

Juncai He: Curriculum Vitae

Applied Mathematics and Computational Sciences
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Research Interest

- Deep Learning, Stochastic Optimization.
- Numerical Analysis, Finite Element Methods, Multigrid Methods.

Academic Experience

- **Research Scientist** July 2022 - present
Applied Mathematics and Computational Sciences, KAUST, Saudi Arabia
- **R.H. Bing Instructor Fellow** August 2020 - July 2022
Department of Mathematics, The University of Texas at Austin, Austin, TX
- **Postdoctoral Scholar** August 2019 - July 2020
Department of Mathematics, The Pennsylvania State University, University Park, PA

Education

- **Ph.D.**, Computational Mathematics, Peking University, 2014-2019
Advisors: Prof. Jinchao Xu and Prof. Jun Hu
Thesis: Finite Element Methods and Deep Neural Networks
- **Visiting Ph.D. Research Scholar**, Center for Computational Mathematics and Application, Department of Mathematics, The Pennsylvania State University, Feb. 2016 - Jul. 2016, Oct. 2017 - Mar. 2018 and Mar. 2019 - May 2019
- **B.S.**, Mathematics and Applied Mathematics, Sichuan University, 2010-2014

Honor and awards

- 2016-2019, The Elite Program of Computational and Applied Mathematics for PHD Candidates of Peking University
- 2017-2019, Ph.D. President Scholarship, Peking University
- 2015, Graduate academic scholarship, Peking University
- 2014, First Prize, Outstanding undergraduate thesis, Sichuan University
- 2011-2014, Excellent undergraduate student scholarship, Sichuan University

The Workshops/ Minisymposium Organized

- KAUST Research Conference on Scientific Computing and Machine Learning (Organizing Committee), November 14-18, 2022, KAUST, KSA.
- Minisymposium on “Multigrid and Multilayer Methods” (Co-organizer with Prof. Jinchao Xu and Dr. Xinliang Liu) in International Multigrid Conference , August 22-26, 2022, Lugano, Switzerland
- Workshop on Mathematical Machine Learning and Application (Organizing Committee), December 14-16, 2020, Penn State University, USA
- Minisymposium on “Multigrid and Machine Learning” (Co-organizer with Prof. Zuowei Shen and Prof. Jinchao Xu) in International Multigrid Conference , August 11-16, 2019, Kunming, China
- 4th PKU Workshop on Numerical Methods for PDEs (Organizing Committee), October 30-31, 2018, Peking University, China
- The First PKU Elite PHD Candidates Workshop on Computational Mathematics and 4th Beijing Graduate Students Workshop on Computational Mathematics (Chair of the Organizing Committee), September 9-12, 2018, Peking University, China

Presentations

- SIAM Conference on Computational Science and Engineering (CSE23), February 26 - March 23, Amsterdam, Netherlands, 2023.
- KAUST Research Conference on Scientific Computing and Machine Learning, November 14-18, KAUST, KSA, 2022.
- International Multigrid Conference (IMG2022), August 22-26, University of Lugano, Lugano, Switzerland, 2022.
- Applied and Computational Mathematics Seminar, UC Irvine, Irvine (Online), USA, Jan. 2022.
- The Finite Element Circus Fall 2021, Penn State University, University Park, USA, Nov. 2021.
- IMA Workshop on Mathematical Foundation and Applications of Deep Learning, Purdue University, West Lafayette (Online), USA, Aug. 2021.
- The First Young Scholar Forum, Peking University Chongqing Research Institute of Big Data, Chongqing (Online, invited talk), China, Jul. 2021.
- Workshop on Mathematical Machine Learning and Application, Penn State University, University Park (Online, invited talk), USA, Dec. 2020.
- Workshop on Computation and Applications of PDEs Based on Machine Learning, Jilin University, Changchun (Online, invited talk), China, Jul. 2020.
- Data Science Seminar, Shanghai Jiao Tong University, Shanghai (Online), China, Mar. 2020.
- “Advances in Multilevel Methods: from PDEs to Data Intensive Studies” and “Multigrid and Machine Learning”, Minisymposiums in International Multigrid Conference, Kunming, China, Aug. 2019.
- 16th Annual Meeting of the China Society for Industrial and Applied Mathematics, Chengdu, China, Sept. 2018.

- The First PKU Elite PHD Candidates Workshop on Computational Mathematics and 4th Beijing Graduate Students Workshop on Computational Mathematics, Peking University, Beijing, China, Sept. 2018.
- Workshop on Numerical Methods for PDEs, Peking University, Beijing, China, Jul. 2017.

