

CONTACT

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EDUCATION

2021 - **PhD in Mathematics:** *National University of Singapore, Singapore.*

Supervisor: Assistant Professor Qianxiao Li (<https://blog.nus.edu.sg/qianxiaoli>)

2019 - 2020 **MSc in Mathematics:** *National University of Singapore, Singapore.*

2015 - 2019 **BSc in Pure and Applied Mathematics:** *Jilin University, China.*

EXPERIENCES

2020 - 2021 **Research Assistant:** *Department of Mathematics, National University of Singapore, Singapore.*

- Maintain and develop the code repository for OnsagerNet model, based on TensorFlow 2.
- Contribute to a collaborative project to compare mathematical models for weather prediction, involving code development and data analysis to evaluate model performance.

PUBLICATIONS

Journal papers (submitted)

Learning Parametric Koopman Decompositions for Prediction and Control.

<https://arxiv.org/pdf/2310.01124.pdf>

Joint work with: Milan Korda, Ioannis G. Kevrekidis, and Qianxiao Li.

Our approach constructs approximate Koopman-type decompositions for dynamic systems with static or time-varying parameters. It simultaneously creates an invariant subspace and a parametric family of projected Koopman operators using neural networks and training with trajectory data. The method is theoretically valid, and in numerical experiments, it outperforms existing methods in prediction tasks, particularly for systems with large dimensions and strong non-linear dynamics. Additionally, it allows for data-driven solutions to optimal control problems with non-linear dynamics, with potential implications for controllability.

Journal papers (published)

Personalized Algorithm Generation: A Case Study in Learning ODE Integrators.

<https://doi.org/10.1137/21M1418629>, *SIAM Journal on Scientific Computing.*

Joint work with: Felix Dietrich, Tom Bertalan, Danimir T. Doncevic, Manuel Dahmen, Ioannis G. Kevrekidis, and Qianxiao Li.

We explore a novel approach to numerical algorithm design that combines mathematical structure with data-driven adaptation. We apply machine learning to automatically create efficient solvers for ordinary differential equations (ODEs) without manual coefficient computation. Our method often outperforms traditional approaches, demonstrating the potential of learning-based algorithm design for solving differential equations and other numerical tasks.

COMPETITIONS

The APAC Datathon Spring 2023

Mathematical Modelling for Traffic Police Resource Allocation

Our study creates a math model to better position traffic police in Philadelphia for crime reduction. By studying past search results and crime data, we use linear, exponential, and time-based models to suggest where police should focus more. Our heat maps show where to adjust search efforts, making sure police work is effective and focused on high-crime areas, reducing their presence in safer neighborhoods. This makes crime prevention more efficient.

AWARDS & SCHOLARSHIPS

- 2021-2025 Research Scholarship, National University of Singapore, under the NRF fellowship
- 2023 First Place, The APAC Datathon Spring 2023

SKILLS

Programming: Matlab, Python (NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow, PyTorch) (GitHub: <https://github.com/GUOYUE-Cynthia>)

Languages: Mandarin Chinese (native), English (professional)

Last updated: Feb 2024