



## Mohamed Nagy Mostafa

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🌐 Website: <https://mohamednagymostafa.github.io/web/>

### EDUCATION AND TRAINING

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#### Doctor of Philosophy, Electrical Engineering and Computer Science

**Khalifa University** | **CGPA: 4 out of 4** [ 01/01/2023 – Current ]

City: Abu Dhabi | Country: United Arab Emirates | Final grade: 4 | Thesis: Robust Multi-Object Tracking Through Motion Dynamics and Deep Semantic Integration

Thesis Title: Robust Multi-Object Tracking Through Motion Dynamics and Deep Semantic Integration

#### Robotics Software Engineering Nanodegree

**Udacity** [ 31/05/2023 – 30/06/2023 ]

Country: United Arab Emirates

#### Master's degree, Computer Science

**Khalifa University** | **CGPA: 3.93 out of 4** [ 17/01/2021 – 31/12/2022 ]

City: Abu Dhabi | Country: United Arab Emirates | Field(s) of study: Computer Science | Final grade: 3.93/4.0 CGPA | Thesis: Persistence 3D Multi-Object Tracking for Autonomous Vehicles Using Sensor Fusion

Thesis Title: Persistence 3D Multi-Object Tracking for Autonomous Vehicles Using Sensor Fusion

#### Bachelor in Mathematics and Computer Science

**Helwan University** [ 01/09/2014 – 31/05/2018 ]

City: Cairo | Country: Egypt | Field(s) of study: Mathematics and Computer Science

### WORK EXPERIENCE

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🏢 **Technical University of Munich** – Munich, Bavaria, Germany

#### Visiting Researcher

[ 09/01/2026 – 31/05/2026 ]

Joining the Institute of Automotive Technology at the Technical University of Munich (TUM) to pursue research in multi-object tracking for autonomous vehicles, as well as deploy my recent tracking research on the TUM autonomous vehicle/s.

🏢 **Khalifa University** – Abu Dhabi, United Arab Emirates

#### Graduate Researcher and Teaching Assistant

[ 01/01/2021 – Current ]

As a graduate researcher, I am a member of an autonomous vehicle lab at Khalifa University, responsible for the perception engine. In addition, I have teaching assistant duties for undergraduate and postgraduate courses. i.e., ECCE-230 Object-Oriented Programming and COSC-604 Artificial Intelligence.

🏢 **Harvard University** – Cambridge, Massachusetts, United States

#### NSF IAIFI Summer Workshop

[ 08/2025 – 08/2025 ]

Attending the NSF AI Institute for Artificial Intelligence and Fundamental Interactions summer workshop as a speaker for a contributed talk. The talk covers part of my recent research published in IEEE Transactions on Intelligent Transportation Systems.

🏢 **ETH Zürich** – Zürich, Switzerland

## RobotX Summer School

[ 07/2023 – 07/2023 ]

Joining the ETH Robotics Summer School 2023 held by the RobotX initiative at ETH Zurich. The summer school involves tutorials and hands-on sessions that will take place at a dedicated education and training center for search and rescue, an opportunity to program a (semi)-autonomous rough-terrain UGV, to extensively test it in a variety of environments, and finally to challenge other colleagues in a Search and Rescue competition. Some of the subjects/topics included in the summer school are state estimation, trajectory optimization, mapping and localization, computer vision, and SLAM. Our team developed and integrated ROS packages into a ground robot to enable fully autonomous operation in a rough environment. Moreover, we employed exploration techniques in the robot to navigate, explore, and map buildings that had never been seen before.

 **Khalifa University** – Abu Dhabi, United Arab Emirates

## Autonomous Vehicles Lab Member

[ 01/06/2021 – 01/06/2023 ]

I am a part of the perception engine team in an autonomous vehicle lab at Khalifa University. I have developed projects that include 3D multi-object tracking (Camera/LiDAR/IMU), drivable surface detection and localization (Stereo Camera-Zed2), and roughness estimation (LiDAR). We also joined the Dubai World Challenge for Self-Driving Transport 2021 and won the first-place for ground robotics.

