# Arkadeep Narayan Chaudhury

https://arkadeepnc.github.io
LinkedIn, GitHub
ResearchGate

Email: arkadeepnc@cmu.edu
Cell: +1 412-626-4231
4225 Newell-Simon Hall, 5000 Forbes Avenue
Carnegie Mellon University, Pittsburgh, PA, ZIP: 15232


## 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 for small scenes, sensor fusion, photometric stereo, active perception, prototyping low-level computer vision systems and CV accelerators, tactile sensing.

## 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]