# SAI SAMPATH KEDARI

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## Education

**University of Michigan, Ann Arbor** Jan 2023 – Apr 2024
*M.S. in Mechanical Engineering – Robotics* *GPA: 3.66/4.0*

**University of Michigan, Ann Arbor** Aug 2021 – Dec 2022
*M.S. in Automotive Engineering – Dynamics & Control* *GPA: 3.64/4.0*

**National Institute of Technology Rourkela, India** Jul 2015 – May 2019
*B.Tech. in Mechanical Engineering* *GPA: 8.22/10.0*

## Work Experience

**Peer Robotics**: Motion and Controls Intern Jul. 2025 – Sep. 2025

**iRaL, UMich**: Research Assistant under Prof. Vasileios Tzoumas Aug. 2024 – Jun. 2025

**ROAHM Lab, UMich**: Research Intern under Prof. Ram Vasudevan May 2022 – Aug. 2022

**Dassault Systèmes & Altair Engineering**: Software Engineer (C++) Sep. 2019 – Aug. 2021

## Current Projects

**Quadruped Joint Parameter & State Estimation in ROS2 + Gazebo**

**Sequential Decision Making Under Uncertainty**

**Reinforcement Learning & Deep RL**

## Completed Projects

**Monte Carlo Statistical Methods (Casella & Robert)** | GitHub | 13 Reports | 16 Notebooks

- Built a probabilistic inference engine for robotics and learning by reconstructing Monte Carlo methods from first principles to estimate expectations in high-dimensional, nonlinear, non-Gaussian systems arising in state estimation, parameter learning, and policy evaluation.
- Engineered advanced MCMC samplers (Metropolis–Hastings, Adaptive Metropolis, Delayed Rejection, DRAM) for curved, high-dimensional targets (e.g. banana distribution), optimizing proposals via adaptive covariance and two-stage rejection, and quantifying mixing with effective sample size and autocorrelation diagnostics.
- Applied variance-reduction techniques (importance sampling, control variates, scaling laws) to accelerate Monte Carlo integration, and validated estimator reliability through convergence analysis (LLN, CLT), emphasizing numerical stability and failure modes relevant to robotics pipelines.

**Bayesian Filtering & Smoothing (Särkkä)** | GitHub | 13 Reports | 7 Notebooks

- Developed recursive Bayesian state estimation pipelines for robotic dynamical systems by deriving and implementing Kalman, EKF, UKF, and Gauss–Hermite filters from joint-distribution formulations with explicit uncertainty propagation.
- Implemented particle filtering via sequential importance sampling resampling for nonlinear, non-Gaussian systems, analyzing weight-degeneracy, resampling criteria, and belief collapse using effective sample size diagnostics.
- Benchmarked inference on robotics-relevant dynamical systems (e.g. pendulum), comparing Gaussian approximations against particle methods to expose linearization error, multimodality, and limits of classical estimators for downstream learning and control.

**Bayesian Inference for Dynamical Systems (MCMC)** | GitHub | 1 Report | 2 Notebooks

- Built MCMC-based Bayesian parameter estimation pipelines for nonlinear dynamical models, enabling joint posterior inference over system parameters and uncertainty-aware predictive dynamics.
- Performed convergence, mixing, and identifiability analysis using trace plots, autocorrelation, and posterior-predictive checks to diagnose unidentifiable parameters and uncertainty propagation in complex system models.

## Technical Skills

**Languages & Tools:** Python, C++, C, ROS2, PyTorch, Gazebo, MATLAB, NumPy, SciPy