Zubair **Irshad**

PhD Canidate · Robotics & Deep Learning

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Deep Learning · Perception · Robotics · Artificial Intelligence · Visual Understanding

Education

Georgia Institute of Technology — *Atlanta, GA*

PhD in Robotics/AI and Mechanical Engineering — *Aug. 2017 - Present*

- Courses: Robotics, Deep Learning, Machine Learning, Computer Vision, Intro to Robotics Research, Linear Controls, Math. Methods in Applied Sciences, Reinforcement Learning, Visual Perception, Planning & Controls (Autonomous Systems).

GIK University of Science & Technology — *Topi, PK*

B.S in Robotics/Mechanical Engineering — *Aug. 2011 - May. 2015*

Work Experience

Toyota Research Institute, Machine Learning Research — *Los Altos, CA*

Deep Learning Research Intern with Adrien Gaidon, Rares Ambrus and Sergey Zakharov — *Jan. 2022 - Mar. 2022*

- Implicit neural representations for generalized 3D object understanding

Toyota Research Institute, Robotics — *Los Altos, CA*

Deep Learning and Robotics Research Intern with Thomas Kollar and Michael Laskey — *May. 2021 - Aug. 2021*

- Innovated a Single-Shot Mesh Reconstruction and Category-Level Pose Estimation System (Paper accpeted to ICRA'22)

SRI International — *Princeton, NJ*

Deep Learning Research Intern with Dr. Han-Pang and Dr. Rakesh Kumar — *May. 2020 - Aug. 2020*

- Proposed Semantically-aware spatio-temporal reasoning agent for Vision-and-language navigation (Paper in preprint)

Georgia Institute of Technology — *Atlanta, GA*

Graduate Research Assistant with Dr. Zsolt Kira — *Jan. 2019 - Present*

- Sponsored under the DAPRA Lifelong Learning Machines (*L2M*) program. Developing Supervised and Self-Supervised Learning agents for DeepMind StarCraft2 Environments.
- Research Interests: 3D perception, Scene Understanding and Embodied AI

Research & Projects

Implicit representations for Shape, Appearance & Pose Optimization — *Toyota Research Institute*

Research Intern — *Spring. 2022*

- Proposed a novel differentiable databse of implicit shape and texture priors for 3D novel object understanding in the real world
- Improved SOTA on 6D pose and size estimaiton by 8% ↑ and PSNR by 50% ↑ with latent optimization. (Paper in pre-print)

Object-centric Holistic 3D Scene Understanding — *Toyota Research Institute*

Research Intern — *Summer. 2021*

- Proposed a novel single-shot method to reconstruct complete 3D shape and recover pose and size of novel object instances in real-world.
- Improved performance on 6D pose and size estimation by 12% with fast and real-time inference (40 FPS ↑) [arXiv | Project Page | Github | Video]. Accepted to ICRA'22.

Neural Perception & Planning for Embodied AI — *Georgia Tech*

PhD — *Nov. 2017*

- Proposed an innovative hierarchical method for robotics vision-and-language navigation and introduced a novel data-set i.e. Robo-VLN for long-horizon and cross-modal perception-based control of embodied agents [Project Page | Github | arXiv]. Accepted to ICRA'21.
- Introduced suite of benchmarks and set a new state-of-the-art on robotics vision-and-language navigation task (14% SR ↑ and 14% SPL ↑)

Semantic Cross-Modal Reasoning for Embodied AI — *SRI International*

Research Intern — *Summer. 2020*

- Proposed a transformer-inspired semantically-aware method for Vision-and-language navigation task in Pytorch.
- Improved success performance in unseen simulation environments by 22% ↑ [arXiv]

Autonomous Navigation of Mobile Robots — *Georgia Tech*

PhD — *Summer. 2020*

- Developed algorithms for successfully navigating the turtle-bot robot to given waypoints while avoiding obstacles using camera, lidar and ROS.
- Completed a maze navigation task using Classification and ROS and demonstrated the algorithm on turtlebot3 robot [Project Page | Github]

Environment Perception and Control for Autonomous Driving *Georgia Tech*

PhD *Summer. 2020*

- Developed a visual odeometry system for autonomous driving: Estimated the vehicle trajectory using feature matching among subsequent set of camera images [Project Page | Github]
- Implementation of Longitudinal and Lateral control to autonomously navigate a car through a set of given way points

Patent Applications

P1 **M.Z.Irshad**, T.Kollar, M.Laskey, K.Stone. Single-shot multi-object 3D shape reconstruction and categorical 6D pose and size estimation. US Patent App. 63/243,984

P2 H.Chiu, Z.Seymour, N.C.Mithun, **M.Z.Irshad**, S.Samarasekera, R.Kumar, K.Thopalli. System and method for efficient visual navigation. US Patent App. 63/126,981

Teaching

Deep Learning CS7643 (Co-taught with Facebook AI): *Atlanta, GA*

Graduate Teaching Assistant, Georgia Institute of Technology *Spring. 2021*

- Hosting office hours and grading assignments.

Robotics ME 7757 *Atlanta, GA*

Teaching Practicum, Georgia Institute of Technology *Spring. 2011*

- Co-teaching 3 classes, designing homework and exam.

Honors & Awards

International

2017 **Fulbright International Scholar,** for M.S at Georgia Tech *U.S.A*

2018 **ASME RICE Cullimore Scholar,** for M.S at Georgia Tech *Atlanta, GA*

2016 **Global Employee Recognition Awards,** for best performance at GSK *Karachi, PK*

Domestic

2015 **Distinction/Dean honors roll,** (all semesters) for outstanding academic achievement *Topi, PK*

2018 **1st Place,** Technology Ventures class competition among 12 teams at Georgia Tech *Atlanta, GA*

Skills

Deep Learning frameworks Pytorch, Tensorflow

Programming Python, C++, Matlab, ROS

Robots Fetch, Turtlebot, PyRobot (Facebook), Golem Krang(Humanoid)

Professional Activities

Reviewer ICRA ' 21

Reviewer ICRA ' 22

Reviewer IROS ' 21

Reviewer RA-L ' 22

Advising Asawaree Bidhe (M.S Georgia Tech), Arvin ignaci (M.S Georgia Tech)

Leadership

2018 **Graduate Senator,** Student Government Association, Georgia Tech *Atlanta, GA*

2015 **Chairman,** Institution of Mechanical Engineers, GIKI *Topi, PK*