

Mohan Krishna NUTALAPATI

Research Scholar

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📍 ACES-307, IIT Kanpur, Uttar Pradesh

I'm a research scholar at Indian Institute of Technology Kanpur, expecting to submit my thesis by **October, 2022**. I'm interested in developing **optimization-based algorithms for the problems in robotics and large-scale machine learning**. I've worked on some interesting applications such as point-cloud registration, simultaneous calibration of wheeled robots, online trajectory optimization and document clustering. Currently, I'm working as a full-time research intern at **Intel corporation India on the warehouse automation project**. Specifically, I'm responsible for obstacle avoidance, multi-agent task assignment, path finding and coordination pipelines.

EDUCATION

2014 - present	Integrated M.tech + PhD Department of Electrical Engineering, Indian Institute of Technology, Kanpur PhD Thesis : Optimization Based Algorithms for the Problems in Robotics Advisor(s) : Prof. Ketan Rajawat and Prof. Rajesh M Hegde Expected to submit thesis by October 2022 M.tech Thesis : Development of an Unmanned Robotic Assistance System Advisor(s) : Prof. Ketan Rajawat and Prof. Rajesh M Hegde Defended on 11 th June, 2021. Award : Presented this work at DRDO DRUSE-2018 and won zonal (north) first	CPI : 8.18/10
2012	B.tech Department of Electronics and Communication Engineering GMR Institute of Technology, Rajam Thesis : Comparison of LMS and Neural Network algorithms to reduce ISI (Inter Symbol Interference)	Marks : 77.16 %

RESEARCH (ONGOING)

DISTRIBUTED AND ASYNCHRONOUS SUCCESSIVE CONVEX APPROXIMATION ADMM

- > We develop a distributed and asynchronous framework that incorporates ideas from alternating direction method of multipliers (ADMM) and successive convex approximations (SCA) to solve constrained non-convex problems
- > The objective function consists of shared cost between pairs of agents/robots and private cost for individual robots
- > We can handle the presence of non-convex constraints and also delays in the agent network
- > Experimental evaluations are being made on multi-agent trajectory planning and distributed pose graph SLAM problems
- > **SLAM Datasets used** : Intel(2D), Manhattan(2D), Torus(3D) and Sphere(3D)

Non-convex optimization Distributed and Decentralized Asynchronous Architecture Multi-agent Trajectory Planning Pose Graph SLAM

STOCHASTIC NON-CONVEX OPTIMIZATION

- > We develop a stochastic variance reduced based accelerated framework that minimizes the expected non-convex objective function under non-convex functional constraints
- > The framework utilizes the ideas from variance reduction and successive convex approximation methods
- > Experimental evaluation is being made on the sparse classification problem
- > **Database used** : Mnist, Gisetete, Reuters

Stochastic Non-Convex Optimization Variance Reduction Successive Convex Approximation Sparse Classification

STOCHASTIC GRADIENT DESCENT BASED IMITATION LEARNING

- > We develop a framework inspired from the ideas of stochastic gradient descent and variants to minimize the imitation learning loss
- > Experimental evaluations are made on agents operating in OpenAIGym environments
- > **Simulators used** : Environments provided in OpenAIGym

Imitation Learning Stochastic Gradient Descent Expert Demonstrations

ORTHOGONAL NON-NEGATIVE MATRIX FACTORIZATION FOR DATA CLUSTERING

- > We have proposed a new non-negative matrix factorization (NMF) which relaxes the orthogonality constraints and improves clustering performance on various synthetic and real database
- > **Database used** : TDT2 document corpus, Reuters document corpus

Orthogonal NMF Constrained Non-Convex Optimization Document Clustering

PUBLICATIONS

In preparation

1. Atanu Samanta, **Mohan Krishna Nutalapati**, and Ketan Rajawat, “**Approximately orthogonal non-negative matrix factorization for data clustering**.” (to be submitted in *IEEE Transaction on Signal Processing*, in a week).
2. **Mohan Krishna Nutalapati**, Lavish Arora, Sandeep Kumar and Ketan Rajawat, “**Distribution and asynchronous successive convex approximation ADMM**.” (expected to submit in two weeks in *International Journal of Robotics Research (IJRR)*).
3. **Mohan Krishna Nutalapati**, Atanu Samanta, and Ketan Rajawat, “**SCARAH : A faster stochastic method for solving constrained non-convex optimization**.” (expected to submit in a month, in *IEEE Transaction on Signal Processing*).

