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 reconstruction, 3D sensing for small scenes, sensor fusion, active perception, design of low-level computer vision systems, robotic manipulation.

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. Developed 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]