HADUSH GEBRERUFAEL

Fairfield, IA 52557-0001 • +1-641-233-0225 • <u>hadush.gebrerufael@gmail.com</u> <u>https://www.linkedin.com/in/hadush-hailu/</u>

AI Software Engineer

Experienced AI and Robotics Engineer with 6 years of professional experience and a robust background in developing and implementing advanced 2D and 3D computer vision algorithms, Natural Language Processing, deep learning techniques, AI model optimization, SLAM, and robot control. Proven track record of 20+ projects, specializing in image processing techniques, computer vision models, robot kinematics, and dynamics. Proficient in TensorFlow, ROS, Python, C++, Java, Gazebo, and RVIZ to optimize and fine-tune models and enhance robot autonomy, navigation, and sensory capabilities.

Design patterns • LLMs • Robot Frameworks • 3D Vision • Computer Vision Machine Learning • NoSQL & RDBMS • Camera Calibration and 3D geometry • CPU & GPU architectures

Languages: Python, C++, C, Java Web Services: REST, SOAP, JSON, XML Web/App Servers: APACHE, Tomcat Frameworks: TensorFlow, PyTorch, ROS, Spring Boot Databases: MySQL, MongoDB Design Patterns: Observer, Strategy, Template, Factory, Command, Adapter, Proxy, Decorator SDLC: SCRUM, TDD Tools: GTest, CMake, Maven, Unittest Platforms: Windows, Linux Application/Software: Fusion360

PROFESSIONAL EXPERIENCE

CAREER NOTE: Completed on-campus studies and currently taking distance education courses to complete a **Master's Degree in Computer Science** (Available for full-time, W-2 employment).

QIBITECh, Tokyo, Japan • 04/2021 - 01/2024

AI and Robotics company.

Staff Egineer

Designed and implemented robotic systems and algorithms.

- Accurately mapped 3D points to 2D image coordinates for the Teleportation camera control system by removing tangential and radial distortions and implementing homography-based transformations to align and warp images, enhancing multi-view data integration and ensuring consistent spatial accuracy.
- Developed, optimized, and fine-tuned deep computer vision models for puddle and grate detection for the SPOT robot using PyTorch along with FastRCNN, MMDetection, and YOLO8 frameworks, and achieved an F1-score of 0.86 to attain a testing accuracy of 98.2%.
- Developed multi-robot collision avoidance for the robotic control system using RVO and integrated it with ROS Eband Local Planner and Kalman Filter, achieving proactive path planning and dynamic obstacle avoidance.
- Engineered a Visual SLAM system integrating a camera and a single LIDAR sensor, utilizing ICP-based laser scan alignment and feature extraction techniques to achieve precise odometry estimation and local map creation for navigation.
- Developed a light-insensitive sink detection algorithm for the toilet sink cleaning robot using OpenCV, adaptive thresholding, Canny edge detection, and contour detection with Python Unittest, achieving accurate identification and improved cleaning efficiency.
- Developed a ROS to SPOT SDK interface for the SPOT control system using Python and gRPC, enabling visualization of payload data, waypoints, transformations, and camera on RVIZ and control through ROS commands.
- Guided four junior team members on robotics projects using agile methods, creating requirements, drafts, and cost estimates; designed architecture, assigned tasks, and managed planning and budgets, resulting in the on-time, onbudget delivery of three projects.

Technologies Used: ROS, PyTorch, OpenCV, Gazebo, RVIZ, OpenRTm, KVS, AWS, SQLAIchemy, YOLO8

UNIVERSITY OF TSUKUBA, Tsukuba, Japan • 04/2018 – 04/2019 University.

Research Assistant

Fine-tuned LIDAR data processing and tested mobile robot controllers, reducing drift and correcting pose issues.

- Performed fine-tuning of angular velocity and time-delay for LIDAR data processing using advanced calibration techniques, achieving a reduction in drift from 20 cm to 2 cm during robot rotation.
- Tested the YPSur mobile robot controller across various wheeled robots under multiple scenarios, detected pose drift during rotation, and corrected it by adjusting the wheel radius.

Technologies Used: ROS, PCL, LIDAR

MEKELLE UNIVERSITY, Mekelle, Ethiopia • 08/2016 – 03/2018

University.

