JOSEPH ADEOLA

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OBJECTIVE

Graduate student specializing in Intelligent Robotics, university valedictorian, and bronze medalist at the International Youth Mathematics Challenge. Proficient in robotics, machine learning, computer vision, programming, control, and motion planning, with 3 years experience in software development. Passionate about continual learning and seeking a Master's thesis research position in Task Planning for Robotic Applications using LLMs at Austrian Institute of Technology GmbH. Committed to delivering innovative research contributions and creating a significant impact on the organization's success.

EDUCATION

Erasmus Mundus Masters in Intelligent Field Robotic Systems,   Sept 2023 - Feb 2024
University of Zagreb, Faculty of Electrical Engineering and Computing, Zagreb, Croatia.
Relevant Coursework: Multi-robot systems, Human-robot interaction, Ethics and technology, Aerial Robotics, Advanced Machine Learning, Sensors, perception, and actuation in Robotics

Erasmus Mundus Masters in Intelligent Field Robotic Systems,   Sept 2022 - June 2023
Universitat De Girona, Spain.
Relevant Coursework: Robot Manipulation, Probabilistic Robotics, Autonomous Systems, Multiview Geometry, Machine Learning, Hands-on Perception, Hands-on Localization, Hands-on Intervention, Hands-on planning.
Grade: 9.01/10

Bachelor of Science in Mathematics,   2016 - 2021
University of Ilorin, Nigeria.
Relevant Coursework: Linear Algebra, Differential Equations, Numerical Analysis, Computer Programming, Optimization, Mathematical Modelling, Mathematical Packages, Abstract Algebra & Probability Distribution,
Grade: 4.92/5.0
Honors: First-Class Honors, Dean's List, University Valedictorian (ranked 1st out of 9,338 graduates)

SKILLS

Technical Skills: Python, Pandas, Numpy, Matplotlib, PyTorch, TensorFlow, Keras, Scikit-Learn, Kivy, Pytrees | Matlab| C++ | R | C | OMPL | PDDL | Robot Operating System (ROS) | Docker | Git | OpenCV | Linux OS | Gazebo | Stonefish | MS Office Suites
Knowledge Base: Robotics, Software Development, Sensor Fusion, Motion Planning & Control, Kalman Filtering, Software Architecture, SLAM, Deep Learning, Reinforcement Learning, Machine Learning, Supervised Learning, Neural Networks, Task Planning, Point Clouds, 3D Reconstruction, Visual Odometry, Project Management
Data Analysis: MS Excel, R, VBA, Data Visualization, Data Wrangling
Soft Skills: Communication, Leadership, Team-Work, Critical Thinking, Problem-Solving

EXPERIENCE

Deep Learning Research Intern   Jun 2023 - Present
Computer Vision and Robotics Research Institute, Universitat De Girona   *Girona, Spain*

- Worked on the [iToBos project](), a research initiative focused on developing an intelligent total body scanner for early detection of melanoma using computer vision techniques and deep learning models.

- Applied computer vision techniques for dataset preprocessing to improve the quality and usability of the skin lesion dataset.

- Developed and trained deep learning models for skin lesion detection and classification using state-of-the-art architectures.

- Collaborated with a multidisciplinary team of researchers and professionals to achieve project objectives and milestones.

- Contributed to the research and implementation of an explanable AI technique for generating histological text descriptions for lesion images, enhancing the interpretability of AI-driven diagnoses.

Financial Risk Management Intern   Feb 2022 - Sept 2022
KPMG Professional Services,   *Lagos, Nigeria*

- Developed a C++ program for stock option pricing, which involved coding and debugging the software and testing it against market data to ensure accuracy.
- Built financial models in R, MS Excel, and VBA, and used data analytics tools to analyze and interpret financial data for clients.
- Designed and developed software for the probability of default and expected credit loss estimation with a team of four, for a major Nigerian Bank using R and Python.

