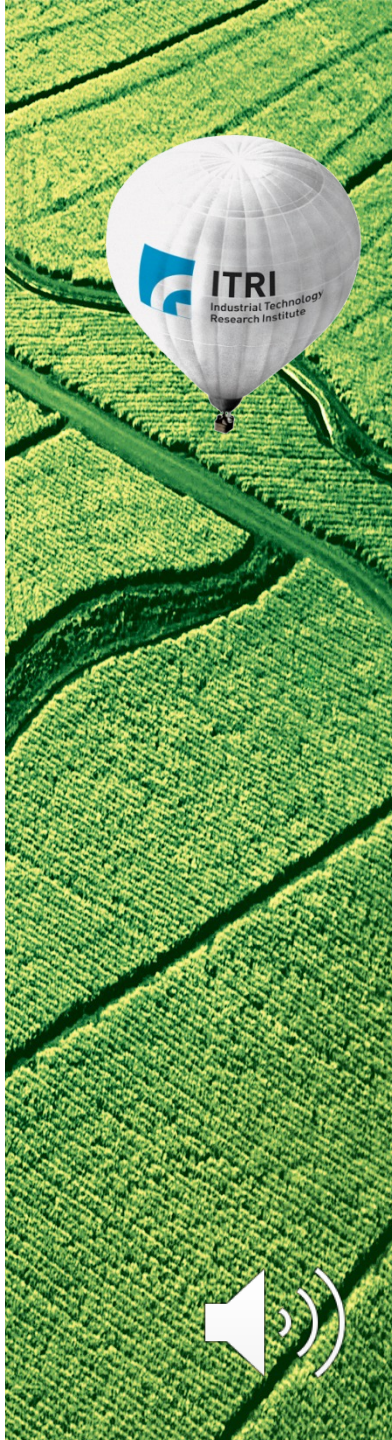
工業技術研究院
Industrial Technology
Research Institute

CV Final Project

3D Reconstruction
from
Road Marker Feature Points



Outline

- Introduction
- Dataset
- Evaluation
- Schedule
- Submission

Dataset Introduction

- Public Set
  - 3 video sequences
  - Download link: https://140.112.48.121:25251/sharing/Lw8QTICUf

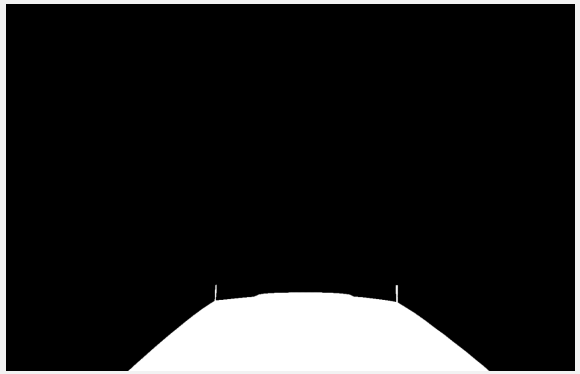
- Private Set
  - 2 video sequences
  - More information will be released soon…

Dataset Structure

- ITRI_dataset
  - ReadMe.md
  - camera_info/
  - seq1, seq2, seq3/

Dataset Structure

```
camera_info/
    {camera}/ (e.g. lucid_cameras_x00)
        {camera_name}_camera_info.yaml: (e.g. gige_100_b_hdr_camera_info.yaml)
            intrinsic parameters
        {camera_name}_mask.png:
            The mask for the ego car show in the image, it could help for decreasing some false alarms in detection.
        camera_extrinsic_static_tf.launch:
            transformation parameters between cameras
            key_word: tf2_ros, Robot Operating System (ROS)
```



