Exercise: Odometry Calibration

Implement an odometry calibration tool based on a least-squares method as presented in the lecture. To support this task, we provide a small *Octave* framework (see course website). The framework contains the following folders:

- **data** contains the recorded raw odometry and the motion estimated by a scan-matcher for each time step.
- **octave** contains the Octave framework with stubs to complete.
- **plots** this folder is used to store images.

The below mentioned tasks should be implemented inside the framework in the directory **octave** by completing the stubs:

- Implement the functions in **ls_calibrate_odometry.m** for constructing and solving the least-squares system.
- Implement the function in **apply_odometry_correction.m** for applying the calibration matrix to a set of odometry measurements.
- Implement the function in **compute_trajectory.m** for chaining up the affine transformation matrices of the relative odometry measurements.

After implementing the missing parts, you can run the framework. To do that, change into the directory **octave** and launch *Octave*. To start the main loop, type **LSCalibrateOdometry**. The script will produce a plot showing the trajectory of the raw odometry measurements, the estimate obtained by scan-matching, and the odometry after applying the calibration. This plot will be saved in the **plots** directory. Figure 1 shows the result that you should obtain.
Some implementation tips:

- The functions $v2t$ and $t2v$ are available within the framework and allow to convert between a vector representing the pose of a robot and its corresponding affine transformation matrix.

- The function reshape returns a matrix with specified dimensions whose elements are taken from another matrix. It can, for example, convert a vector into a matrix.

- Many of the functions in Octave can handle matrices and compute values along the rows or columns of a matrix. Some useful functions that support this are \texttt{sum}, \texttt{log}, \texttt{sqrt}, \texttt{sin}, \texttt{cos}, and many others.