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Appointments

Assistant Professor (Tenure-Track), Jul 2024 ∼ Present
The Hong Kong Polytechnic University (PolyU), Hong Kong SAR, China

Phillip Griffiths Assistant Research Professor, Aug 2022 ∼ Jun 2024
Duke University, United States
Mentors: **Jianfeng Lu** and **Hongkai Zhao**

Research Fellow, National University of Singapore, Singapore Jan 2021 ∼ Jul 2022
Mentor: **Zuowei Shen**

Education

Ph.D. in Mathematics, National University of Singapore, Singapore Aug 2016 ∼ Jan 2021
Thesis: *Deep neural network approximation via function compositions* [PDF, URL]
Supervisors: **Zuowei Shen** and **Haizhao Yang**

B.S. in Mathematics, Wuhan University, China Sep 2012 ∼ Jun 2016
Thesis supervisor: **Xiliang Lv**

Teaching

Optimization Methods (AMA 4850), PolyU Sem 2, 2024/2025
Instructor, **Syllabus**

Mathematical Numerical Analysis (Math 361S), Duke University Spring 2024
Instructor, **Syllabus**

Matrices and Vectors (Math 218D-2), Duke University Fall 2023
Teaching assistant

Awards

Departmental Best Paper Award, AMA, PolyU, 2024-2025, URL.

Scholar Award, NeurIPS 2022 Financial Assistance Program, URL.

The EASIAM (East Asia section of SIAM) Student Paper Prize, 2020 ∼ 2021, first prize, URL.

Publications

[number] Author(s). *Paper title.* Journal or conference reference. [Links]

* Corresponding author † Equal contribution

Preprint(s)

[16] **Shijun Zhang***, Hongkai Zhao, Yimin Zhong, Haomin Zhou. *Fourier Multi-Component and Multi-Layer Neural Networks: Unlocking High-Frequency Potential.* Submitted. [arXiv]

[15] Fenglei Fan, Juntong Fan, Dayang Wang, Jingbo Zhang, Zelin Dong, **Shijun Zhang**, Ge Wang, Tieyong Zeng. *Hyper-Compression: Model Compression via Hyperfunction.* Submitted. [arXiv]

[14] **Shijun Zhang***, Hongkai Zhao, Yimin Zhong, Haomin Zhou. *Structured and Balanced Multi-component and Multi-layer Neural Networks.* Submitted. [arXiv]

Published (Accepted)

[13] **Shijun Zhang***, Hongkai Zhao, Yimin Zhong, Haomin Zhou. *Why shallow networks struggle with approximating and learning high frequency.* Accepted by **Information and Inference: A journal of the IMA**. [arXiv]

[12] Qianchao Wang†, **Shijun Zhang**†, Dong Zeng, Zhaoheng Xie, Hengtao Guo, Feng-Lei Fan, Tieyong Zeng. *Don't Fear Peculiar Activation Functions: EUAF and Beyond.* **Neural Networks**, 186, June 2025. [arXiv, Journal]

[11] **Shijun Zhang***, Jianfeng Lu, Hongkai Zhao. *Deep network approximation: Beyond ReLU to diverse activation functions.* **Journal of Machine Learning Research**, 25(35):1–39, 2024. [arXiv, Journal]

[10] **Shijun Zhang***, Jianfeng Lu, Hongkai Zhao. *On enhancing expressive power via compositions of single fixed-size ReLU network.* Proceedings of the 40th International Conference on Machine Learning (**ICML 2023**), PMLR 202:41452–41487, 2023. [arXiv, Poster, Conference]

[9] Zuowei Shen, Haizhao Yang, **Shijun Zhang***. *Neural network architecture beyond width and depth.* Advances in Neural Information Processing Systems (**NeurIPS 2022**), 35:5669–5681, 2022. [arXiv, Poster, Conference]

[8] Zuowei Shen, Haizhao Yang, **Shijun Zhang***. *Deep network approximation in terms of intrinsic parameters.* Proceedings of the 39th International Conference on Machine Learning (**ICML 2022**), PMLR 162:19909–19934, 2022. [arXiv, Spotlight, Conference]

[7] Zuowei Shen, Haizhao Yang, **Shijun Zhang***. *Deep network approximation: achieving arbitrary accuracy with fixed number of neurons.* **Journal of Machine Learning Research**, Volume 23, Issue 276, September 2022, Pages 1–60. [arXiv, Journal]

[6] Zuowei Shen, Haizhao Yang, **Shijun Zhang***. *Optimal approximation rate of ReLU networks in terms of width and depth.* **Journal de Mathématiques Pures et Appliquées**, Volume 157, January 2022, Pages 101–135. [arXiv, Journal]