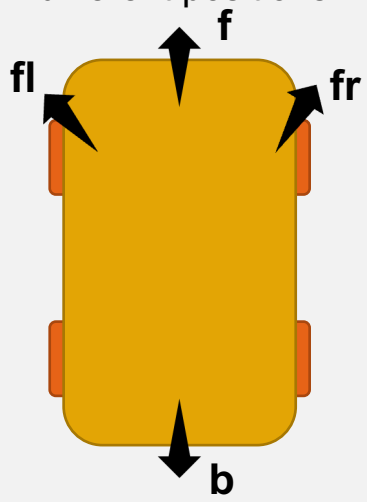
f_mask.png

Dataset Structure

- camera_extrinsic_static_tf.launch
  - tf2_ros
  - Robot Operating System

base_link

the common reference frame for cameras installed in different positions




```
<launch>
    <arg name="main_camera_frame_id" value="/lucid_cameras_x00/gige_100_f_hdr"/>

    <rosparam param="/perception/main_camera_frame_id">
        /lucid_cameras_x00/gige_100_f_hdr
    </rosparam>

    <!-- All LiDAR to camera extrinsic parameters -->
    <node pkg="tf2_ros" type="static_transform_publisher"
      name="tf_main_camera__gige_100_fr_hdr"
      args="0.559084 0.0287952 -0.0950537 -0.0806252 0.607127 0.0356452 0.789699
      $(arg main_camera_frame_id) /lucid_cameras_x00/gige_100_fr_hdr" />

    <node pkg="tf2_ros" type="static_transform_publisher"
      name="tf_main_camera__gige_100_fl_hdr"
      args="-0.564697 0.0402756 -0.028059 -0.117199 -0.575476 -0.0686302 0.806462
      $(arg main_camera_frame_id) /lucid_cameras_x00/gige_100_fl_hdr" />

    <node pkg="tf2_ros" type="static_transform_publisher"
      name="velo2cam_tf__gige_100_fl_hdr_gige_100_fr_hdr_mix"
      args="-1.2446 0.21365 -0.91917 0.074732 -0.794 -0.10595 0.59393
      /lucid_cameras_x00/gige_100_fl_hdr /lucid_cameras_x00/gige_100_b_hdr" />

    <!-- tf about vehicle -->
    <node pkg="tf2_ros" type="static_transform_publisher"
      name="tf_main_camera__front_bump"
      args="0.06742502153707941 1.723731468585929 1.886103532139902 0.5070558775462676 -0.47615311808704197 0.4812773544166568 0.5334272708696808
      $(arg main_camera_frame_id) /front_bump"/>

    <node pkg="tf2_ros" type="static_transform_publisher"
      name="tf_main_camera__base_link_tmp"
      args="0.0 0.0 0.0 -0.5070558775462676 0.47615311808704197 -0.4812773544166568 0.5334272708696808
      /base_link $(arg main_camera_frame_id)"/>

</launch>
```

f-fr

f-fl

fl-b

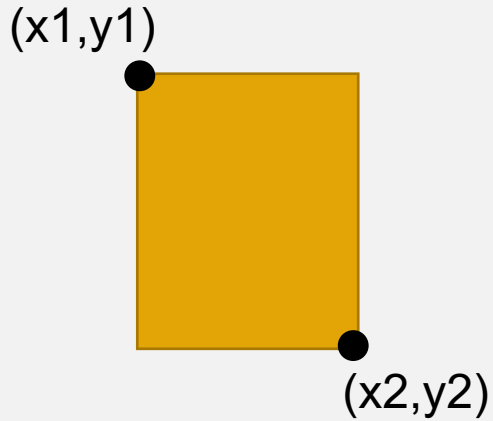
base_link-f

Dataset Structure

```
seq/ (e.g. seq1, seq2, seq3)
    dataset/
        {time_stamp}/ (e.g. 1681710717_532211005)
            1. camera.csv:
                camera name
            2. detect_road_marker.csv:
                a. detected bounding boxes, the bounding box are not always correct.
                b. format: (x1, y1, x2, y2, class_id, probability)
                c. class_id: (0:zebracross, 1:stopline, 2:arrow, 3:junctionbox, 4:other)
            3. initial_pose.csv:
                initial pose for ICP in "base_link" frame.
            4. raw_image.png:
                captured RGB image
            5. sub_map.csv:
                map points for ICP, (x, y, z).
            6. gound_turth_pose.csv: """not exist in all dirs"""
                x, y localization ground turth in "base_link" frame.

    other_data/
        {timestamp}_raw_speed.csv: (e.g. 1681710717_572170877_raw_speed.csv)
            car speed(km/hr)
        {timestamp}_raw_imu.csv:
            1st line: orientation: x, y, z, w
            2nd line: angular_velocity: x, y, z
            3rd line: linear_acceleration: x, y, z

    all_timestamp.txt:
        list all directories in time order
    localization_timestamp.txt:
        list all directories with "gound_turth_pose.csv" in time order
```



