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Personal Statement:

A self-motivated individual seeking a master's in the field of Robotics. My core research focuses on Robot motion planning and Reinforcement learning for autonomous robotic systems. I am driven by the challenge of bringing robots to life and solving real-world problems through intelligent and practical solutions.

Education:

Bachelor's in Electrical and Electronics Engineering
Easwari Engineering College, Anna University, Tamil Nadu, India **(2016- 2020)**

Achievements:

1. Developed and implemented a motion planner tailored for robotic spine instrumentation and led a **cadaver study,** which resulted in **16 successful** pedicle screw placements with **grade 0 breach**.
2. Ranked among the top **5 finalists** in the EndoCV2022 Grand Challenge, competing against **100+** participants worldwide.

Research Experience:

HTIC R&D, Indian Institute of Technology Madras(IITM), India.

Project Associate **(July 2021 - Present)**

- **Robotic Fetal Ultrasound System**:

  This project is the extended version of our KUKA Innovation Award 2022 project - (Team AROKI)

  - Working on developing an Autonomous navigation module in a Robotic fetal Ultrasound system using **proximal policy approximation** methods for autonomous fetal biometric estimation.
  - Devised a motion planner that incorporates the ISUOG six-step approach for Robotic fetal Ultrasound screening.
  - Developed a deep learning model to detect **Standard Planes** for estimating **fetal biometric** data, utilized in the Robotic Fetal Ultrasound System.
  - Collaborating with the team to integrate multiple submodules such as motion planner, computer vision, registration, and force control module for the robotic fetal ultrasound system for CUSP.

- **Cobot-guidance platform for comprehensive percutaneous spinal interventions:**
  - Engineered a Hybrid motion planner combining **Computational geometry** and **constrained sampling-based** methods, ensuring probabilistically complete path generation.
  - Developed an **optimization**-based **Robotic stereotactic guidance module** that provides doctors a higher factor of ergonomics while operating in a clinical scenario.
  - Developed Modules related to the robotic surgical application, such as Device Registration, and Navigation Docking.
  - Incorporated real-time collision detection Capability for the system by utilizing the **Bullet physics engine**.
  - Designed a ROS validation tool to perform in-house **validation**. This tool mimics real-world surgical plans to validate and ensure motion planner efficiency and Reliability.

- **Real-Time Collision Avoidance for Serial Robot**:
  - Worked on a real-time collision avoidance module utilizing an **Artificial Potential field**-based planner to avoid collisions dynamically.
  - This system incorporates a depth-sensing camera to determine a 3D human pose estimation. network.

- **Deep learning for endoscopy:**
  - Spearheaded the development of deep learning models for **monocular depth estimation, super-resolution**, **Cancer cell segmentation**, and detection utilized in the endoscopy procedure.
  - Analyzed various **model compression** techniques for the real-time deployment of deep learning models, such as model pruning, knowledge distillation, and quantization**,** to achieve high-speed inference capabilities.
  - Directed efforts towards **enhancing model inference speed**, achieving a significant performance boost on **NVIDIA Jetson** systems. Utilized inference optimization tools like TensorRT and Apache TVM to deploy on-edge devices to maximize throughput.
  - Successfully deployed the models in an **indigenous endoscopy** system, achieving real-time performance with an inference time of **3 ms** on the Jetson Nano after model compression, compared to approximately 10 ms before compression.

Publication:

- ***XP-Net: An Attention Segmentation Network by Dual Teacher Hierarchical Knowledge Distillation for Polyp Generalization*.** CEUR Workshop Proceedings (CEUR-WS.org) Link
- ***Motion Planning and Long-term Robot Monitoring Perspective: A Cadaver Study on Robot-Assisted Pedicle Screw Fixation*.** IEEE Medical Measurements & Applications Link
- ***Robust Hand-Eye Calibration Workflow for Robotic Spine Surgery: Insights from a Cadaver Study.*** IEEE Medical Measurements & Applications Link

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Patents:

Inventor: Use of Triangulated Virtual Enclosures for Robot Route-Finding in Image Guided Robotic Surgery and Intervention (Under PCT Filing)

Area of Interest:

Reinforcement Learning, Robot Motion Planning.

Skills:

Python, C++, OMPL, ROS, Pybullet, Pytorch, TVM Apache, OpenCV, Nvidia TensorRT, Mathematica.

Academic Project:

ED5215: Motion Planning (Indian Institute of Technology *Madras*):

Developed a motion planner for robotic **laparoscopy** procedures for achieving remote center of motion (RCM). A constrained sampling-based technique was implemented for a 7-DOF redundant manipulator (**KUKA iiwa7**).

Courses from IIT Madras (Classroom learning):

CS6700: Reinforcement Learning, ED5215: Motion Planning,CS6015: Linear Algebra and Random Process, ED6007: Mechanics of Serial Robots, ED5315 - Field and Service Robotics.
