Sharath Matada

Email: sharath.matada@gmail.com
Portfolio: www.sharathmatada.com
Github: https://github.com/sharath-matada
Phone no: +1(858)319-6381

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 Ritcher, 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, Reinforcement 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 intertial 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