Al researcher

Al research and development

- Proposed and submitted three AI research projects for Mekelle University, won two projects, and supervised teams of five and four people respectively, resulting in the successful completion of one-year projects.
- Developed an Optical Character Recognition system for the Geez language research project using 2D image processing, synthetic and augmentation techniques for data collection, bilateral filter for noise reduction, and Hough Transformation for deskewing to generate the dataset with Python OpenCV.
- Enhanced and fine-tuned a deep Convolutional Neural Network architecture for the OCR system using TensorFlow and Python, resulting in a character error rate of 6%, overall accuracy of 94%, and a Matthews Correlation Coefficient of 0.7.
- Performed image preprocessing for 2D mammography by removing noise using Gaussian and Median Filters, enhancing images with CLAHE, and applying Morphological operations and OTSU thresholding to accurately extract the Region of Interest (ROI) from the background.
- Optimized R-CNN models for 2D mammography by utilizing CNN for feature extraction, RPN for bounding box generation, and ROI pooling layers for classification, achieving a detection accuracy of 91.8%, sensitivity of 94.61%, and an AUC-ROC of 92.2%.

Technologies Used: C++, Python, TensorFlow, Pytorch, OpenCV

ACADEMIC PROJECTS

Maharishi International University (2024) • Multi-View Image Fusion using Discriminative Few-Shot Learning for Real-Time Multi-Face Detection and Identification: Developed a discriminative few-shot learning approach for face recognition using a Siamese network with triplet loss and VGG pretrained model, Vector DB for efficient embedding retrieval, CodePipeline for streamlined deployment, and GPU for accelerated training, achieving enhanced accuracy and efficiency with limited data. Utilized TensorFlow, Python, GPU, LLM

University of Tsukuba (2019) • **Tsukuba Open Robotics Challenge:** Performed encoder and IMU fusion using an Extended Kalman Filter (EKF), resulting in improved robot pose estimation. Developed SLAM using Velodyne for mapping, Hokuyo laser sensor for near-robot obstacle detection, and GNSS with RTK for outdoor navigation with AMCL and Gmapping, achieving robust navigation. The system, however, experienced localization failure 0.9 km into a 2.5 km goal due to the robot hitting a curb. Utilized ROS, OPENCV, RVIZ, PyTorch

Mekell University (2014 - 2017) • RoboSoccer Cup Competition: Developed a system for 3D object detection and tracking by applying a Kalman Filter for player and ball tracking, integrating a Bipartite Graph algorithm (Hungarian algorithm), and utilizing 3D Intersection over Union (IOU) to enhance accuracy in identifying and following objects.Created a multi-robot coordination algorithm using a role assignment strategy and path planning with an RRT Planner, allowing robots to execute behaviors based on their roles and achieving 100% goal scoring across all

competitions. Achieved 2nd place in a national robotics competition by re-modeling three biomorphic robot toys into autonomous robots. This was accomplished

by incorporating a Raspberry Pi into the internal controller, integrating a step motor with a camera for 360-degree scanning, and linking it with ROS, converting the low-cost toy into a competitive entry. Utilized OPENCV, ROS

PERSONAL PROJECT

EDABOT: An efficient Deep-Learning based Amharic language FAQ chatbot for universities 2024: Developed a chatbot for handling frequently asked questions in Amharic by implementing natural language processing techniques such

as tokenization, normalization, stop word removal, and stemming, and using SVM, Multinomial Naïve Bayes, and deep neural networks with TensorFlow, Keras, and NLTK, achieving 91.55% accuracy and a validation loss of 0.3548 with Adam optimizer and SoftMax activation function. Utilized TensorFlow, Python, NLP

EDUCATION

Master Science in Computer Science

(In progress via distance education; expected completion 10/2026) Maharishi International University, Fairfield, Iowa

Key Courses: Machine Learning, Enterprise Architecture, Advanced Software Development

Master of Engineering in Computer Science

University of Tsukuba, Tsukuba, Japan (03/2021)

Key Courses: Intelligent Sensors, Adaptive Media processing, Numerical Simulation, Computational Biology

Bachelor of science in Computer Science and Engineering in Computer Science and Engineering Mekelle University, Mekelle, Tigray (07/2016)

AWARD

Finalist in the national RoboSoccer Cup by Ethiopia's Ministry of Technology (03/2017)