

# Shijun ZHANG

Assistant Professor

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<b>Name in Chinese:</b>	张仕俊	<b>Homepage:</b>	<a href="https://shijunzhang.top">https://shijunzhang.top</a>
<b>Email:</b>	<a href="mailto:shijun.math@outlook.com">shijun.math@outlook.com</a>	<b>Google Scholar:</b>	<a href="#">URL</a>
	or <a href="mailto:shijun.zhang@polyu.edu.hk">shijun.zhang@polyu.edu.hk</a>	<b>ORCID:</b>	<a href="#">0000-0003-4115-7891 (URL)</a>

## Appointments

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<b>Assistant Professor</b> (Tenure-Track), The Hong Kong Polytechnic University (PolyU), Hong Kong SAR, China	Jul 2024 ~ Present
<b>Phillip Griffiths Assistant Research Professor</b> , Duke University, United States Mentors: <b>Jianfeng Lu</b> and <b>Hongkai Zhao</b>	Aug 2022 ~ Jun 2024
<b>Research Fellow</b> , National University of Singapore, Singapore Mentor: <b>Zuowei Shen</b>	Jan 2021 ~ Jul 2022

## Education

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<b>Ph.D. in Mathematics</b> , National University of Singapore, Singapore Thesis: <i>Deep neural network approximation via function compositions</i> [PDF, URL] Supervisors: <b>Zuowei Shen</b> and <b>Haizhao Yang</b>	Aug 2016 ~ Jan 2021
<b>B.S. in Mathematics</b> , Wuhan University, China Thesis supervisor: <b>Xiliang Lv</b>	Sep 2012 ~ Jun 2016

## Teaching

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<b>Operations Research Methods</b> (AMA 3820), PolyU Instructor, <a href="#">Syllabus</a>	Sem 1, 2025/2026
<b>Optimization Methods</b> (AMA 4850), PolyU Instructor, <a href="#">Syllabus</a>	Sem 2, 2024/2025
<b>Mathematical Numerical Analysis</b> (Math 361S), Duke University Instructor, <a href="#">Syllabus</a>	Spring 2024
<b>Matrices and Vectors</b> (Math 218D-2), Duke University Teaching assistant	Fall 2023

## Awards

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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

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

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\* Corresponding author    † Equal contribution

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## Preprint(s)

- [17] Hanyu Pei, Jing-Xiao Liao, Qibin Zhao, Ting Gao, **Shijun Zhang**, Xiaoge Zhang, Feng-Lei Fan. *NeuronSeek: On Stability and Expressivity of Task-driven Neurons* Submitted. [ arXiv ]
- [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 ]

## Published (Accepted)

- [14] **Shijun Zhang**\*, Hongkai Zhao, Yimin Zhong, Haomin Zhou. *Structured and Balanced Multi-Component and Multi-Layer Neural Networks*. **SIAM Journal on Scientific Computing**, 47(5):C1059-C1090, 2025. [ arXiv, Journal ]
- [13] **Shijun Zhang**\*, Hongkai Zhao, Yimin Zhong, Haomin Zhou. *Why Shallow Networks Struggle to Approximate and Learn High Frequencies*. **Information and Inference: A journal of the IMA**, Volume 14, Issue 3, September 2025, iaaf022, <https://doi.org/10.1093/imaiai/iaaf022>. [ arXiv, Journal ]
- [12] Qianchao Wang<sup>†</sup>, **Shijun Zhang**<sup>†</sup>, 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

Assistant Professor, PolyU

Approximation theory

Neural networks

	All	Since 2020
Citations	1476	1466
h-index	11	11
i10-index	12	12

0 articles

9 articles

not available

available

Based on funding mandates

TITLE	CITED BY	YEAR
<a href="#">Deep network approximation for smooth functions</a> J Lu, Z Shen, H Yang, S Zhang SIAM Journal on Mathematical Analysis 53 (5), 5465–5506	389	2020
<a href="#">Deep network approximation characterized by number of neurons</a> Z Shen, H Yang, S Zhang Communications in Computational Physics 28 (5), 1768-1811	277	2020
<a href="#">Optimal approximation rate of ReLU networks in terms of width and depth</a> Z Shen, H Yang, S Zhang Journal de Mathématiques Pures et Appliquées 157, 101-135	216	2022
<a href="#">Neural network approximation: Three hidden layers are enough</a> Z Shen, H Yang, S Zhang Neural Networks 141, 160-173	176	2021
<a href="#">Nonlinear approximation via compositions</a> Z Shen, H Yang, S Zhang Neural Networks 119, 74-84	127	2019
<a href="#">Deep network with approximation error being reciprocal of width to power of square root of depth</a> Z Shen, H Yang, S Zhang Neural Computation 33 (4), 1005-1036	76	2021
<a href="#">Deep network approximation: Achieving arbitrary accuracy with fixed number of neurons</a> Z Shen, H Yang, S Zhang The Journal of Machine Learning Research 23 (276), 1-60	64	2022
<a href="#">Deep network approximation: Beyond relu to diverse activation functions</a> S Zhang, J Lu, H Zhao Journal of Machine Learning Research 25 (35), 1-39	56	2024
<a href="#">Neural network architecture beyond width and depth</a> S Zhang, Z Shen, H Yang Advances in Neural Information Processing Systems 35, 5669-5681	26	2022
<a href="#">Deep network approximation for smooth functions. arXiv e-prints</a> J Lu, Z Shen, H Yang, S Zhang arXiv preprint arXiv:2001.03040	20	2020
<a href="#">Deep neural network approximation via function compositions</a> S Zhang PhD thesis, National University of Singapore	13 *	2020

TITLE	CITED BY	YEAR
<a href="#">Why shallow networks struggle to approximate and learn high frequencies</a> S Zhang, H Zhao, Y Zhong, H Zhou Information and Inference: A Journal of the IMA 14 (3), iaaf022	11 *	2025
<a href="#">On enhancing expressive power via compositions of single fixed-size relu network</a> S Zhang, J Lu, H Zhao International Conference on Machine Learning, 41452-41487	8	2023
<a href="#">Deep network approximation in terms of intrinsic parameters</a> Z Shen, H Yang, S Zhang International Conference on Machine Learning 162, 19909-19934	8	2022
<a href="#">Don't fear peculiar activation functions: EUAF and beyond</a> Q Wang, S Zhang, D Zeng, Z Xie, H Guo, T Zeng, FL Fan Neural Networks 186, 107258	5	2025
<a href="#">Hyper-Compression: Model Compression via Hyperfunction</a> F Fan, J Fan, D Wang, J Zhang, Z Dong, S Zhang, G Wang, T Zeng arXiv preprint arXiv:2409.00592	2	2024
<a href="#">Structured and Balanced Multicomponent and Multilayer Neural Networks</a> S Zhang, H Zhao, Y Zhong, H Zhou SIAM Journal on Scientific Computing 47 (5), C1059-C1090	1	2025
<a href="#">Fourier Multi-Component and Multi-Layer Neural Networks: Unlocking High-Frequency Potential</a> S Zhang, H Zhao, Y Zhong, H Zhou arXiv preprint arXiv:2502.18959	1	2025
<a href="#">NeuronSeek: On Stability and Expressivity of Task-driven Neurons</a> H Pei, JX Liao, Q Zhao, T Gao, S Zhang, X Zhang, FL Fan arXiv preprint arXiv:2506.15715		2025