[5] Zuowei Shen, Haizhao Yang, **Shijun Zhang**. *Neural network approximation: Three hidden layers are enough.* **Neural Networks**, Volume 141, September 2021, Pages 160–173. [arXiv, Journal]

[4] Zuowei Shen, Haizhao Yang, **Shijun Zhang**. *Deep network with approximation error being reciprocal of width to power of square root of depth.* **Neural Computation**, Volume 33, Issue 4, April 2021, Pages 1005–1036. [arXiv, Journal]

[3] Jianfeng Lu, Zuowei Shen, Haizhao Yang, **Shijun Zhang**. *Deep network approximation for smooth functions.* **SIAM Journal on Mathematical Analysis**, Volume 53, Issue 5, September 2021, Pages 5465–5506. [arXiv, Journal]

[2] Zuowei Shen, Haizhao Yang, **Shijun Zhang**. *Deep network approximation characterized by number of nuerons.* **Communications in Computational Physics**, Volume 28, Issue 5, November 2020, Pages 1768–1811. [arXiv, Journal]

[1] Zuowei Shen, Haizhao Yang, **Shijun Zhang**. *Nonlinear approximation via compositions.* **Neural Networks**, Volume 119, November 2019, Pages 74–84. [arXiv, Journal]

Shijun Zhang 张仕俊

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Approximation theory
Neural networks

	All	Since 2020
Citations	1199	1186
h-index	11	10
i10-index	11	11

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TITLE	CITED BY	YEAR
Deep network approximation for smooth functions J Lu, Z Shen, H Yang, S Zhang SIAM Journal on Mathematical Analysis 53 (5), 5465–5506	338	2020
Deep network approximation characterized by number of neurons Z Shen, H Yang, S Zhang Communications in Computational Physics 28 (5), 1768-1811	243	2020
Optimal approximation rate of ReLU networks in terms of width and depth Z Shen, H Yang, S Zhang Journal de Mathématiques Pures et Appliquées 157, 101-135	164	2022
Neural network approximation: Three hidden layers are enough Z Shen, H Yang, S Zhang Neural Networks 141, 160-173	145	2021
Nonlinear approximation via compositions Z Shen, H Yang, S Zhang Neural Networks 119, 74-84	115	2019
Deep network with approximation error being reciprocal of width to power of square root of depth Z Shen, H Yang, S Zhang Neural Computation 33 (4), 1005-1036	68	2021
Deep network approximation: Achieving arbitrary accuracy with fixed number of neurons Z Shen, H Yang, S Zhang The Journal of Machine Learning Research 23 (276), 1-60	39	2022
Deep network approximation: Beyond relu to diverse activation functions S Zhang, J Lu, H Zhao Journal of Machine Learning Research 25 (35), 1-39	23	2024
Neural network architecture beyond width and depth S Zhang, Z Shen, H Yang Advances in Neural Information Processing Systems 35, 5669-5681	19	2022
Deep network approximation for smooth functions. arXiv e-prints J Lu, Z Shen, H Yang, S Zhang arXiv preprint arXiv:2001.03040	19	2020
Deep neural network approximation via function compositions S Zhang PhD thesis, National University of Singapore	11 *	2020

TITLE	CITED BY	YEAR
Deep network approximation in terms of intrinsic parameters Z Shen, H Yang, S Zhang International Conference on Machine Learning 162, 19909-19934	6	2022
Why shallow networks struggle with approximating and learning high frequency: A numerical study S Zhang, H Zhao, Y Zhong, H Zhou arXiv preprint arXiv:2306.17301	4	2023
Don’t fear peculiar activation functions: EUAF and beyond Q Wang, S Zhang, D Zeng, Z Xie, H Guo, T Zeng, FL Fan Neural Networks, 107258	3	2025
On enhancing expressive power via compositions of single fixed-size relu network S Zhang, J Lu, H Zhao International Conference on Machine Learning, 41452-41487	2	2023
Fourier Multi-Component and Multi-Layer Neural Networks: Unlocking High-Frequency Potential S Zhang, H Zhao, Y Zhong, H Zhou arXiv preprint arXiv:2502.18959		2025
Hyper-Compression: Model Compression via Hyperfunction F Fan, J Fan, D Wang, J Zhang, Z Dong, S Zhang, G Wang, T Zeng arXiv preprint arXiv:2409.00592		2024
Structured and Balanced Multi-component and Multi-layer Neural Networks S Zhang, H Zhao, Y Zhong, H Zhou arXiv preprint arXiv:2407.00765		2024