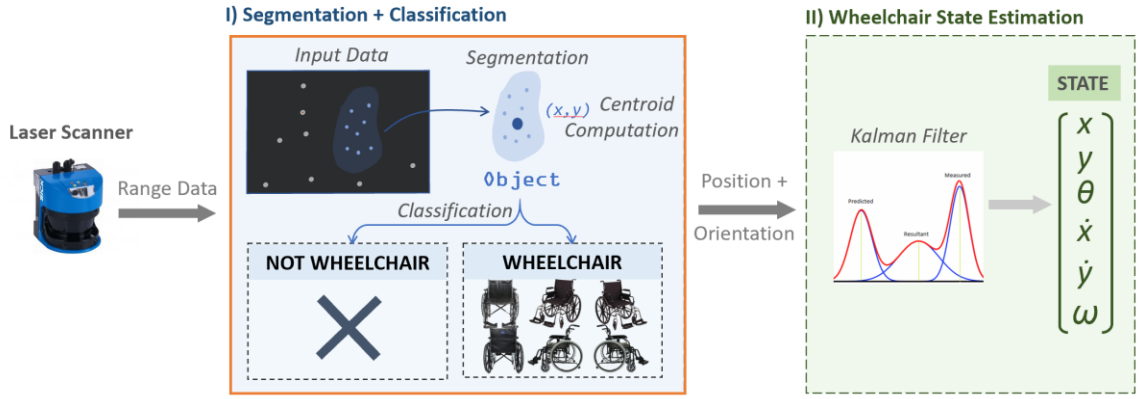
MECH 493 Web Summary

Wheelchair Detection and State Estimation using Laser Scanning Sensors for Mobile Robots

Student: Jessica Bo (#30016125)
Date: April 27, 2020



To address emerging trends in the introduction of mobile robots to human-populated environments, ensuring safe and intuitive human-robotic interaction is becoming a growing need. While previous studies have explored interactions with foot pedestrians, far fewer have investigated that for wheelchair users. Since the dynamic behaviour of wheelchairs is atypical to foot pedestrians, accurate characterization of wheelchairs in the real-world is crucial to improve interactions with wheelchair users. The 2D laser scanner is a common sensor that is suited for accurate distance measurements and fast computation speeds. The overarching objective of this research is to develop a wheelchair detection and state estimation pipeline using 2D range data. The implementation and experimentation in MECH493 focus on estimating the orientation of detected wheelchairs. This is done in two steps — a binary Random Forest that classifies range data objects into wheelchairs, then a multi-class Neural Network that predicts the orientation of the wheelchair as *[front-facing, back-facing, left 45° angled, right 45° angled, left side-facing, right side-facing].* Data collection is performed to verify the classification performance, achieving 98.1% true positive rate for wheelchair detection and ~86% true positive rate for orientation classification. A future step is to compute the wheelchair position as an input to a Kalman filter for state estimation.