Arkadeep Narayan Chaudhury

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Education

Carnegie Mellon University, Robotics Institute — Pittsburg, PA
MS + PhD in Robotics — *Aug. 2020 – May 2024 (expected)*

Carnegie Mellon University, CIT — Pittsburg, PA
PhD in Mechanical Engineering — *Aug. 2018 – Aug 2020 (transferred to the RI)*

Indian Institute of Science — Bangalore, India
Master of Science in Mechanical Engineering — *Aug. 2015 – Dec. 2017*

Indian Institute of Engineering Science and Technology — Shibpur, India
Bachelor of Engineering in Mechanical Engineering — *Jul. 2011 – May 2015*

Research Experience

Neural 3D representations, 3D sensing for manipulation, sensor fusion, active perception, design of 3D vision systems around robots

Experience

Toyota Research Institute — Los Altos, CA
Research Scientist Intern — *May. 2023 – Aug. 2023*
Team: ML @ TRI

Physically based 3D representations: Researched algorithms on physically based capture of 3D assets for robotics. Researched a robot mounted multi-flash stereo camera rig to capture multi-modal data from small objects in bounded scenes. [Patent filed]

Atkeson Lab, CMU RI — Pittsburgh, PA
Graduate Research Assistant — *Nov. 2019 – Present*
Advisor: Prof. Christopher Atkeson
Thesis topic: *Moving lights and cameras for better 3D vision*

Moving cameras: Developed an ensemble of collocated vision, depth and touch sensors and a set of algorithms to visually servo robots to workspace goals and localize objects through vision and touch. ICRA & RA-L'22

Moving lights: Designed and implemented a robot workspace scale photometric stereo setup for object agnostic, surface texture, surface orientation, and surface deformation perception. WACV'24

Moving lights and cameras: Designed and implemented a portable multi-flash stereo camera for appearance and geometry perception of small scenes. Project

Biorobotics Lab, CMU RI — Pittsburgh, PA
Graduate Research Assistant — *Aug. 2018 - Jul. 2019*
Advisor: Prof. Howie Choset

Medical device prototype: Co-developed and prototyped a hand held soft tissue investigation device for low-cost tumor diagnosis. Hamlyn '19

Non-rigid registration: Surveyed algorithms for human organ registration and proposed and implemented faster algorithms with comparable accuracy to handle larger volumes of data. Link

Robotics and Design Lab, IISc — Bangalore, India
Research Staff — *Jan. 2018 - Jul. 2018*
Advisor: Prof. Ashitava Ghosal

Optimal Motion Planning: Derived optimal, polynomial time motion plans for snake-like robots in confined spaces such as endoscopes in GI tract, pipe inspection robots and in cluttered search and rescue scenarios. CAD

Robotics and Design Lab, IISc — Bangalore, India
Graduate Research Assistant — *Jul. 2015 - Dec. 2017*
Advisor: Prof. Ashitava Ghosal

Design of Parallel Robots: Designed Monte Carlo simulations to model workspaces of parallel robots. Modeled the human 3-fingered grasp and proposed techniques for optimal design of parallel robots. Thesis, MMT, JMR.

Selected Course Projects

Planning on Manifolds: Devised algorithms for path planning of collaborative robot arms to manipulate ultra-sound probes on a human body phantom. This algorithm was lated used to research automatic femoral artery catheterization. [Video]

SLAM for Legged Robots: Used GTSAM and OpenCV to co-develop a framework for visual state estimation in legged robots using their gait information. [Report]

Publications. [Google Scholar Page]

[1] **Chaudhury, A. N.**, Keselman, L. & Atkeson, C. (2022) "Controlled illumination for perception and manipulation of Lambertian objects" *Proc. of the WACV '24* Link

[2] **Chaudhury, A. N.**, Man, T. Yuan, W. & Atkeson, C. (2022) "Using Collocated Vision and Tactile Sensors for Visual Servoing and Localization." *IEEE RA-L 2022* Link

[3] Ashwin K.P.*, **Chaudhury A.N.***, and Ashitava Ghosal. (2020) "Efficient representation of ducts and cluttered spaces for realistic motion planning of hyper-redundant robots through confined paths."J. Computer-Aided Design, 119, 102777. Link

[4] **Chaudhury, A. N.**, & Ghosal, A. (2017). "Optimum design of multi-degree-of-freedom closed-loop mechanisms and parallel manipulators for a prescribed workspace using Monte Carlo method". Mechanism and Machine Theory, 118, 115-138. Link

[5] **Chaudhury, A. N.**, & Ghosal, A. (2018). "Workspace of Multi-fingered Hands Using Monte Carlo Method". Journal of Mechanisms and Robotics, 10(4), 041003. Link

[6] **Chaudhury, A. N.**, & Datta, D. (2017). "Analysis of prismatic springs of non-circular coil shape and non-prismatic springs of circular coil shape by analytical and finite element methods". Journal of Computational Design and Engineering, 4(3), 178-191. Link

Skills

Programming Languages: Python, C++, CUDA, Cython

Robot platforms: Universal Robots UR5, Franka Emika FR3, XArm-7

Computing Environments: Linux [Ubuntu]

Machine Learning Toolboxes: PyTorch, TensorFlow, SciKit-Learn

Software Libraries: ROS, OpenCV, PCL, GTSAM

Languages: English (full proficiency), Bengali (native proficiency) and Hindi (bi-lingual proficiency)

Relevant Courses

At CMU: Computer Vision, Geometric Methods in Computer Vision, Advanced Nonlinear Control Theory, Robot Mapping and Localization, Linear Systems, Statistical Techniques in Robotics, Deep Reinforcement Learning, Machine Learning

At IISc: Robotics (Kinematics, Dynamics and Control), Numerical Linear Algebra, Geometric Modelling, Linear and Non-Linear Optimization,

Awards

DST-SERB Overseas PhD fellowship (Govt. of India) [Declined]	08/2018 – 08/2023
Graduate Research Fellowship (CMU)	08/2018 – 08/2019
DST Graduate Scholarship (Govt. of India)	08/2015 – 12/2017

References

Prof. Christopher G. Atkeson Professor, CMU, cga@cmu.edu [advisor]

Prof. Ashitava Ghosal Professor, IISc Bangalore. asitava@iisc.ac.in [ex. advisor]

Dr. Igor Vasiljevic Research Scientist, Toyota Research Inst., igor.vasiljevic@tri.global [Internship Mentor]