Fang Bai (Dr/He)

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Senior Research Fellow
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Education

- 2016 – 2020   University of Technology Sydney, Sydney, Australia
  Ph.D. in Robotics

- 2013 – 2015   Northeastern University, Shenyang, China
  M.S. in System Analysis and Integration

- 2006 – 2010   Nankai University, Tianjin, China
  B.S. in Computer Science and Technology

Research experience

- Generalized Procrustes analysis (GPA) in nonrigid scenes   (Bai IJCV 2022, RSS 2022, IJRR 2023)
  The establishment of the concept of deformable transformation and the first solution in robotics and vision to nonrigid GPA. It's a globally optimal solution in closed-form.

- Regularized optimization on the sphere manifold   (Bai T-PAMI 2022)
  The discovery of the proxy step-size, proved monotone to the actual step-size, leads to an elegant proximal gradient step, which handles sphere manifolds just as Euclidean space. An exact and super fast solution.

- Rolling shutter camera   (Bai CVPR 2022)
  The discovery of scanline-homography which explains rolling-shutter image distortions by a class of line-to-line mappings. Scanline pose recovery by proposing the fundamental homography equation.

- Pose graph optimization (PGO) in cycle space   (Bai T-RO 2021, RA-L 2018)
  The initialisation of solving PGO in graph cycle space by designing a tailored minimum cycle basis (MCB) algorithm. The cycle based PGO is very robust, and particularly effective for sparse graphs.

- Change of optimal values   (Bai ICRA 2020, IROS 2018, RA-L 2018)
  The establishment of closed-form equations, so as to predict the change of optimal values between two incrementally constructed optimisation problems without solving the second one. Good for combinatorics.

Selected publication

- **Fang Bai**, Kanzhi Wu, and Adrien Bartoli. "KernelGPA: A globally optimal solution to deformable SLAM in closed-form". *International Journal of Robotics Research* (**IJRR**), 2023.

- **Fang Bai**, Adrien Bartoli. "The Proxy Step-size Technique for Regularized Optimization on the Sphere Manifold". *IEEE Transactions on Pattern Analysis and Machine Intelligence* (**T-PAMI**), 45(5):6428-6444, 2022.

- **Fang Bai**, Adrien Bartoli. "Procrustes Analysis with Deformations: A Closed-Form Solution by Eigenvalue Decomposition". *International Journal of Computer Vision* (**IJCV**), 130(2):567-593, 2022.

- **Fang Bai**, Teresa Vidal-Calleja, Giorgio Grisetti. "Sparse Pose Graph Optimization in Cycle Space". *IEEE Transactions on Robotics* (**T-RO**), 37(5):1381-1400, 2021.

Occupation

- Research fellow   07/11/2023 —
  Delta-NTU laboratory, Nanyang Technology University, Singapore.
  I am working on a multi sensor fusion project.

- **Visiting researcher**   31/10/2022 — 31/10/2023
  Tongji University, Shanghai, China
  I finalized the initial draft of my IJRR paper on KernelGPA (invited from RSS 2022) in Tongji, thanks to the hosting of Prof. Yi Dong. In Tongji, I advised Shaoran Yang (PhD) and Xin Hong (Master).
- **Visiting researcher**   24/03/2022 — 23/08/2022
  Université Clermont Auvergne, Clermont-Ferrand, France
  From April 2022, I finalized my TPAMI paper in UCA-EnCov France when applying for a visa to Australia. I flied back to China on September 28, 2022.
- **Postdoctoral researcher**   24/09/2020 — 23/03/2022
  Université Clermont Auvergne, Clermont-Ferrand, France
  I worked with Prof. Adrien Bartoli. I submitted my PhD thesis on Jan 27, 2020 and received my PhD degree on Nov 5, 2022. During the COVID lockdown, I revised my TRO paper in China.
- **Visiting researcher**   01/03/2019 — 30/06/2019
  Sapienza University of Rome, Rome, Italy
  I worked with Prof. Giorgio Grisetti.
- **Visiting researcher**   25/05/2017 — 12/06/2017
  Zhejiang University, Hangzhou, China
  I worked with Prof. Rong Xiong.
- **Junior Ph.D. candidate**   12/03/2017 — 17/03/2017
  Australia National University, Kioloa, Australia
  I attended the Robotic Vision Summer School (RVSS) as a Junior Ph.D. candidate.