 **Helwan University** – Egypt

## Teaching Assistant

[ 01/09/2018 – 2021 ]

Teaching Computer Science and Mathematics Subjects

Subjects: (Math (2) -Differential Equations - Artificial Intelligence(Machine/Deep Learning) - Introduction to programming - Advanced Programming(Object-Oriented) - Basic Android Development- Algorithms)

 **South African National Space Agency (SANSA)** – Pretoria, South Africa

## Research assistant

[ 01/01/2018 – 31/07/2018 ]

I cooperated with a research team in the space department at Helwan University and a research team at South African National Space Agency (SANSA) to develop software tools that facilitate and accelerate their research. The research focused on tracking the radiation amount (Dose) on worldwide flights.

## PROJECTS

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[ 31/12/2025 – 31/05/2026 ]

**EDGAR: Perception for Self-Driving in Urban Area (TUM)** I have joined the perception team at the Technical University of Munich (TUM) for the EDGAR project. I am responsible for the tracking module and for overcoming challenges such as occlusion, ghost tracks, and safe navigation. My research on multi-object tracking is being deployed to replace traditional tracking in the EDGAR. This work includes investigation, evaluation, and testing via autonomous driving in wide urban regions in Munich.

Link: <https://youtu.be/7x6zwAV08Xc>

[ 09/2025 – 11/2025 ]

**LLM Prompt Engineering for Code Reasoning** The objective is to fine-tune the Qwen model to reason over code problems in various programming languages. A dynamic prompt is designed, inspired by the RAG technique, to handle multiple coding prompts, including debugging, algorithmic problems, and code compilation. The model is fine-tuned using LoRA, QLoRA, and PLoRA, with a deep analytical investigation of the performance of each strategy.

Link: <https://1drv.ms/p/c/a8843f00b74923e2/IQDOPTiPKSYZQZRYLRVKIWk8Afb9RCAqr3cq7p0loqXf9Lg?e=a4jl4U>

[ 10/2024 – 12/2024 ]

**Visual Motion Multi-Object Tracking Based on Kalman Filter Using Event Camera** The main objective is to track multiple target based on their captured visual motion through an event camera. The Kalman filter is reformulated and adapted for visual motion estimation. Given current observed motion for an object, the proposed Kalman filter estimates next visual motion state for the object. The result showed it efficiency for close object, but low performance with distant objects.

Link: <https://youtu.be/bx5OtXj64OI?feature=shared>

[ 07/2023 – 08/2023 ]

**Autonomous Robot Navigation in Rough Terrain** I joined ETH Zurich for a robotics summer school, where I cooperated with my team members to implement a full-stack robot for a segway. The stack includes perception, mapping, localization, state estimation, navigation, and trajectory optimization. We worked on a ground robot, and we successfully made the robot navigate in the target region, locate objects on the map, explore the entire area, and safely leave the place.

Link: <https://www.linkedin.com/feed/update/urn:li:activity:7101527850154901504/>

[ 17/01/2023 – 06/2023 ]

**Odor Diffusion Simulation and Mapping Using Aerial Drone** The objective of the project is outdoor odor diffusion finding. Initially, a particle shooter is implemented to simulate odor diffusion on Gazebo, and the scattering of the particles is based on a predefined diffusion model. An air monitoring sensor is customized and embedded in the AutoPilot drone to measure particle concentration per  $m^3$ . Eventually, the drone performs sophisticated algorithms to find odor diffusion sources in the environment. The work is implemented in C++.

Link: <https://youtu.be/6GMyQs353AA>

[ 06/2023 – 06/2023 ]

**Home Service Robot** The Home Service Workspace project is a robotics project developed using ROS (Robot Operating System). It aims to simulate a home service scenario where a robot performs pick-up and drop-off tasks autonomously in a simulated environment.

