Jian Luo

University of Science and Technology of China, Hefei
jianluo@mail.ustc.edu.cn | https://smart-jluo.github.io/

RESEARCH INTERESTS

AI for PDEs, Natural Language Processing

EDUCATION

University of Science and Technology, China September 2022 — Now
M.E. in Electronic Engineering GPA: 3.76 / 4.30

Central China Normal University September 2017 — June 2021
B.E. in Electronic Engineering GPA: 85 / 100

PUBLICATION

- Neural Krylov Iteration for Accelerating Linear System Solving **(Accepted as Spotlight)**
  Luo, J., Wang, J., Wang, H., Dong, H., & Wang, J. In Thirty-Eighth Annual Conference on Neural Information Processing Systems, NeurIPS.
- Accelerating PDE Data Generation via Differential Operator Action in Solution Space
  Dong, H., Wang, H., Liu, H., **Luo, J.**, & Wang, J. In Forty-first International Conference on Machine Learning, ICML.

RESEARCH

Accelerating Linear System Solving via Neural Krylov Iteration Sep 2023 — May 2024
Accepted to NIPS'24, Spotlight

- Traditional numerical solvers based on the Krylov subspace iteration algorithm suffer from the low-efficiency problem.
- We addressed this challenge by training a neural operator to predict the invariant subspace of the given linear system, using QR decomposition for stability and a projection loss function as our training objective.
- Experimental results show that our algorithm achieves a 5.5x speedup compared with GMRES.

Accelerating PDE Data Generation via Operator Action Dec 2023 — May 2024
Published in ICML'24

- One significant challenge for Neural Operators is their reliance on vast amounts of high-precision training data, which require substantial computational resources to generate.
- To address this challenge, we propose a novel PDE dataset generation algorithm, which generates basic PDE solutions, combines them, and applies differential operators to efficiently produce accurate PDE data points.
- Our algorithm boosts large-scale dataset generation by 300 times, with resulting model performance nearly equivalent to that trained on the original dataset.

Neural Projector for Large Scale Eigenvalue Problems Oct 2023 — Feb 2024

- Eigenvalues problem of large scale matrix is crucial in many fields, but traditional solvers, with their cubic time complexity, are inefficient for practical large-scale problems.
- We introduce a neural operator-based module to predict eigenvalues, modeling the problem as an operator learning task.
- We developed a Krylov-based module that projects matrices, reducing sapce complexity, which enables large matrix eigenvalue prediction.
- Experiments shows that our algorithm achieves up to 28.3-fold acceleration compared to traditional algorithms.

Multi-Prompt Triple Classification for Knowledge Graph Completion Oct 2022 — May 2023

- Triple classification is key for knowledge graph prediction, yet current text-based models are costly (requiring manual templates) or uncontrollable.
- We designed an auto-complete method based on the perplexity evaluation metric, effectively addressing the high costs of manual template design and the uncontrolled generation problem.
- Our algorithm achieved state-of-the-art results across multiple datasets. Moreover, our method converges faster during training with the same pre-trained model and outperforms the baseline in few-shot scenarios.

AWARDS

USTC Second-Class Academic Scholarship September 2023
USTC Second-Class Academic Scholarship September 2022
National Scholarship October 2020
CCNU Silver Academic Scholarship September 2019
CCNU Bronze Academic Scholarship September 2018

SKILLS

- **Programming:** Python, MATLAB, C/C++
- **Tools:** PyTorch, Transformers, Numpy, SciPy, PETSc