

M. Nomaan Qureshi

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Research interests Vision based Navigation, Control and Manipulation.

Education **International Institute of Information Technology** Hyderabad, India
Integrated BTech/MS in Computer Science August, 2018 – April, 2023
Advisor: Prof. K. Madhava Krishna.
BTech. GPA: 8.75/10. MS GPA: 9.6/10

Academic Achievements Dean's Research List for excellence in research for the year 2020-21.

Dean's Merit List for academic excellence for the year 2019-20 and 2018-19.

Publications ♦ **RTVS: A Lightweight Differentiable MPC Framework For Real Time Visual Servoing**

M. Nomaan Qureshi*, Pushkal Katara*, Abhinav Gupta*, ..., K. Madhava Krishna
International Conference on Intelligent Robots and Systems (IROS), 2021.

♦ **Learning Object Manipulation Skills from Video via Approximate Differentiable Physics**

Vladimir Petrik, M. Nomaan Qureshi, Josef Sivic, Makarand Tapaswi
International Conference on Intelligent Robots and Systems (IROS), 2022.

♦ **Deep Sequenced Linear Dynamical Systems for Manipulation Policy Learning**

M. Nomaan Qureshi, Ben Eisner, David Held

GPL Workshop, International Conference on Learning Representations (ICLR), 2022

♦ **Flow Synthesis Based Visual Servoing Frameworks for Monocular Obstacle Avoidance Amidst High-Rises**

Harshit K. Sankhla*, M. Nomaan Qureshi*, ... K. Madhava Krishna

International Conference on Automation Science and Engineering (CASE), 2022.

Research Experience — **Research Intern, Robotics Institute, Carnegie Mellon University, U.S.A.**

Advisor: Prof. David Held.

April, 2021 – Present

- Developed differentiable trajectory representation to accelerate the learning by 150% on tasks from metaworld benchmark. Formulated a reparametrization of Linear Dynamic Systems, which makes it possible to integrate LDS into any end-to-end differentiable system. [GPL Workshop, ICLR 22.]

- Solved various engineering problems during the internship. Modified the Garage Reinforcement Learning Library to support multi-action policies, implemented control systems on the newly released Sapien simulator etc.

– **Research Assistant, Robotics Research Center, IIIT Hyderabad.**

Advisor: Prof. K. Madhava Krishna.

May, 2020 – Present

- Proposed a novel and lightweight visual servoing technique for fast navigation which is 10 times faster than existing state-of-the-art approaches. Utilized an effective sampling strategy for optimal control generation, resulting in a 74% decrease in the servoing time. [IROS '21]
- Formulated a framework that leverages the high-precision visual servoing frameworks for avoiding high-rise buildings. Our algorithm reduces the collision rate with buildings by 90% and is able safely navigate in an urban environment. [CASE, 22]

– **Research Assistant, CVIT, IIIT Hyderabad.**

Advisor: Prof. Makarand Tapaswi.

September, 2021 – Present

- Worked on integrating Video Object Segmentation(VOS) with skill learning from videos. The improved segmentation masks obtained from VOS led to a 10% improvement in the execution of these skills.
- Proposed a differentiable approach to solving a set of Ordinary Differential Equations(ODEs) that allows us to approximately model laws of physics such as gravity, friction, and hand-object or object-object interactions.[IROS,22]

Skills

Languages : C, C++, Python, Bash, Javascript

Frameworks : Pytorch, Git, Habitat-Simulator, Open3D, Tensorflow, ROS, Scikit, Garage

Platforms : Linux, Web, MacOS, Windows, Arduino, Raspberry

Tools : Kubernetes, Docker, GIT, PostgreSQL, MySQL, SQLite

**Other
Projects**

Generating Occupancy Grids

Using pre-trained DL models and camera transformations for generating occupancy maps. The system takes a stereo pair and generates a depth map(using PSMNet) and instance segmented scene(using maskrcnn). We then use these to get a 3D Model of the scene. This 3D model is projected to the ground to get the occupancy grid.

Pose Graph Optimization for 2D SLAM

Optimized the 2D trajectory of a robot from scratch using the Levenberg-Marquardt method for non-linear least squares. PGO which is typically used in most of today's SLAM Backend

Model Predictive Control for Path Planning

Implemented the MPC algorithm for an omnidirectional robot to navigate a two dimensional space, avoiding known locations with various obstacles given the localization information.

C-Shell

Implemented a Linux Bash shell, a command line interpreter in C. Supports numerous bash commands along with piping, foreground and background processing.

BP Monitoring Mobile Application

Led a team of four to develop an android application which monitors Blood Pressure (BP) of patients. Features included chat, location tracking of patient, getting data from sensor using bluetooth, raising alerts etc.

Database Engine

Implemented a mini SQL engine that supported various SQL operations like select, join and where clause. Additionally implemented recursion in the SQL engine to support nested SQL queries.

Robotics CV Algorithms

Collection of core tasks related to robotics, computer vision and deep learning

Co-
Curricular

Coordinator : Robotics Club, IIITH.

Organising Robotics Events and Competitions, conducting Teaching sessions for college students.