Link: <https://github.com/MohamedNagyMostafa/home-service-robot>

[ 2022 – 2023 ]

**Multi-Object Association and Tracking Using Sensor Fusion for Autonomous Vehicles** This is my thesis project in multi-object tracking for self-driving cars. The project utilizes a camera, LiDAR, and IMU sensors to persistently track objects in 2D Camera frames and a 3D LiDAR point cloud. The project obtains objects' trajectories using Kalman Filter under constant acceleration assumption. This project is implemented from scratch (End-to-End) using C/C++, and a portion of it is submitted to ICRA 2023 under the title DFR-FastMOT framework. The framework is a non-learning online multi-object tracking that utilizes a camera and LiDAR sensors and outperforms recent state-of-art (learning and non-learning) methods with the capability to track objects under either long occlusions or detection distortion. The computational time is seven times less than recently published frameworks.

Link: [https://www.linkedin.com/posts/mohamed-nagy-7a2a25b9\\_autonomousvehicles-sota-autonomoucars-activity-7000823626237153280-hLIY?utm\\_source=share&utm\\_medium=member\\_desktop](https://www.linkedin.com/posts/mohamed-nagy-7a2a25b9_autonomousvehicles-sota-autonomoucars-activity-7000823626237153280-hLIY?utm_source=share&utm_medium=member_desktop)

[ 2022 ]

**3D Map Roughness Estimation using LiDAR for Mobile Robots** In this project, I have developed a 3D adjustable grid map for roughness estimation using the LiDAR point cloud. The grid is a map of small rectangles surrounding the robot; each rectangle estimates a roughness score based on the contained point cloud. RANSAC algorithm and Euclidean distance property are used to complete the project. The project is implemented using C++.

Link: [https://www.linkedin.com/posts/mohamed-nagy-7a2a25b9\\_autonomoucars-tracking-detection-activity-7002354214672711680-3tCI?utm\\_source=share&utm\\_medium=member\\_desktop](https://www.linkedin.com/posts/mohamed-nagy-7a2a25b9_autonomoucars-tracking-detection-activity-7002354214672711680-3tCI?utm_source=share&utm_medium=member_desktop)

[ 2021 ]

**3D Drivable Surface Detection and 2D Localization Map Using stereo camera** In this project, I used the ModifiedUNET model to extract drivable surfaces using semantic segmentation and the RANSAC algorithm to localize the drivable surface into 3D space using a stereo camera (Zed2) depth map. Besides, semantic outcome segmentation is also utilized to localize obstacles on the surface. Lastly, I utilized the camera's pose information to generate a 2D map of mobile robots' tracks and localize the robot on the map.

Link: <https://www.linkedin.com/feed/update/urn:li:activity:6863195535113764864/>

[ 2021 ]

**Semantic Segmentation | Modified U-Net Model** A research project investigates the weaknesses of deep learning architectures for semantic segmentation. In this project, I implement a U-Net model architecture from scratch and then start upgrading the architecture based on the observed weaknesses in the performance of the Mapillary Vistas dataset. The last architecture involves downsampling and upsampling hierarchy from the U-Net model, skipping connections propagation from DenseNet, and parallel convolution layers with kernel sizes from the InceptionV3 model.

Links: <https://www.linkedin.com/feed/update/urn:li:activity:6868635094811205632/> | <https://github.com/MohamedNagyMostafa/RoadSceneUnderstanding-ModifiedUNET> | [https://www.youtube.com/watch?v=rs\\_arrF417I](https://www.youtube.com/watch?v=rs_arrF417I)

## SKILLS

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Sensor Fusion / Autonomous Cars / Deep Learning, / Computer vision: Object detection, object tracking / State estimation / C, C++ C# / Android Development (Android Studio) / Embedded Systems: Embedded C / Mathematics for Machine Learning / Pytorch / Tensorflow / ROS, Gazebo / Robot Perception / Devops: Docker, Jenkins / Path Planning

## HONOURS AND AWARDS

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[ 27/11/2025 ] Khalifa University

### Outstanding Graduate Student Award

Link: <https://github.com/user-attachments/assets/a75012fe-130f-47f9-88a1-312a1752b4a5>

[ 09/2024 ] Federal Authority for Identity, Citizenship, Customs & Port Security

**UAE Golden VISA | Outstanding Graduate Student** I have been nominated as an outstanding graduate student to obtain the UAE Golden VISA.

