SAI SAMPATH KEDARI

Seeking full-time research opportunities in Dynamics Learning, State Estimation, and Control, with interest in foundational machine learning and robust algorithm design.

sampath@umich.edu | 734-510-1994 | sai-sampath-kedari | SaiSampathKedari | @SSampathKedari

RESEARCH AND WORK EXPERIENCE

Research Assistant

Prof. Vasileios Tzoumas' Lab, University of Michigan, Ann Arbor

Aug'24 – Present | Ann Arbor, MI

- Developing algorithms for learning-based control of agile quadrotors using Koopman operator theory to model aerodynamic effects and enhance data-driven controllers.

Research Study

ROAHM LAB: Prof Ram Vasudevan,University of Michigan, Ann Arbor

May'22 – Aug'22 | Ann Arbor, MI

- Performed system identification of Fetch Robot dynamic parameters (link friction, mass, inertia) using open-loop testing, regression, and phase-plane analysis.

Teaching Assistant, Physics 151/241/360- Elec & Magn, Spec Relativity

University of Michigan, Ann Arbor

Aug'22 – May'24 | Ann Arbor, MI

CATIA R&D Software Developer

Dassault Systems

Sep'20 – Aug'21 | Pune, India

- Developed Functional Tolerance & Annotations Workbench in CATIA using advanced C++, integrating the latest ISO standards.

Software Developer

Altair Engineering

Sep'2019 – Sep'20 | Bangalore, India

- Developed C++ HyperMesh APIs and MotionView tools for force visualization and two-wheeler dynamics modeling with stability analysis using MDL.

EDUCATION

M.S. in Mechanical Eng. (Robotics)

University of Michigan, Ann Arbor

Jan'23 - Apr'24 | GPA: 3.66/4

M.S. in Automotive Eng. (Controls & Dynamics)

University of Michigan, Ann Arbor

Aug'21 - Dec'22 | GPA: 3.64/4

B.Tech in Mechanical Engineering

National Institute of Technology Rourkela, India

Jul'15 - May'19 | GPA: 8.22/10

COURSEWORK

- Inference, Estimation, and Learning
- Machine Learning
- Computational Data Science & ML
- Intro To Statistical Theory
- Stochastic Process II
- Probability Distribution Theory
- Nonlinear Programming
- Nonlinear Systems & Control
- Linear Systems Theory
- Linear Feedback Control
- Control Systems Analysis & Design
- Deep Learning

TECHNICAL SKILLS

C/C++ | Python | Matlab | CMake | TCL/TK Scripting | Bash Scripting | ROS1

PROJECTS

AEROSP 567: Statistical Inference, Estimation, and Learning

Jan'2024 - May'2024 | University of Michigan, Ann Arbor

- Designed Monte Carlo sampling for estimating rare event probabilities in random walks, using variance reduction methods like importance sampling and multilevel Monte Carlo, with the addition of control variates for faster convergence. **(Project Report)**
- Implemented Gaussian Process for scent distribution modeling in a 2D field from sparse sensor data of a flying robot. Developed a search strategy using Bayesian optimization to enhance search efficiency and minimize false positives. **(Project Report)**
- Applied Metropolis-Hastings, Adaptive Metropolis, and Delayed Rejection Adaptive Metropolis (DRAM-MCMC) sampling algorithms for parameter inference in dynamical systems, facilitating posterior sampling of parameter distributions. **(Project Report)**
- Developed Extended Kalman Filter (EKF), Unscented Kalman Filter (UKF), Gauss-Hermite Kalman Filter (GHKF), and Particle Filtering algorithms for state estimation and prediction in nonlinear dynamic systems.**(Project Report)**

Literature Review : Prof. Alex Gorodetsky (Project Report) (PPT)

Jan'2024 - May'2024 | University of Michigan, Ann Arbor

- Literature Review on "Bayesian system ID: optimal management of parameter model, and measurement uncertainty"

- This paper discusses the development of a mathematical objective function for joint parameter-state estimation in dynamic systems, which is fundamental for learning parameters and predicting states in System Identification, and highlights its impact on popular methods like DMD and SINDy

---

Implementation of "Safe planning in Dynamic Environments using Conformal prediction" research paper (Github)

Research Study: Prof. Dimitra Panagou

Jan'2023 - May'2023 University of Michigan, Ann Arbor

- Implemented a Social-LSTM neural network to forecast the motion of surrounding agents around drones, and applied conformal prediction to generate confidence intervals used for optimizing robot motion planning.

Re-implemented an ICML 2022 paper on physics-aware neural networks for PDE modeling.

Machine Learning Course Project

Aug'2022 - Dec'2022 University of Michigan, Ann Arbor

- Implemented physics-aware neural networks, including TCN, ConvLSTM, PhyDNet, and FINN, for the learning of PDEs and ODEs.

MATH FOUNDATIONS

I believe that mastering and developing an intuitive understanding of mathematical foundations is the key to unlocking new possibilities in research and innovation. The subjects below reflect this commitment—each studied rigorously with all chapter-end exercises solved.

- **Real Analysis:** Elementary Analysis by Kenneth Ross - **(Github)**
- **Probability and Distribution Theory:** Casella & Berger - **(Github)**
- **Statistical Inference Theory:** Casella & Berger **(Github)**
- **Matrix Methods for Machine Learning: (Github)**
- **Convex-Optimization:** Stephen Boyd & Lieven Vandenberghe **(Github)**
- **The Fourier Transform & its Applications:** - Stanford EE261 **(Github)**
- **Signals & Systems:** Alan V. Oppenheim, Willsky, Nawab **(Github)**
- **Differential Equations:** MIT 18.03 & Edwards-Penney **(Github)**