Graduate Research Assistant   June 2021 - Nov 2021
University of Ilorin   *Ilorin, Nigeria*

- Collected and cleaned data for research projects, utilizing Python libraries and MS Excel.
- Designed, implemented, and developed Python algorithms and software for data-cleaning automation, resulting in more efficient and accurate data-cleaning processes.
- Analyzed large datasets and utilized data to make predictions, contributing to the development of research findings.

UNIVERSITY PROJECTS

Computer Vision

- **Development of a Feature Tracker using ICP Algorithm for Event-based Pose Estimation on DAVIS346 Camera Sensor**
  Collaboratively, my team and I developed a feature tracker for an event-based pose estimation algorithm, specifically for the DAVIS346 event camera sensor. The project consisted of two main parts. Firstly, we implemented a feature tracker using the iterative closest point (ICP) algorithm for event-based vision. Secondly, we integrated the feature tracker with intensity images to initialize the features and estimate the initial pose. We evaluated the performance of the algorithm by testing it on self-recorded datasets from the DAVIS346 event-based sensor. In my role as the team lead, I took charge of managing version control, designing algorithms, and implementing certain sections of the algorithm in Python.

- **Stereo Visual Odometry Using UTIAS Dataset**
  Leveraged the UTIAS Long-Term Localization and Mapping Dataset in this project to address the stereo odometry challenge for a Robot Utility Vehicle using two distinct approaches. Conducted an uncertainty analysis to evaluate the performance of these approaches. Applied the solutions to a

complete trajectory and juxtaposed the outcomes with ground truth data to identify any drift issues and draw insightful comparisons.

- **Camera Calibration, Pose Estimation, and Augmented Reality using Aruco Markers in C++** I developed a project in C++ that involved camera calibration, pose estimation, and augmented reality using Aruco markers. The project began with camera calibration to determine intrinsic parameters such as focal length and distortion coefficients. Then, using Aruco markers as visual cues, I implemented pose estimation techniques to estimate the camera's position and orientation relative to the markers. Finally, I integrated augmented reality by overlaying virtual objects onto the real-world camera feed based on the estimated camera pose. This project allowed me to gain practical knowledge in computer vision, camera calibration techniques, and augmented reality applications.

- **Classification on the Nano: Facial Expression Recognition using Transfer Learning with RESNET-18 on Nvidia Jetson Nano**
  Implemented a deep-learning framework for facial expression recognition on the Nvidia Jetson Nano device, utilizing transfer learning techniques with the RESNET-18 architecture. The project focused on training the model to recognize various facial expressions, such as happiness, sadness, anger, and more, contributing to applications in emotion analysis and human-computer interaction.

- **Underwater Image Analysis and Registration**
  Engaged in a two-week lab project on underwater image analysis and registration. Employed SIFT algorithm for robust feature extraction, conducted image registration aligning divergent images in the same area. Demonstrated skill in planar transformations using homography matrices and refining accuracy through data normalization and RANSAC outlier rejection techniques.

- **Epipolar Geomerty and Stereo**
  Explored Epipolar geometry and fundamental matrices through a lab project. Calculated transformation matrices for simulated dual cameras and derived the fundamental matrix connecting them. Implemented the 8-point algorithm for comparison. Evaluated noise effects on results.

SLAM and Control

- **Implementation of EKF-SLAM with ICP scan-matching using 2D LiDAR and IMU sensors.**
  As part of a team, I implemented an ICP scan-matching-based Extended Kalman Filter (EKF) for Simultaneous Localization and Mapping (SLAM) using 2D LiDAR on a TurtleBot robot. We fused an IMU sensor with the 2D LiDAR to update the robot's heading state and performed online extrinsic calibration to estimate the sensor transformation from the robot's center. My responsibilities included deriving the equations and implementing them in Python, while my colleagues conducted tests on the real robot. We evaluated the performance of the ICP scan-matching SLAM system through comparisons between odometry and EKF-SLAM results via simulations and tests in various indoor environments.

