



PEILUN (TOMMY) LI

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Biography

I am a rising senior pursuing double majors in Computer Science (Honors track) and Mathematics (Honors track) at Vanderbilt University. I am passionate about understanding and developing novel data-driven approaches to analyze Cyber-Physical Systems with reliability, generalizability, and interpretability. My recent work focuses on combining Bayesian learning with physics prior knowledge for modeling of physical systems.

Research Interests: Physics-Informed Learning, Uncertainty Quantification, Machine Learning, Robotics.

Education

Vanderbilt University

Aug 2021 – May 2025

B.S. in Computer Science (Hons) & Mathematics (Hons)

GPA: 3.924/4.00

- **Research advisor:** Prof. Thomas Beckers
- **Major advisors:** Prof. Gautam Biswas, Prof. Glenn Webb
- **Selected coursework:** numerical linear algebra, numerical modeling with differential equations, real and complex analysis, (scientific) machine learning, statistical inference and probability, topology, discrete math.

Publications

1. **P.Li**, K.Tan, and T.Beckers. “PyGpPHs: A Python Package for Bayesian Modeling of Port-Hamiltonian Systems”. In: Proceedings of the 8th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control (**LHMNC**). 2024. (accepted)
2. K.Tan, **P.Li**, and T.Beckers. “Physics-Constrained Learning for PDE Systems with Uncertainty Quantified Port-Hamiltonian Models”. In: Proceedings of the 6th Conference on Learning for Dynamics and Control (**L4DC**). 2024. (accepted)

Research Experiences

Department of Computer Science, Vanderbilt University

May 2023 – Present

Research Assistant, VUSE Summer Fellowship '23 '24

Nashville, TN

- Projects' Theme: Physics-Informed Bayesian Modeling and Uncertainty Quantification on Cyber-Physical Systems
- Collaborator: Kaiyuan Tan (Ph.D. Student), PI: Prof. Thomas Beckers
- Currently researching to combine Model-Predictive Control (MPC) with uncertainty quantification for a data-driven, robust, and reliable controller for physical systems.
- Designed, developed, and maintained PyGpPHs, a Python package based on GP-PHS (Gaussian Process port-Hamiltonian System), that shows high accuracy, efficiency, and generalizability in modeling non-linear dynamics.
- Studied and expanded Bayesian modeling approaches to distributed Port-Hamiltonian System (dPHS). Collaborated in implementing GP-dPHS models.

Department of Mathematics, Vanderbilt University

Jan 2023 – May 2023, Aug 2024 – Present

Research Assistant

Nashville, TN

- Project: Age-Structured, Data-Driven Modeling and Analysis of Disease Population Dynamics
- Mentor/PI: Prof. Glenn Webb
- Currently studying theories of statistical machine learning to design a data-driven modeling approach of disease population dynamics with mathematical guarantee.
- Studied mathematical theories of disease modeling with ordinary and partial differential equations (ODE and PDE). Developed theory and implementation of population age-structured, compartmentalized systems of ODE. Presented my findings and system of ODE at Shanks Workshop on mathematical biology.

Data Science Institute, Vanderbilt University

Jan 2023 – May 2023

Research Assistant

Nashville, TN

- Project: Dialogic Questioning AI Product Using GPT Models for Improving Reading Comprehension among Children

- PI: Prof. Jesse Spencer-Smith, Dr. Umang Chaudhry
- Utilized Chat-GPT API for building a interactive dialogic questioning AI product. Improved the performance through prompt engineering and fine-tuning techniques.

Vanderbilt University Medical Center

Aug 2022 – Feb 2023

Research Assistant

Nashville, TN

- Project: Identification of Geometry-Defining Protein sub-chains using Neural Network
- PI: Dr. Richard Stein, Prof. Hassane Mchaourab
- Studied basics of protein biology and neural networks, utilized tools like Omega-fold, protein library, and dimension reduction to engineer a learning framework for identifying and analyzing geometry-defining protein sub-chain.

Teaching Experiences

Department of Computer Science

Aug 2022 – Present

Teaching Assistant and Grader

Nashville, TN

- CS3251/5251: Intermediate Software Design, Spring 2024
- CS3251/5251: Intermediate Software Design, Fall 2023
- CS/DS1100: Applied Programming and Problem Solving with Python, Fall 2022

Conferences and Presentations

16th World Congress on Computational Mechanics

Jul 2024

Oral Presentation

Vancouver, British Columbia

- Presented our paper on PyGpPHs toolbox for Bayesian Modeling of Port-Hamiltonian Systems
- Presented our paper on Physics-Constrained Learning for PDE Systems with Uncertainty Quantified PHS

ISIS 25th Anniversary Celebration

Aug 2023

Poster Presenter

Nashville, TN

- Presented our recent work on "Bayesian Physical-Informed Models for Soft Robotics."

Shanks Workshop on Advances in Theoretical Biology and Mathematical Biology

Mar 2023

Poster Presenter

Nashville, TN

- Presented my work on Age-Structured Systems of Ordinary Differential Equation Modeling on COVID-19.

Awards and Honors

Tennessee Beta Chapter of Tau Beta Pi at Vanderbilt University (Junior Class)

Dec 2023

Vanderbilt University

- Award extended to undergraduate engineering majors who are in the top 1/8 of Junior Class.

School of Engineering Award Undergraduate

May 2023

Vanderbilt University

- Scholarship award to 40 excelling undergraduate students in School of Engineering.

Dean's List

Aug 2021 – Present

Vanderbilt University

American Mathematics Competition

Feb 2021

AMC10, AMC12

- Achieved top 5% score in the AMC 12 competition and AMC 12 Honor Roll; qualified for AIME.

Technical Skills

Computational Programming: Ordinary, Partial Differential Equations, Numerical Methods, Probability, Linear Algebra
Technologies/Frameworks: Python{Numpy, SciPy, Pandas, CVXOPT, Scikit-Learn, Ctype, Matplotlib, Seaborn, Pytorch} C++{algorithms, Eigen}
Languages: Python, C/C++, R, MatLab, Mathematica, Java, LaTeX