MINGLANG YIN, Ph.D.

myin16@jhu.edu | Personal Website: minglangyin.github.io | Baltimore, MD

AI · Scientific Machine Learning · Predictive Modeling · Statistics · Multimodal Learning

EDUCATION & PROFESSIONAL APPOINTMENTS

Senior Postdoctoral Researcher, AI Leader of ADVANCE — Johns Hopkins University (JHU) *Aug 2022 – Present*
Alliance for Cardiovascular Diagnostic and Treatment Innovation (ADVANCE), Dept. of Biomedical Engineering
Advisor: Prof. Natalia Trayanova (ADVANCE/BME), Prof. Mauro Maggioni (Dept. Applied Mathematics & Statistics)

Ph.D., Biomedical Engineering and M.Sc., Fluids & Thermal Sciences — Brown University *2016 – 2022*
Advisor: Prof. George Em Karniadakis (Division of Applied Mathematics, School of Engineering)

B.S., Aeronautical Engineering — Northwestern Polytechnical University *2012 – 2016*

RESEARCH EXPERIENCE

Foundation Model for Partial Differential Equations (PDEs) **JHU, 2022–present**

- Proposed a generic learning framework, DIMON, for predicting solutions of PDEs on a family of geometries.
  - Achieved 10,000× speedup and validated on 1000+ real patient's hearts (left ventricles, 600+ left atrium) with over 98% accuracy.
  - Published in *Nature Computational Science and conferences (AAAI 2024, ICME, and Heart Rhythm Scientific Sessions).*
- Extended DIMON as a Time-Series Foundation Model for in silico drug tests in real human hearts.
  - Enhanced training efficiency with GPU parallel training and generalizability of forecasting pro-arrhythmia risk with pre-training.
  - Validated on 28+ drugs in 600+ human hearts with overall accuracy >95% for each drug.
  - Presented in Conferences (*Heart Rhythm Scientific Session*, *SIAM CSE*). Manuscript in preparation for *Nature Machine Intelligence*.

Multimodal AI for Forecasting Medical Conditions **JHU, 2022–present**

- Designed a generic multimodal AI to predict sudden cardiac death based on medical images and covariates.
  - Cross-validated on the internal/external cohorts (n=553/286) and with 50%+ improvement over clinical benchmarks.
  - Improved model explainability (SHAP score & attention rollout) and performance (loss for unbalanced data & vision Transformer).
  - *Published in Nature Cardiovascular Research*, *JACC: Clinical Electrophysiology, Heart Rhythm Scientific Session.*
- Developed a multimodal AI for survival analysis of atrial fibrillation (AF) ablation.
  - Led the development of a multimodal AI (n=450+) with a non-proportional hazard model for forecasting AF recurrence post-ablation and outperformed clinical scores and baseline Cox (proportional hazard) model.
  - Designed and implemented hypothesis tests for patient characteristics analysis, survival analysis, and model calibration.
  - Manuscript accepted in *Journal of American Heart Association* and presented in *Heart Rhythm Scientific Session*.

AI for Heart Shape Analysis **JHU, 2024–present**

- Developed a shape analysis framework for analyzing heart morphology.
  - Designed feature selection from encoded morphological features, informed risk prediction, and improved predictive performance.
  - Analyzed encoded features and performed data clustering for elucidating association between morphology and disease progression.
  - Published in *Computers in Biology and Medicine*. Additional manuscript in preparation for Nature Biomedical Engineering.

Scientific Machine Learning for Biomechanics (PhD Research) **Brown, 2018–2022**

- Probabilistic and physics-informed ML for inference and prediction from sparse, noisy scientific data
  - **Bayesian inference & UQ**: Built a GAN-based generative model coupled with Markov Chain Monte Carlo (MCMC) to infer material parameters of the human vascular system from sparse, noisy data, with full posterior uncertainty quantification; benchmarked against physics-informed ML and Gaussian Process baselines.
  - **High-Performance Computing:** implemented a custom Smoothed Particle Hydrodynamics (SPH) solver for nonlinear solid mechanics within the LAMMPS framework (not natively supported); implemented lumped-parameter boundary condition in a parallel CFD solver; Co-designed a GPU–CPU parallel simulation pipeline (zebrafish-brain flow); Simple Molecular dynamics solver with CUDA.
  - **Forward modeling**: Developed physics-informed and data-driven surrogates for material failure and vascular hemodynamics.
  - **Publications**: Journal of the Mechanics and Physics of Solids, Computer Methods in Applied Mechanics and Engineering, Journal of The Royal Society Interface, Computational Mechanics, AAAI, etc.

SELECTED GRANTS & AWARDS

- **AHA Rapid Impact Research Award** (Collaborator; based on my NIH K99 proposal) *2026*
- **Best PhD Thesis Award in Biomedical Engineering**, (Int. J. Numer. Methods Biomed. Eng.) *2024*
- **Kenneth M. Rosen Fellowship in Cardiac Pacing** Heart Rhythm Society *2023*
- **Chinese Government Award for Outstanding Students Abroad** Top 1/600 globally *2022*

HIGHLIGHTED PUBLICATIONS (Full Publication: Google Scholar)

- **M. Yin** et al. Predicting the *When*: Multimodal AI for Time-to-Recurrence Analysis After Atrial Fibrillation Ablation, Journal of American Heart Association, 2026.
- C. Lai, **M. Yin** et al. *Multimodal AI to forecast arrhythmic death in hypertrophic cardiomyopathy.* Nature Cardiovascular Research, 2025. **[JHU Hub, Johns Hopkins Medicine, New York Magazine]**
- **M. Yin** et al. *A scalable framework for learning geometry-dependent solution operators of PDEs.* Nature Computational Science, 2024. **[99th percentile; Communication of the ACM, MIT Tech Review, NSF News, JHU Hub]**
- **M. Yin**, et al. *A generative modeling framework for inferring families of biomechanical constitutive laws in data-sparse regimes.* Journal of the Mechanics and Physics of Solids, 2023.

TECHNICAL SKILLS

Python, C++, CUDA, OpenMPI; PyTorch, TensorFlow; distributed CPU/GPU computing; statistics & survival analysis, Hypothesis testing, Bayesian inference/UQ, Numerical Method for PDEs; Git, Linux, SLURM