- **Feature-based SLAM using Monocular Camera and Aruco Markers**
  I implemented a feature-based Simultaneous Localization and Mapping (SLAM) system using a monocular camera and Aruco markers. The project focused on estimating the camera's pose and mapping the environment based on visual features extracted from Aruco markers. By leveraging the information provided by the markers, the SLAM system enabled real-time localization and mapping capabilities using a single camera. This project involved feature extraction, feature matching, and optimization techniques to estimate the camera pose and construct a map of the environment. It provided me with practical experience in feature-based SLAM algorithms and their implementation using computer vision techniques.

- **Design and Development of a kinematic Control System for a Mobile Manipulator based on the Task-Priority Redundancy Resolution**
  Implemented a vision-based pick-and-place system for an ArUco-tagged cube using a Kobuki Turtle-Bot 2 equipped with an Intel RealSense camera and a uSwift Arm Pro manipulator. Developed a kinematic controller and a pick-and-place behaviour trees control sequence that allows the robot to detect the ArUco cube, pick it up, and place it on its back. The robot then moves to the nearest corner, picks up the cube again, and places it near the corner. Evaluated the system's performance through simulations and tests on the real TurtleBot at the Polytechnic School labs

Motion Planning

- **Autonomous Robot Exploration using Frontier-Based RRT* Algorithm with Dynamic Window Controller and OMPL Path Planner**
  As part of a team, I contributed to the development of a real-time sampling-based autonomous robot exploration algorithm. The algorithm prioritized finding the largest frontier available in the corresponding OctoMap to build an optimal occupancy grid-mapping of the environment. My responsibilities included designing and writing Python scripts for the dynamic window local planner, RRT* Frontier Exploration, and Global Path-Planning using the Open Motion Planning Library (OMPL). I integrated these components to work together in parallel with simultaneous localization and mapping (SLAM). We evaluated the algorithm's performance through simulations and tests on both a TurtleBot robot and in the lab environments at the Polytechnic School.

- **Robot Pick and Place task using PDDL AI-Planner**
  I designed and implemented a robot pick and place task using a PDDL (Planning Domain Definition Language) AI-Planner. The project involved modeling the robot's actions, environment, and goals using PDDL and defining a planning problem. By utilizing an AI-Planner, the system generated a plan to accomplish the pick and place task efficiently. This project allowed me to gain experience in AI planning, logic-based modeling, and automated decision-making for robotic tasks.

- **Reinforcement Learning Algorithm for moving a robot from a start position to a goal position within a known map environment** Developed a Q-Learning algorithm in Python for a robot to move from a start position to a goal position in a simulated environment. Evaluated the performance of the Q-Learning algorithm under different conditions and tuned hyperparameters for optimal results.

- **A*, RRT, and RRT* motion planning algorithms:** Implemented wavefront planner, A*, RRT, and RRT* motion planning algorithms in Python for moving a Turtlebot robot from a start position to a goal position. Independently developed and implemented the algorithms, and conducted testing and debugging.

PUBLICATION

- S.A. Bello, K.A. Yusuf, S.O. Ige, O.A. Joseph, L.D. Oluwafemi1, M. Abdullah, N.S.A. Hamid (2022), DINData: A Windows software to reformat and clean digisonde numeric dataset. ESS Open Archive. view

HONORS & AWARDS

- European Union's Erasmus Mundus Joint Masters Degree Scholarship Award   2022

- Valedictorian, University of Ilorin, 36th Convocation (1st out of 9,338 graduates).   2021

- Best Graduating Student, Faculty of Physical Sciences, University of Ilorin, Nigeria.   2021

- Best Graduating Student, Department of Mathematics, University of Ilorin, Nigeria.   2021

- Bronze Medalist, International Youth Mathematics Challenge   2019
- MTN Foundation Scholarship Award, MTN Nigeria.   2019

LANGUAGES

- English - (Highly Proficient) | Yoruba - (Native)