Mark Naeem

Robotics and Computer Vision Engineer

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A computer vision and robotics research and development engineer with demonstrated hands-on experience in industry and academia. A passionate self-learner with an urge to support open-source and research communities. A recognised team player in startups and prominent open-source projects, excelling in dynamic, self-directed, and challenging environments.

EXPERIENCE

Perception Software Engineer
Kingdom Technologies Ltd

January 2022 – Present
Glasgow, UK

Kingdom is an autonomous lawnmower manufacturer for large-scale fields. Working in a small team for a startup, I undertake a diverse range of responsibilities.

- Operating an extensive suite of sensors (LiDAR, stereo cameras, GNSS, IMU) in dynamic, unstructured environments shared with humans.
- Optimising and productising models for real-time, safety-critical tasks on resource-constrained devices.
- Working on state-of-the-art perception models such as 3D object detection, point cloud segmentation, obstacle classification, and traversability estimation.
- Investigating different visual odometry techniques for GNSS-denied environments with limited visual features.
- Running CI/CD pipelines to streamline software deployment across a network of over 50 active assets.
- Navigated multiple software development lifecycles (SDLC) – from business requirement analysis and planning to the implementation of embedded drivers, high-level interfaces, the creation of unit/integration tests, and maintenance.
- Built MLOps pipelines for training, testing, deployment, and performance monitoring for various vision models.

Machine Learning Research Engineer
Uniparticle

September 2020 – December 2021
Cairo, Egypt

Uniparticle is a software house specialised in large-scale and government projects. I worked on various projects in different areas of machine learning such as machine vision, recommendation systems, and probabilistic modelling.

- Built IDeepify, a complete end-to-end deep learning-based KYC (Know Your Customer) pipeline.
- Published a novel Hidden Markov Model-based technique, in collaboration with Discovery Education, to analyse assessment results. The technique was validated with a real-life dataset.
- Built BKT-CAT, a Bayesian knowledge tracing computerised adaptive testing system.
- Used knowledge space theory and recommendation systems along with adaptive testing results to build an adaptive learning engine.
- Introduced various probabilistic student modelling and simulation techniques to improve adaptive quizzes quality.
- Improved the performance of an existing adaptive testing simulation algorithm, optimising it to run 20 times faster.

Teaching Assistant - Machine Vision
Ain Shams University

September 2020 – February 2021
Cairo, Egypt

- Tutored and prepared the material for the machine vision course.
- The course covered traditional computer vision techniques and modern machine learning-based approaches.

Visiting Researcher
University of Central Lancashire (UCLan)

June 2019 – September 2019
Preston, UK

- The grant goal was to fully design, simulate, and manufacture RHex, an off-road legged mobile platform.
- Led a team of three researchers.
- Worked on the robot's locomotion and gait analysis.
- Designed and implemented the leg joints' velocity profiles and controllers.

PUBLICATIONS

Bayesian Knowledge Tracing for Assessment Results Analysis   IEEE

February 2022   <u>Link to the paper</u>

Bayesian Knowledge Tracing, a Hidden Markov model, is utilised to analyse assessment results. The technique was tested and validated with a real-life dataset. This was a collaboration research project between Discovery Education and Uniparticle.

Linear Time Invariant State Space System Identification Using Adam Optimization   IEEE

February 2020   <u>Link to the paper</u>

A new system identification method is proposed. A state space model is presented with a TensorFlow graph. Adam optimisation is used to optimise the learnable state and input matrices.

PROJECTS

VSLAM Playground 🌐◯▶

A full Visual SLAM pipeline using deep learning-based feature descriptors and matchers and deep stereo depth estimation.

Depth Yolact ROS 🌐◯▶▶

A real-time 3D object detection and pointcloud instance segmentation for RGBD images.

IDeepify 🌐

Robust deep learning-based KYC product consisting of face recognition and matching, text segmentation, data extraction, and OCR. Synthetic data was used for training due to the scarcity of labelled data.

Swerve Steering Controller – ROS Controller Package 🌐◯▶

A real-time safe N-wheel non-holonomic omnidirectional vehicle controller.

Deep Computer-Aided Sperm Analysis (CASA) 🌐

Faster R-CNN object detection and a modified DeepSORT tracking were used to detect and track human spermatozoa in phase-contrast, dark-field, and bright-field microscopy imaging.

Move Base Sequence – ROS Package 🌐◯▶

A ROS action server to handle multiple goals and track execution with ROS navigation stack.

D435i Visual-Inertial Odometry and SLAM 🌐

D435i camera is solely used to obtain reliable visual-inertial odometry and SLAM.

AWARDS

- Al-Alfi foundation scholarship for outstanding undergraduate students
- Erasmus+ research grant at the University of Central Lancashire (UCLan)
- Graduation project grant organised by the University of Lincoln and Ain Shams University
- Best project of the year for design of mechatronic systems course
- 1st place in FSUK18 C&M, honoured by the president in the National Youth Conference 2018, Egypt

SKILLS

C/C++, Python, Git, CI/CD, Linux, RTOS, Embedded Software, Docker, Kubernetes, MATLAB, ROS/ROS2, ADAS, State Estimation, Localisation, SLAM, Visual Odometry, Sensor Fusion, Multi-Sensor Calibration, Motion Planning, CUDA, Reinforcement Learning, Tensorflow, PyTorch, Teamwork, Leadership, Self-discipline, Problem-Solving

EDUCATION

Ain Shams University   September 2015– June 2020

B.Sc. in Mechatronics Engineering – Robotics - Class of 2020   Five-year degree

- **GPA:** 3.86/4.00
- Ranked Top 5 (3rd)
- **Graduation Project:** Autonomous mobile manipulator for fruit picking – A collaboration between Ain Shams University and University of Lincoln. (project GPA: 4.00/4.00 A+)
- **Activities:**
  - Embedded software engineering team – Ain Shams Racing team (FSUK18) – 1st place Cost & manufacturing.
  - Powertrain and Business teams – Sussex Ain Shams (SAR) Racing team (FSUK19).