22
12. International Conference on Continuous Optimization (ICCOPT), Lehigh University, Jul '22
13. Seminar at ESD (hosted by Antonios Varvitsiotis), Singapore University of Technology and Design, Aug '21
14. IDeAS Seminar (hosted by Amit Singer), Princeton (online), Jan '21
15. 1W-MINDS Seminar (online), Jan '21
16. Research Group Talk (hosted by Demba Ba), Harvard/MIT (online), Oct '20
17. Seminar (two talks, both hosted by Karin Schnass), University of Innsbruck, Jul '19
18. SIAM Conference on Applied Algebraic Geometry, Bern, Jul '19
19. Seminar at NUS Business School (hosted by He Long), Jun '19
20. INFORMS (Student Paper Prize Talk), Phoenix, Nov '18
21. SIAM Conference on Optimization, Vancouver, May '17

22. Signal Processing with Adaptive Sparse Structured Representations (SPARS), Lund University, Lisbon, Jun '17
23. Seminar at ESD (hosted by Shaowei Lin), Singapore University of Technology and Design, Jun '16
24. LCCC Focus Period on Large-Scale and Distributed Optimization, Lund University, Jun '17
25. Allerton Conference, University of Illinois at Urbana Champaign, Sep '16
26. IEEE International Symposium on Information Theory, Hong Kong, Jun '15

## Honors and Awards

1. W.P. Carey & Co. Prize in Applied Mathematics (Caltech thesis prize), '19
2. Ben P.C. Chou Doctoral Prize in Information Science and Technology (Caltech thesis prize), '19
3. INFORMS Optimization Society, Student Paper Prize, '18
4. National Science Scholarship, A*STAR, Singapore, '12
5. International Mathematical Olympiad, Silver Medal, '05

## Grants and Fellowships

1. MOE Tier 1 Grant, Title: Convex Relaxations for Optimal Transport Problems and Quadratic Programming, Amount: SGD205,665, Duration: Jun '23-Jun '26
2. Start-up Grant, Title: Matrix Factorizations and its Applications in Data Science, Amount: SGD180,000, Duration: May '21-Apr '26

## Service to Profession

**Reviewer**

1. Annals of Statistics
2. Biometrika
3. IEEE Transactions on Information Theory
4. IEEE Transactions on Signal Processing
5. Information and Inference: A Journal of the IMA
6. Journal of Machine Learning
7. SIAM Journal on Applied Algebra and Geometry (SIAGA)
8. SIAM Journal on Mathematics of Data Science (SIMODS)
9. SIAM Journal on Optimization (SIOPT)

**Singapore International Mathematical Olympiad (SIMO) Committee**

*President* Jul '24 – Present

*Vice-President* Aug '23 – Jun '24

1. *Team Leader*, Singapore Delegation to the 65th IMO, Bath, UK, '24
2. *Team Leader*, Singapore Delegation to the 64th IMO, Chiba, Japan, '23