Review service

T-RO, IJCV, RA-L, ICRA, IROS

Reference

Adrien Bartoli   University Clermont Auvergne, Clermont-Ferrand, France
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Shoudong Huang (黄守东)   University of Technology Sydney, Sydney, Australia
Email: shoudong.huang@uts.edu.au

Publication list (first-author)

I am also the corresponding author of these papers.

Journal papers

- **Fang Bai**, Kanzhi Wu, and Adrien Bartoli. "KernelGPA: A globally optimal solution to deformable SLAM in closed-form". *International Journal of Robotics Research* (**IJRR**), 2023. **Regular paper. IF: 9.2**
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- **Fang Bai**, and Adrien Bartoli. "The Proxy Step-size Technique for Regularized Optimization on the Sphere Manifold". *IEEE Transactions on Pattern Analysis and Machine Intelligence* (**T-PAMI**), vol. 45, no. 5, pp. 6428-6444, 2022. **Regular paper. IF: 23.6**
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- **Fang Bai**, and Adrien Bartoli. "Procrustes analysis with deformations: A closed-form solution by eigenvalue decomposition". *International Journal of Computer Vision* (**IJCV**), vol. 130, no. 2, pp. 567-593, 2022. **Regular paper. IF: 19.5**
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- **Fang Bai**, Teresa Vidal-Calleja, and Giorgio Grisetti. "Sparse pose graph optimization in cycle space". *IEEE Transactions on Robotics* (**T-RO**), vol. 37, no. 5, pp. 1381-1400, 2021. **Regular paper. IF:7.8**
  [pdf] [code]

- **Fang Bai**, Teresa Vidal-Calleja, and Shoudong Huang. "Robust incremental SLAM under constrained optimization formulation". *IEEE Robotics and Automation Letters* (**RA-L**), vol. 3, no. 2, pp. 1207-1214, 2018. **IF: 5.2**
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Conference papers

- **Fang Bai**, and Adrien Bartoli. "KernelGPA: A Deformable SLAM Back-end". *Robotics: Science and Systems* (**RSS**), XVIII.002, New York, 2022.
  [pdf] [code]

- **Fang Bai***, Agniva Sengupta*, and Adrien Bartoli*. "Scanline homographies for rolling-shutter plane absolute pose". *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (**CVPR**), pp. 8993-9002, New Orleans, 2022.
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- **Fang Bai**. "Change of optimal values: A pre-calculated metric". *IEEE International Conference on Robotics and Automation* (**ICRA**), pp. 8295-8301, Paris, 2020.
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- **Fang Bai**, Teresa Vidal-Calleja, Shoudong Huang, and Rong Xiong. "Predicting objective function change in pose-graph optimization". *IEEE/RSJ International Conference on Intelligent Robots and Systems* (**IROS**), pp. 145-152, Madrid, 2018.
  [pdf] [code]

- **Fang Bai**, Shoudong Huang, Teresa Vidal-Calleja, and Qingling Zhang. "Incremental SQP method for constrained optimization formulation in SLAM". *14th International Conference on Control, Automation, Robotics and Vision* (**ICARCV**), pp. 1-6, Phuket, 2016.
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PhD thesis

- **Fang Bai**. "Two novel techniques for graph optimization -- cycle based formulation and change of optimal values". University of Technology Sydney, Sydney, Australia. ***Ph.D. Dissertation***, 27 Jan, 2020.
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