### University of Wollongong

School of Computing and IT

**CSCI444/944 - Perception and Planning - 2025**

**Assignment 2**

* This assignment is worth **10 marks**
* Date due: 11:59pm **Friday 10 October (Week-5).**
* You are to complete the following exercises and then write a program.
* You must also write a report describing the design, implementation and operation of your program.
* The aim of this assignment is to introduce you to writing programs and to provide some experience in developing perception applications and writing a report.

# Requirements:

Implement a Visual Odometry System with Dataset Input and 3D Visualization.

**Background**

Visual Odometry (VO) is the process of estimating a camera’s motion (trajectory) by analyzing sequential images. A basic VO system includes:

• Reading dataset input (RGB-D images)

• Extracting features and estimating motion

• Incrementally updating the trajectory

• Visualizing the results

This assignment focuses on building a VO framework that reads dataset files, processes frames, and visualizes the estimated camera trajectory.

**Task Requirements**

Write a program using OpenCV and your VO implementation to perform the following tasks:

1. Parameter File Input

• The program should take one argument: the path to a parameter file.

• Load configuration values (e.g., dataset directory).

1. Dataset Handling

• TUM (https://cvg.cit.tum.de/data/datasets/rgbd-dataset) containing synchronized RGB and depth image pairs.

• Store image file paths and timestamps in vectors.

• Ensure the file is read correctly; otherwise, print an error message.

1. Frame Construction

• For each RGB-D image pair:

• Load the color and depth images.

• Create a new Frame object and assign the camera, images, and timestamp.

1. Visual Odometry Processing

• Pass each frame to the VO system.

• Measure and print the runtime cost of each VO step.

• Stop processing if VO state becomes LOST.

1. Trajectory Visualization

• Visualize the world and camera coordinate systems.

• Update and display the estimated camera pose after processing each frame.

• Show the current color image alongside the 3D visualization.

Reference https://github.com/gaoxiang12/slambook/tree/master/project/0.2

### Documentation:

* Write a brief document explaining the design.

**Name it "Assignment2\_*your\_name\_student\_ID*.docx" or "Assignment2\_group*\_ID*.docx"** (Make sure you submit a word doc file and not a pdf file. And list all the names and IDs of your group members. )

### Submit:

* Put all the files comprising your programs and the manual into a zip file named: "**Assignment2\_***your\_name\_student\_ID*.zip" **or "Assignment2\_group*\_ID*.zip"**
* Note: Submit your .zip file to the Assignment 2 submission link on Moodle before the deadline. For international students, submit your .zip file to the e-mail address: shenzhenquan@ccnu.edu.cn