Yilin Li — Personal Introduction

Machine Learning & Applied Math

Yilin Li

https://asanoharuka157.github.io/index.html

Contents

About Me

Profile

- B.Sc. in Information & Computational Sciences, Nankai University, 2021–2025.
- Interests: Machine Learning, High-Performance Computing, Operation Research, AI for Healthcare, Bioinformatics and Statistics, Computer Vision, Applied Math. Part of these interest would be selected.
- Comfortable with Python (PyTorch/Pandas), Linux, CUDA / NVCC / C/C++.

Document Links

1. My CV is available at https://drive.google.com/file/d/1iMUBk7sKwfo6Opt3igb-WdVYF0hWMi7L/view?usp=sharing
2. My Writing Sample: Personalized Alzhemer's Disease Neural Network Model is available at https://drive.google.com/file/d/1CoTXN-XUVngSBvQOL4SLTU9NjLl-D_yw/view?usp=sharing
3. My Writing Sample: Undergraduate Thesis on Functional Analysis and Quantitative Finance is available at https://drive.google.com/file/d/1cNFIOOQA6o8uQ_Y9M9cJuSOavcnwVZUr/view?usp=sharing

Selected Coursework (scores)

- Data Mining 93; OS & Network 91
- GPU Programming 90; Data Structures & Algorithms 94
- Numerical Approximating 91; Signals & Systems 90
- Mathematical Modeling 92; Operation Research 87
- Dynamical Systems 85; Differential Manifolds 86; Functional Analysis 87

Skills & Tools

- Programming: Python, PyTorch, Pandas, C/C++, CUDA/NVCC, MATLAB, Linux
- ML/DL: Fine-tuning & PEFT, optimization basics (KKT), computer vision
- Sci/Num: Numerical PDEs, Galerkin/Ritz/Variational Methods with their Neural Network Variants
- HPC: NVCC

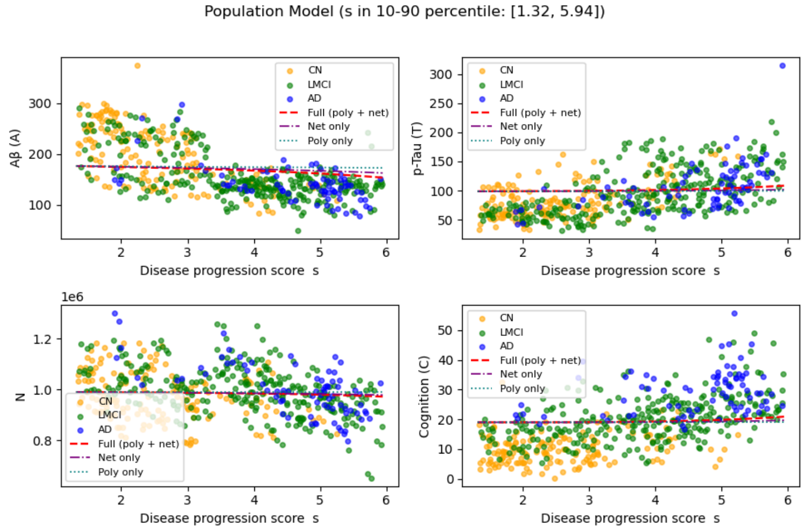
Honors & English

- Outstanding Student Union Cadre (09/2023)
- Outstanding Teenager in Beilin District (06/2019)
- First-Class High-School Scholarship (02/2021)
- MCM/COMAP S Prize (2024)
- TOEFL: R 29 / L 29 / S 22 / W 22

Research Experience

Personalized AD Neural Network Model

- Goal: model Aβ → tau → neurodegeneration (N) → cognition (C) dynamics; personalize via transfer/fine-tuning.
- Compare polynomial model vs FNN / Poly+FNN (residual) / Poly×FNN; trade off interpretability & performance (PINN ideas).
- Add uncertainty estimates (e.g., confidence/credible intervals).
- Current population-level fit & stage identification; extend to subject-level parameters.
- Repo: https://github.com/AsanoHaruka157/Personalized-Alzhemer-s-Disease-Neural-Network-Model



