

# Report for HILTI SLAM CHALLENGE

Tsingsens Team  
boshizhao6@gmail.com

## I. TECHNICAL APPROACH DESCRIPTION

Our SLAM system takes IMU, Lidar and images as input. For pre-process, the raw data collected from Lidar will be processed by scan-to-local-map algorithm, the images will be dealt with super robust feature detection and matching. Multi sensor fusion is achieved by factor graph and output of the odometry is accurate and robust.

Our approach is optimization based and only uses the information at present and the past to evaluate the current pose of the agent. Sliding window bundle adjustment is used to improve the accuracy of the results. There is loop closure method embedded.

## II. SENSOR MODALITIES USED

In our method, IMU and Lidar data are utilized to realize the localization and mapping. For the Lidar data, we have tested for data from Livox and Ouster and finally chose Ouster as our Lidar data source.

## III. PROCESSING TIME AND HAREWARE OVERVIEW

The whole SLAM system is carried on in hareware listed below:

Table I  
HAREWARE OVERVIEW

<b>CPU</b>	<b>AMD 5800X</b>
<b>MEMORY</b>	<b>32G@3200Mhz</b>

Due to the development of the computation abilities, all the computation need by the slam system can be handled by the CPU in real time. The processing time is listed as below:

Table II  
PROCESSING TIME

<b>IC Office</b>	<b>real-time</b>
<b>Office Mitte</b>	<b>real-time</b>
<b>Parking Deck</b>	<b>real-time</b>
<b>Basement</b>	<b>real-time</b>
<b>Basement 3</b>	<b>real-time</b>
<b>Basement 4</b>	<b>real-time</b>
<b>Lab</b>	<b>real-time</b>
<b>Construction Site Outdoor 1</b>	<b>real-time</b>
<b>Construction Site Outdoor 2</b>	<b>real-time</b>
<b>Campus 1</b>	<b>real-time</b>
<b>Campus 2</b>	<b>real-time</b>

The same set of parameters is used throughout all the sequences. We have tried several combinations of parameters and done a lot of tuning. The parameters were eventually settled to achieve great results on all the sequences.

## IV. NOTE

Our trajectory is in the /os\_imu frame