

Sharath Matada

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Portfolio: www.sharathmatada.com

Github: <https://github.com/sharath-matada>

EDUCATION

- **University of California, San Diego** La Jolla, United States of America
• *Master of Science - Mechanical and Aerospace Engineering* September, 2022 - March, 2024
Relevant Coursework:
ECE276A: Sensing and Estimation in Robotics, ECE276B: Planning and Learning in Robotics, ECE271A: Statistical Learning, MAE204: Robotics, MAE207: Soft Robotics
- **National Institute of Technology, Karnataka(NITK)** Surathkal, India
• *Bachelor of Technology - Mechanical Engineering* August 2014 - May, 2018
Relevant Courses: Automatic Control Engineering, Robotic Systems
Additional Courses: Deep Learning using PyTorch(IBM), Model Predictive Control

PUBLICATIONS

- **Reconstructing Robot Motion from Video**
*In preparation to be submitted to **Science Robotics***
Jingpei Lu, **Sharath Matada**, Yiyu Chen, Florian Ritzler, Quan Nguyen, Michael Yip
[Website](#)

SKILLS SUMMARY

- **Robotics:** Optimal Control, Path Planning(A*,RRT, RRT*), Model Predictive Control for Quadrupeds, Kalman Filter, Particle Filter, Visual-Inertial Extended Kalman Filter
- **Machine Learning:** Statistical Learning, Supervised and Self-Supervised Learning, Physics Informed Learning
- **Programming Languages:** Python,C, C++
- **Simulation:** CoppeliaSim, MuJoCo, PyBullet
- **Machine Learning Tools:** Pytorch, Tensorflow, JAX
- **Robotics Software Development:** ROS2
- **Others:** Linux, Arduino, Raspberry Pi, MATLAB, Labview, GIT, MS Office

EXPERIENCE

- **Graduate Research Assistant, Existential Robotics Lab, UCSD**
Jul 2023 - Current, Advisor: Prof. Nikolay Atanasov, Assistant Professor
 - * Working on a learning based motion planner for dynamic environments capable of real-time planning in high dimensional spaces that maps the **Signed Distance Field** of the environment to generate a **Value function** based on the **Hamilton-Jacobi Bellman Equation in real-time**
 - * Implemented a **Neural Signed Distance Field (SDF)** utilizing self-supervised learning techniques that achieves generalization in dynamic environments
- **Graduate Research Assistant, Advanced Robotics and Controls Lab, UCSD**
Oct 2022 - Jun 2023, Advisor: Prof. Michael Yip, Associate Professor
 - * Worked on reconstruction of complex robot motion (specifically dancing) on a quadruped using **Model Predictive Control (MPC)**, leveraging off-the-shelf optimal control solvers
 - * Successfully implemented the MPC controller on Pybullet for the Go1 robot, achieving a frequency of 400 Hz in C++, enabling real-time execution
 - * Implemented an **Extended Kalman Filter** for the **real Go1 Hardware Platform** to enable sim-to-real transfer
- **Senior Robotics Engineer, Systemantics(Collaborative Robotic Arm Maker)**
Jun 2018 - Aug 2022, Advisor: Dr. Jagannath Raju, CTO
 - * **Motion Control**
 - Designed feedback controller and modeled friction, inertial and gravity effects for a robotic manipulator
 - Reduced visible vibrations using flexible joint control with full-state feedback
 - * **Safety for Human-Robot Interaction**
 - Designed a disturbance observer to detect collisions with external environment to improve safety for human-robot collaboration
 - Implemented an admittance controller to achieve kinesthetic teaching (intuitive method of teaching the robot by physically applying forces to the robot to move to a particular point in space)
 - * **Robot Kinematics and Dynamics**
 - Optimized kinematic architectures of hybrid mechanisms(combination of serial and parallel linkages)for maximum dexterity and minimum inertial load on each joint
 - Characterized the effect of joint elasticity coupled with parallel mechanisms on robot performance in task space
 - * **Software Design**
 - Designed a finite state machine and implemented a state estimator for robot joint
 - Implemented trapezoidal commutation for a BLDC motor in a robot joint
 - * **Mechanical Design**
 - Designed an integrated robot joint(hollow bore) consisting of strain wave gearing, BLDC motor, output and input encoders and compact electromagnetic brakes
 - Designed compact spring-loaded electromagnetic brakes with the EM coil optimised for minimum power dissipation during operation
 - Designed lightweight links and grippers for serial robots and precision components for the complex mechanisms

COURSE PROJECTS

- **ECE276A: Sensing and Estimation in Robotics** University of California, San Diego
 - * Conducted data synchronization between IMU and stereo camera image features for accurate and efficient measurements
 - * Implemented EKF prediction for real-time positioning and orientation updates using SE(3) kinematics and IMU measurements
 - * Developed EKF update step to correct landmark locations using Jacobian of observation model with visual observations
 - * Simultaneously corrected car pose and landmark locations using observation model Jacobian w.r.t. car pose, feature locations
 - * Analyzed sensitivity to motion and observation model noise and generated an environment map achieving 95% accuracy
- **ECE276B: Planning and Learning in Robotics** University of California, San Diego
 - * Implemented a collision-checking mechanism for a robot's safe navigation in 3D maze-like environments towards the goal
 - * Implemented and assessed weighted-A* and RRT, RRT* algorithms for the robot's goal-reaching performance
 - * RRT achieved 30 % faster and more memory-efficient performance, while A* showed superior path quality with shorter path
 - * Provided insights into expanded nodes, sampling method heuristic selection (Euclidean, Manhattan distance), aiding algorithm selection based on complexity, efficiency trade-offs, and graph creation efficiency in the sampling-based approach

INTERNSHIP EXPERIENCE

- **ABB Robotics** Bengaluru, India
Intern May 2017 - July 2017
 - * Developed a [robotic system](#) where an anthropomorphic robotic arm was attached to a 6-DOF IRB1600 ID ABB Industrial Robot to explore grasping.
 - * Was involved in the mechanical design, programming and basic electronic design of the system.
- **NMCAD Lab, Aerospace Department, Indian Institute of Science** Bengaluru, India
IASc-INSa-NASI Joint Academies' Research Fellow (Summer Research Fellowship) May 2016 - July 2016
 - * Worked on Design of Flapping-wing type Micro Aerial Vehicles using self-actuated composites
 - * The design was based on the flapping pattern of the rufous hummingbird (*Selasphorus Rufus*) with the mechanism to allow 2 degrees of freedom for figure 8 like configuration

TEACHING EXPERIENCE

- **MAE3: Introduction to Mechanical Design** University of California, San Diego
Graduate Teaching Assistant Oct 2022 - Dec 2022
 - * Designed bearing devices to demonstrate basic concepts of under-constraint, exact constraint and over-constraint bearing designs to students
 - * Conducted physics review for MAE3 students
 - * Conducted weekly office hours at the Design Studio

ACTIVITIES

- **Volunteer at Youth for Seva**
A not-for-profit NGO in India supporting schools and other organisations in social sector
- **Amateur Runner and Cyclist**
A weekend activity to explore new places and test personal limits
- **Former Secretary of Association for Computer Machinery, Student Chapter, NITK**
Managed club activities such as the project expo

REFERENCES

- **Dr.Jagannath Raju** CTO, Systemantics India Pvt. Ltd
jagannath@systemantics.com. PhD, MIT
- **Prof. Michael Yip** Associate Professor, UCSD
yip@ucsd.edu
- **Prof. Nikolay Atanasov** Assistant Professor, UCSD
natanasov@ucsd.edu