Tensor / Convolutional Tensor Neural Networks (TNN/CTNN)

- Represent high-dimensional functions with CP-style tensor factors → reduce integrals to multiple 1-D Gauss quadratures.
- Designed CTNN with coupled input dimensions; derived training via (deep) Galerkin for PDE BVPs.
- Study acceleration algorithms: Apply various types of tensor decomposition
- Repo: https://github.com/AsanoHaruka157/Tensor-Decomposition-for-Neural-Networks

$$= \Sigma_{j=1}^{p}\Sigma_{l=1}^{p} u_j u_l \int_{\Omega} (\Delta\phi_j(x))(\Delta\phi_l(x))dx$$
$$= \Sigma_{j=1}^{p}\Sigma_{l=1}^{p} u_j u_l M_{j,l}$$

where $M_{j,l} =< \Delta\phi_j, \Delta\phi_l >$.

This integral $M_{j,l}$ is complex. We should use **tensorized computing techniques** to reduce memory cost and accelerate computing. More specifically, we save the values of function components and their second derivatives on fixed Gauss points x_q (as Gauss points are fixed and same for each Ω_i, we omit the dimension index) (where $q = 1...N$) as the following **tensor form**:

$$U = U[d, d, p, N] \tag{23}$$

where d is the dimension of $\Omega \subseteq \mathbb{R}^d$, p is the rank of the tensor neural network function $u(x)$, and N denotes the number of Gauss points on each 1D interval Ω_i. The index of each dimension is $\boldsymbol{s}, \boldsymbol{k}, \boldsymbol{j}, \boldsymbol{q}$, respectively.

- $U[k, k, j, q]$ stores the value of the second derivative w.r.t x_k for the j-th basis function's k -th component, evaluated at the q-th quadrature point for the k-th dimension: $\phi''_{k,j}(x_{k,q})$.
- $U[s, k, j, q]$ for $s \neq k$ stores the value of the j-th basis function's s-th component, evaluated at the q-th quadrature point for the s-th dimension: $\phi_{s,j}(x_{s,q})$.

8 ACCELERATE DERIVATION

Research Interests

1) Optimization & Fine-Tuning

- Theory: KKT-based views; generalization/error bounds intuition.
- PEFT with random masking; Hessian spectrum ; robustness & stability under fine-tuning.
- Currently no hands-on projects or papers.

2) High-Performance ML Systems

- Unified scheduling for large-model training/inference on multi-GPU & heterogeneous clusters; pipeline/graph partitioning.
- Federated/edge learning: limits of differential privacy; explore homomorphic encryption & better privacy math.
- Model-size reduction: pruning/sparsification; low-level GPU-aware kernels for LLM inference.
- Currently no hands-on projects or papers.

3) AI for Healthcare & Computer Vision & Bioinformatics and Statistics

- Neuroscience & disease modeling: AD now; future depression/anxiety/vestibular migraine.
- Medical imaging: MRI segmentation, multimodal fusion, 3D reconstruction.
- Bayesian Analysis and Statistics
- Project and preprints:
  1. Personalized Alzhemer's Disease Neural Network Modeling Github Repository: https://github.com/AsanoHaruka157/Personalized-Alzhemer-s-Disease-Neural-Network-Model
  2. Open Problems - Multimodal Single-Cell Integration Github Repository: https://github.com/AsanoHaruka157/Open-Problems---Multimodal-Single-Cell-Integration

4) Applied Mathematics

- Operation Research: Principle-Agent Contracts
- Quantitative Finance: From a functional analysis point of view

Paper:

1. Undergraduate Thesis: https://drive.google.com/file/d/1cNFIOOQA6o8uQ_Y9M9cJuSOavcnwVZUr/view?usp=sharing

CONTACT

Get in touch

- Web: https://nagasakisoyo157.github.io/
- Email: 2113840@mail.nankai.edu.cn
- Email: chxi780@gmail.com
- Location: Nankai District, Tianjin, China

Thanks for reading!