上海交通大学自动化系
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系统控制与信息处理教育部重点实验室
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One-step full gradient can be sufficient to low-rank fine-tuning, provably and efficiently

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摘要:

In this talk, I will discuss how to improve the performance of Low-Rank Adaption (LoRA) for large language models guided by our theory. Our theoretical results show that i) LoRA will align to the certain singular subspace of one-step gradient of full fine-tuning; ii) preconditioners improve convergence in the high-rank case. Furthermore, we prove that alignment and generalization guarantees can be directly achieved by a well-designed spectral initialization strategy for both linear and nonlinear models, and the subsequent linear convergence can be also built. Our analysis leads to the LoRA-One algorithm (using One-step gradient and preconditioning), a theoretically grounded algorithm that achieves significant empirical improvement over vanilla LoRA and its variants on several benchmarks by fine-tuning Llama-2. Our theoretical analysis has independent interest for understanding matrix sensing and deep learning theory.

简介:

Dr. Fanghui Liu is currently an assistant professor at University of Warwick, UK, a member of Centre for Discrete Mathematics and its Applications (DIMAP). His research interests include foundations of machine learning as well as learning efficiency in machine learning. He was a recipient of AAAI'24 New Faculty Award, Rising Star in AI (KAUST 2023), co-founded fine-tuning workshop at NeurIPS'24, and presented three tutorials at ISIT’24, CVPR’23, and ICASSP’23, respectively. He served as an area chair of ICLR, AISTATS, AAAMS. Prior to his current position, he worked as a postdoc researcher at EPFL (2021-2023) and KU Leuven (2019-2023), respectively. He received his PhD degree from Shanghai Jiao Tong University in 2019 with Excellent Doctoral Dissertation Award and bachelor’s degree from Harbin Institute of Technology in 2014.