Published

1. **Mohan Krishna Nutalapati**, L. Arora, A. Bose, K. Rajawat, R. M. Hegde, “**A Generalized Framework for Autonomous Calibration of Wheeled Mobile Robots**,” *Robotics and Autonomous Systems* (Elsevier), 2022.
2. **Mohan Krishna Nutalapati**, Amrit Singh Bedi, Ketan Rajawat, Marceau Coupechoux, “**Online Trajectory Optimization Using Inexact Gradient Feedback for Time-Varying Environments**”, in *IEEE Transactions on Signal Processing*, vol. 68, pp.4824-4838, 2020.
3. **Mohan Krishna Nutalapati**, S. Joshi, and K. Rajawat, “**Utility-Optimal Trajectory Design for Time-Varying Ocean Environments**”, in *Proc. of the Intl. Conf. on Robotics and Automation (ICRA)*, Montreal, Canada, May 20-24, 2019
4. **Mohan Krishna Nutalapati**, Lavish Arora, Anway Bose, K. Rajawat and, Rajesh M Hegde, “**Model Free Calibration of Wheeled Robots Using Gaussian Process**”, in *Proc. of the Intl. Conf. on Intelligent Robots and Systems (IROS)*, 2019.
5. **Mohan Krishna Nutalapati**, Muppavaram Sai Krishna, Atanu Samanta, Ketan Rajawat, “**Constrained Non-convex Optimization via Stochastic Variance Reduced Ap- proximations**”, in *Proc. of the Sixth Indian Control Conference (ICC)*, 2019, pp. 293-298.
6. Lavish Arora, **Mohan Krishna Nutalapati**, K. Rajawat and, Rajesh M Hegde, “**Automatic Joint Calibration of odometry and sensor parameters**”, in *Proc. of the Intl. Conf. of Advances in Robotics (AIR)*, 2019.

INDUSTRIAL PROJECT

AVAILABLE AND SAFE COLLABORATIVE EDGE ROBOTIC SYSTEM IN WAREHOUSE ENVIRONMENTS

JULY, 2022

- > This work is currently being done at Intel Corporation India, Bangalore
- > One of the verticals is to enable robots to effectively leverage wireless communications and edge computing solutions
- > My role in the project is to find optimal partition of navigational related workloads across robots and edge system
- > Also, I've to enable multi-robot task assignment and path finding capabilities

Edge Robotics Warehouse Automation Navigation Planning Coordination and Control

DIRECTION CONTROL OF UNMANNED AIRCRAFT USING PWM ACTUATION SYSTEM

2011

- > This work was done at Electronics Corporation of India Limited (ECIL), Hyderabad
- > As a undergrad student, my role in the project is to review various state-of-the-art algorithms and implement a proof of concept

ACHIEVEMENTS

1. Won zonal (north) first in DRDO-DRUSE competition conducted at IIT Delhi 2018
2. Qualified in Graduate Aptitude test (GATE) with All India Rank - 441 (among 216K participants) 2014
3. Stood second for presenting a review on “Autonomous cars advancements and future challenges”, in a two-day national-level technical symposium INTERACT 2011, conducted at Anil Neerukonda Institute of Technology and Science (ANITS)
4. Elected as a convener of Institute of Engineers (IE) at GMRIT 2011
5. Availed Central Scholarship for securing 96.1 percentage of marks in the board of Intermediate Education 2008

RELEVANT COURSES

@ IIT Kanpur	Convex Optimization in Signal Processing, Probabilistic Mobile Robotics, Probabilistic Machine Learning, Statistical Signal Processing, Representation and Analysis of Random Signals, Digital Communication Networks, Wireless Communications, Mathematical Methods in Signal Processing
@ Coursera	Data Analysis and Statistical Inference, 3D Motion Dynamics, Control for mobile Robotics
@ Udemy & The Construct	ROS2 for Beginners & ROS2 Navigation (Galactic)

TEACHING AND MENTORING

Tutor	Introduction of Electronics (2 times, @ IITK)
Teaching Assistant	Convex Optimization (Instructor : Prof. Ketan Rajawat, @ IITK) Probabilistic Robotics (Instructor : Prof. Gaurav Pandey, @ IITK) Optimization for Big Data (Instructor : Prof. Ketan Rajawat, @ IITK)

SKILLS

Programming	Python, MATLAB
Tools/Software	InkScape, Adobe Photoshop
Editor	Vim, Visual Studio Code
Typesetting	LaTeX, MS Office/Libre Office
Operating System	Linux(Ubuntu), Windows
Languages	English, Telugu, Hindi
Others	Robot Operating System (ROS), Mujoco Physics Engine, Gazebo Simulator

PERSONAL INFORMATION

DATE OF BIRTH	12 th Jan, 1991
HOBBIES	Playing chess and badminton
MARITAL STATUS	Single
GOOGLE SCHOLAR	tinyurl.com/scholars-nmohank

REFERENCES

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