[ 04/2023 ] ETH Zurich

**Top 50 Participants Globally | RobotX Summer School** I have been selected as one of the 50 participants from graduate students around the world to attend RobotX Summer School, fully funded by ETH Zurich.

[ 10/2021 ] Dubai World Congress for Self-Driving Transport

### First Place for Ground Autonomous Robots

Links: <https://www.linkedin.com/feed/update/urn:li:activity:6863195535113764864/> | <https://sdcongress.com/> | <https://www.ku.ac.ae/two-ku-teams-win-1st-and-2nd-at-dubai-world-challenge-for-self-driving-transport>

[ 2020 ] Helwan University

**Outstanding Teaching Assistant** According to my progress as a teaching assistant, I have been chosen by the Mathematics department in the faculty of science at Helwan University to be honored by the chancellor of Helwan University as the best teaching assistant over the department.

[ 10/2018 ] One Million Arab Coders Initiative "Dubai Future Foundation"

**One of Best Tutors "Ceremony"** Selected as one of the top One Million Arab Coders initiative tutor over the Arab worldwide, moreover, granted a chance to attend the initiation ceremony in Dubai and meet HH Mohamed Bin Rashed and Dubai Future Foundation organization.

Link: <https://www.facebook.com/HHSheikhMohammed/photos/a.10152989801722908/10157434173027908>

[ 01/2018 ] Google Developer Challenge Scholarship

**Google's Winners** Challenge is offered by Google around the world for 3 months in android developing to select best participants (Google winners) for awarding a full advanced android developing Nanodegree program. I have selected to be one of them. I have been selected as one of Google winners.

## PUBLICATIONS

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[2026]

### **Polycepta: Rethinking Visual Tracking with Object-Centric Structured Memory**

**Authors:** Mohamed Nagy, Naoufel Werghi, Jorge Dias, Majid Khonji | **Journal Name:** IEEE Transaction on Image Processing (Under Review)

[2025]

### **Towards Accurate State Estimation: Kalman Filter Incorporating Motion Dynamics for 3D Multi-Object Tracking**

**Authors:** Mohamed Nagy, Naoufel Werghi, Bilal Hassan, Jorge Dias, Majid Khonji | **Journal Name:** IEEE Robotics and Automation Letters (Under Review)

[2025]

### **RobMOT: Robust 3D Multi-Object Tracking by Observational Noise and State Estimation Drift Mitigation on LiDAR PointCloud**

**Authors:** Mohamed Nagy, Naoufel Werghi, Bilal Hassan, Jorge Dias, Majid Khonji | **Journal Name:** IEEE Transactions on Intelligent Transportation Systems

Link: [https://youtu.be/rrMHbu\\_VST0](https://youtu.be/rrMHbu_VST0)

[2023]

**DFR-FastMOT: Detection Failure Resistant Tracker for Fast Multi-Object Tracking Based on Sensor Fusion**

Authors: Mohamed Nagy, Majid Khonji, Jorge Dias and Sajid Javid | Journal Name: IEEE International Conference on Robotics and Automation (ICRA)

Link: <https://www.linkedin.com/feed/update/urn:li:activity:7021039544699346944/>

[2023]

**Towards Autonomous and Safe Last-mile Deliveries with AI-augmented Self-driving Delivery Robots**

Journal Name: IEEE Access

Eyad Sh., Areg Karap., Arjun Sh., Murad Meb., Mustofa Basri, Mohamed Nagy, Majid Khonji, Jorge Dias

[2020]

**The 4th Industrial Revolution in Coronavirus Pandemic Era** Mohamed Nagy, Hagar M. Abbad, Ashraf Darwish, Aboul Ella Hassanien. The 4th Industrial Revolution in Coronavirus Pandemic Era. Springer - International Publisher Science, Technology. 2020.

[2019]

**A Modified Method for Detecting DDoS Attacks Based on Artificial Neural Networks** Mohamed Nagy, Moataz A. Mohamed, Mohamed El-Sersy, Khalid S. Aloufi. A Modified Method for Detecting DDoS Attacks Based on Artificial Neural Networks. The 1st International Conference on Information Technology (IEEE/ITMUSTCONF