Skills

- **Languages:** Chinese, English
- **Programming:** Latex, C, Matlab, MPI, Python, Pytorch

Teaching Experience

- Instructor, M 408N Differential Calculus, UT Austin, Jan. 18 - May. 6 2022.
- Instructor, M 408K Differential Calculus, UT Austin, Aug. 25 - Dec. 10 2021.
- Instructor, M 408N Differential Calculus, UT Austin, Jan. 19 - May 7 2021.
- Instructor, M 408K Differential Calculus, UT Austin, Aug. 26 - Dec. 18 2020.
- Teaching Assistant, Deep Learning Algorithms and Analysis, Penn State University, May - Jun., 2020.
- Teaching Assistant, An Introduction to Deep Learning, Penn State Education Abroad Summer Course, Jul. 6-27, 2019.
- Teaching Assistant, An Introduction for Applied Mathematics, Peking University, Feb. - Jun. 2017.
- Senior Teaching Assistant, Advanced Linear Algebra I, Peking University, Sept. 2016 - Jan. 2017.
- Senior Teaching Assistant, Calculus, Peking University, Sept. 2015 - Jan. 2016.

Publications

1. **J. He**, X. Liu and J. Xu. MgNO: Efficient Parameterization of Linear Operators via Multigrid. ResearchGate, ArXiv (on hold by ArXiv system), Submitted to ICLR2024, 2023.
2. H. Huang, et al. AceGPT, Localizing Large Language Models in Arabic. ArXiv:2309.12053 , 2023.
3. **J. He**. On the Optimal Expressive Power of ReLU DNNs and Its Application in Approximation with Kolmogorov Superposition Theorem. ArXiv:2308.05509, 2023.
4. L. Liu, **J. He** and R. Tsai. Linear Regression on Manifold Structured Data: The Impact of Extrinsic Geometry on Solutions. Accepted to ICML2023 TAGML23 workshop, to be published in PMLR. ArXiv:2307.02478, 2023.
5. J. Zhu, **J. He** and Q. Huang. An Enhanced V-cycle MgNet Model for Operator Learning in Numerical Partial Differential Equations. Accepted by *Computational Geosciences* 2023. ArXiv:2302.00938, 2023.
6. J. Zhu, **J. He**, L. Zhang and J. Xu. FV-MgNet: Fully Connected V-cycle MgNet for Interpretable Time Series Forecasting. *Journal of Computational Science*. 69: 102005, 2023. <https://doi.org/10.1016/j.jocs.2023.102005> [ArXiv:2302.00962].

7. **J. He**, J. Xu, L. Zhang and J. Zhu. An Interpretive Constrained Linear Model for ResNet and MgNet. *Neural Networks*. 162: 384-392, 2023. <https://doi.org/10.1016/j.neunet.2023.03.011> [ArXiv:2112.07441]
8. **J. He**, R. Tsai and R. Ward. Side Effects of Learning from Low-dimensional Data Embedded in a Euclidean Space. *Research in the Mathematical Sciences*. 10(13), 2023. <https://doi.org/10.1007/s40687-023-00378-y>. [ArXiv:2203.00614]
9. **J. He**, L. Li and J. Xu. ReLU Deep Neural Networks from the Perspective of Hierarchical Basis. *Computers & Mathematics with Applications*. 120: 105-114, 2022. <https://doi.org/10.1016/j.camwa.2022.06.006> [ArXiv:2105.04156].
10. **J. He**, L. Li and J. Xu. Approximation Properties of Deep ReLU CNNs. *Research in the Mathematical Sciences*. 9(38), 2022. <https://doi.org/10.1007/s40687-022-00336-0>. [ArXiv:2109.00190].
11. Q. Chen, W. Hao and **J. He**. Power Series Expansion Neural Network. *Journal of Computational Science*. 59, 2022. <https://doi.org/10.1016/j.jocs.2021.101552>. [ArXiv:2102.13221].
12. Q. Chen, W. Hao and **J. He**. A Weight Initialization Based on the Linear Product Structure for Neural Networks. *Applied Mathematics and Computation*. 415, 2022. <https://doi.org/10.1016/j.amc.2021.126722> [ArXiv: 2109.00125].
13. **J. He**, X. Jia, J. Xu, L. Zhang and L. Zhao. Make ℓ_1 Regularization Effective in Training Sparse CNN. *Computational Optimization and Applications*. 77: 163–182, 2020. <https://doi.org/10.1007/s10589-020-00202-1>
14. **J. He**, L. Li, J. Xu, and C. Zheng. ReLU Deep Neural Networks and Linear Finite Elements. *Journal of Computational Mathematics*. 38(3): 502–527, 2020. doi:10.4208/jcm.1810-m2018-0096.
15. **J. He**, K. Hu and J. Xu. Generalized Gaffney Inequality and Discrete Compactness for Discrete Differential Forms. *Numerische Mathematik*. 143, 781–795, 2019 . <https://doi.org/10.1007/s00211-019-01076-0>.
16. **J. He** and J. Xu. MgNet: A Unified Framework of Multigrid and Convolutional Neural Network. *Science China Mathematics*. 62(7): 1331–1354, 2019. <https://doi.org/10.1007/s11425-019-9547-2>.

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