

ME5413: Autonomous Mobile Robot

Homework 1: Perception

AY2023/24-Sem 2

Due date: 22 February 2024, 2359 (Thurs, Week 6)

Important note: All homework is meant to be done in Python. Late submission be penalised. No Plagiarism is allowed.

Introduction: The aim of this assignment is to get students to familiarise themselves with perception algorithms and ROS.

Requirements: *Python 3.9(preferred) and ROS Noetic*

Task 1: Single Object Tracking

The object of interest is provided. Implement a Single Object Tracking algorithm on a series of images.

- i. Template Matching
- ii. Using Kalman Filter
- iii. Evaluate the performance of the Single object tracking algorithm for each of the 5 sequences.
- iv. Visualise & Analyse the result

Task 2: Multi Object Prediction

1. Using constant velocity model to predict the future (1s,2s,3s) trajectories of the target agent and calculate the ADE and FDE.
2. Using constant acceleration model to predict the future (1s,2s,3s) trajectories of the target agent and calculate the ADE and FDE.
3. Briefly discuss the observations from your results.

Bonus Task: Single Object Tracking in ROS

Using your best algorithm from Task 1, apply single object tracking to the given set of rosbags.

	Published Topics Description	Message Type
1	Visualize tracked object	vision_msgs/Detection2D
2	Visualize ground truth objects	vision_msgs/Detection2D
3	Publish Matric Number (i.e. number starting with A0..)	std_msgs/String

Submitting your completed Homework Assignment:

Generate a zipfile of this folder and upload it to CANVAS – under Assignment 1. *We will use the latest version, regardless of who uploads.*

Name of Zipfile: “**YourNusNetID**_Homework1.zip” (e.g. e0123456_Homework1.zip)

Submission Details:

1.	Report	<ol style="list-style-type: none">1. Name2. Matric number (i.e. number starting with A0..)3. Maximum number of 5 pages for the report (+2 pages for the bonus task, and not including front cover page) Font Times New Roman, 11pt Single Spaced
2.	README.txt requirements.txt	Provide Instructions on how to run your code in a README file, Python version and required packages for installation in the requirements.txt. <i>(marks will be deducted if your code cannot be implemented)</i>
3.	Folder: Task 1	<ol style="list-style-type: none">1. Code (Jupyter notebook)2. Results: Location of tracked object in each frame (.txt file)
4.	Folder: Task 2	<ol style="list-style-type: none">1. Code (Jupyter notebook)
5.	Folder: Bonus Task	<ol style="list-style-type: none">1. Code2. Rosbag file with published topics