MONASH
ENGINEERING

MONASH University

Faculty of Engineering

Summer Research Program 2023-2024

Project Title: Did I hear something?: Sound-based Contact Detection for Robots

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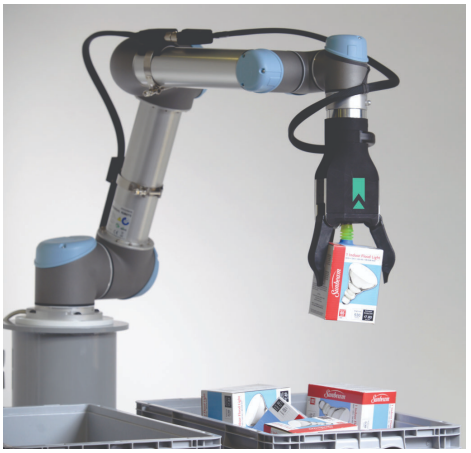
Objective



Humans use sound as an important source for understanding their surroundings, however, it remains and under-utilized sensing source for robotics. This project's objective is to use sound for contact detection. Contact detection can involve contact between the gripper and the object, object and environment (during transport when the object is being held in gripper), or between a robot's body and the environment. It is difficult to detect such contacts from a video feed alone, therefore this project will focus on detecting contact using either sound-only or sound+visual information.

Project Details

The project will start a small literature survey by reading related literature, such as papers for multi-modal fusion here and here, using sound when vision is occluded, and generating desired sounds with a robot. A UR5 robotic arm will be used for this project. We will equip the scene with several microphones, possibly some on the table, object, robot itself or on a standalone tripod. We will look at existing triangulation techniques for sound localization, and focus on detecting impact sounds among other acoustic signatures. Ideally, a deep-learning based approach will be used for impact detection, and we will use sound localization to attribute the impact to the robot's activities. We expect to collect data with different objects, and analyze the performance of our approach. If time permits, we will also involve visual data in the data collection, as well as our contact detection approach, using a audio-visual data fusion.

Prerequisites

- Strong programming skills in Python or C++
- Experience with Linux and Robot Operating System (ROS) is a plus
- Hands-on experience with robots is a plus