

# Zubair Irshad

PHD CANDIDATE · ROBOTICS & DEEP LEARNING

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

## Education

### Georgia Institute of Technology

PHD IN ROBOTICS/AI AND MECHANICAL ENGINEERING

📍 Atlanta, GA

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

B.S IN ROBOTICS/MECHANICAL ENGINEERING

📍 Topi, PK

Aug. 2011 - May. 2015

## Work Experience

### Toyota Research Institute, Machine Learning Research

DEEP LEARNING RESEARCH INTERN WITH **RARES AMBRUS**, **SERGEY ZAKHAROV** AND **ADRIEN GAIDON**

📍 Los Altos, CA

Jan. 2022 - Aug. 2022

- Implicit neural representations for generalized 3D object understanding (Paper accepted to ECCV'22, Patent under submission)

### Toyota Research Institute, Robotics

DEEP LEARNING AND ROBOTICS RESEARCH INTERN WITH **THOMAS KOLLAR** AND **MICHAEL LASKEY**

📍 Los Altos, CA

May. 2021 - Aug. 2021

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

### SRI International

DEEP LEARNING RESEARCH INTERN WITH **DR. HAN-PANG** AND **DR. RAKESH KUMAR**

📍 Princeton, NJ

May. 2020 - Aug. 2020

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

### Georgia Institute of Technology

GRADUATE RESEARCH ASSISTANT WITH **DR. ZSOLT KIRA**

📍 Atlanta, GA

Jan. 2019 - Present

- Sponsored under the DAPRA Lifelong Learning Machines (L2M) program. Developing Supervised and Self-Supervised Learning agents for Deep-Mind StarCraft2 Environments.

## Research & Projects

### Implicit representations for Shape, Appearance & Pose Optimization

Toyota Research Institute

RESEARCH INTERN

Spring. 2022

- Proposed a novel differentiable database of implicit shape and texture priors for 3D novel object understanding in the real world
- Improved SOTA on 6D pose and size estimation by 8% ↑ and PSNR by 50% ↑ with latent optimization. Paper accepted to ECCV'22.

### Object-centric Holistic 3D Scene Understanding

Toyota Research Institute

RESEARCH INTERN [ARXIV | PROJECT PAGE | GITHUB | VIDEO]

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 ↑). Accepted to ICRA'22

### Neural Perception & Planning for Embodied AI

Georgia Tech

PHD [PROJECT PAGE | GITHUB | ARXIV]

Nov. 2017

- Proposed a hierarchical method for robotics vision-and-language navigation ; achieves state-of-the-art (14% SR ↑ and 14% SPL ↑)
- Introduced a novel data-set for long-horizon and cross-modal perception-based control of embodied agents. Accepted to ICRA'21.

### Semantic Cross-Modal Reasoning for Embodied AI

SRI International

RESEARCH INTERN [ARXIV | PATENT | VIDEO]

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% ↑

### Autonomous Navigation of Mobile Robots

Georgia Tech

PHD [PROJECT PAGE | GITHUB]

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

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

## Selected Publications

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- C1** M.Z.Irshad, Sergey Zakharov\*, Rares Ambrus, Thomas Kollar, Zsolt Kira, Adrien Gaidon, "ShAPO: Implicit Representations for Multi-Object Shape, Appearance, and Pose Optimization", [European Conference on Computer Vision, ECCV 2022](#)
- C2** M.Z.Irshad, T.Kollar, M.Laskey, K.Stone, Z.Kira, "CenterSnap: Single-Shot Multi-Object 3D Shape Reconstruction and Categorical 6D Pose and Size Estimation", [IEEE International Conference on Robotics and Automation, ICRA 2022](#)
- C3** M.Z.Irshad, C.Y.Ma, Z.Kira, "Hierarchical Cross-Modal Agent for Robotics Vision-and-Language Navigation", [IEEE International Conference on Robotics and Automation, ICRA 2021](#)
- C4** M.Z.Irshad, N.Mithun, Z.Seymour, H.P.Chiu, S.Samarasekera, R.Kumar, "SASRA: Semantically-aware Spatio-Temporal Reasoning Agent for Vision-and-Language Navigation", [International Conference on Pattern Recognition, ICPR 2022](#)

## Patent Applications

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- 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

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**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

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## 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

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- Deep Learning frameworks** Pytorch, Tensorflow
- Programming** Python, C++, Matlab, ROS
- Robots** Fetch, Turtlebot, PyRobot (Facebook), Golem Krang(Humanoid)

## Professional Activities

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- Reviewer** ECCV ' 22
- Reviewer** ICRA ' 22, RA-L ' 22
- Reviewer** IROS ' 21, ICRA ' 21
- Advising** Asawaree Bidhe (M.S Georgia Tech), Arvin ignaci (M.S Georgia Tech)