Centre for AI-Fundamentals
RAEng Google DeepMind Summer Internship Programme 2025

Project proposal

Project Title	Environment segmentation for 3D mapping in robotics
Lead supervisor	Alexander Morley
Project Description	For robot path planning, it is necessary to identify safe terrain for the robot to move on. One of the key factors affecting this is the type of terrain. For example, quadrupedal robots (such as Boston Dynamics' Spot) can handle relatively rough terrain but generally should avoid stepping into deep water. To this end, it is necessary to distinguish between different types of terrain and position them in a 3D world. This project will develop segmentation techniques to differentiate terrain types and integrate them into the robot's 3D map of the environment. The 3D map of the environment, called OctoMap, will be provided and equipped with an appropriate interface for the developed approach.
Work Plan	The project will break the 7 weeks into 6 tasks: Week 1: Learning the basics of ROS2. Week 2: Integrate OctoMap with 2D and 3D point cloud data to facilitate Simultaneous Localization and Mapping (SLAM) in a simulated environment. Week 3: Use pytorch libraries to train machine learning models to classify terrain types using OctoMap data. Week 4: Research semantic segmentation neural network algorithms and test them on OctoMap data. Week 5: Justify the best algorithm from their research and present their findings. Week 6-7: integrate the trained semantic segmentation model into the SLAM framework, enabling terrain-aware navigation.
Learning Objectives	1. The student will learn to code with ROS and the basics of robot navigation. 2. The student will gain hands-on experience with PyTorch for deep learning, including data preprocessing, model training, and evaluation. 3. The student will have an opportunity to perform independent research on AI and present their findings. 4. The student will implement a terrain-aware navigation system by combining semantic segmentation with SLAM.

	5. The student will integrate a robot navigation algorithm with a machine learning model for efficient path planning.