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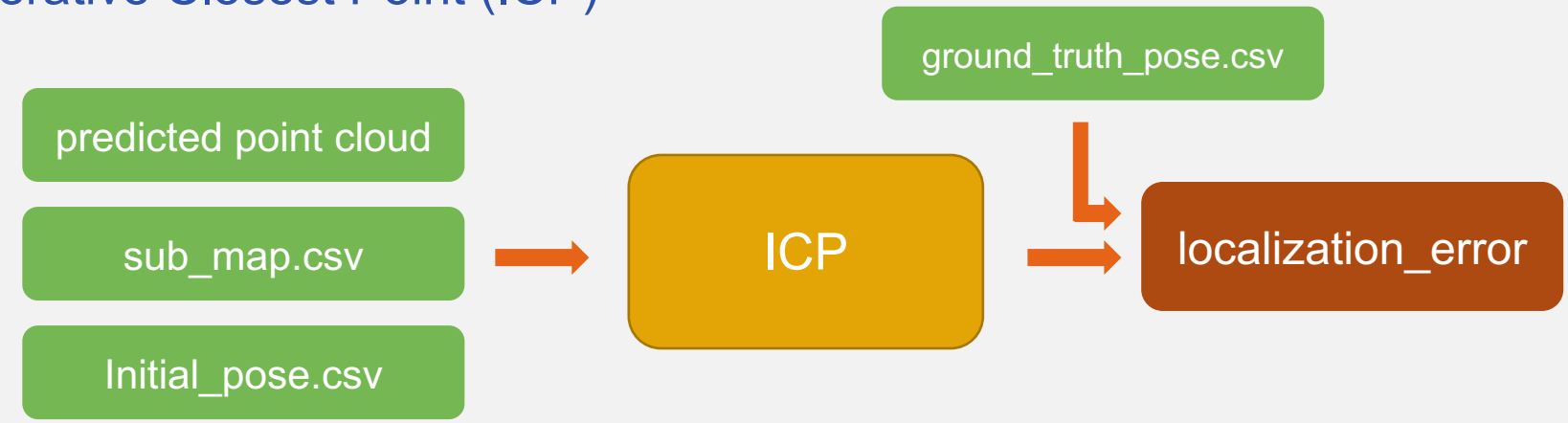
Evaluation Metric

- Iterative Closest Point (ICP)



- More information will be released soon.

Evaluation Server

- Our final project challenge will be hold on Codalab competition server.
- More information will be released soon.

Grading

- Quantitative: 50%
  - according to the leaderboard
- Presentation: 50% (top 10 teams)
  - Novelty and technical contribution (20%)
  - Completeness (25%)
    - Ablation studies, visualization, experiments, analysis, etc
  - Presentation (5%)
- Report: 50% (other teams)
  - Novelty and technical contribution (25%)
  - Completeness (25%)
    - Ablation studies, visualization, experiments, analysis, etc

Score	# of teams
50%	1
49%	1
48%	1
46%	4
42%	4
40%	4
38%	3

Note

Only top 10 teams on the final leaderboard will be chosen for final presentation.

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Schedule

- Evaluation Server Open
  - 2023/05/20 00:00
- Evaluation Server Close
  - 2023/06/05 23:59
- Code Submission
  - 2023/06/06 23:59
- Oral Presentation
  - 2023/06/09 14:20~17:20 (Tentative)
- Report Submission
  - 2023/06/09 23:59

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Code Submission

- Only the team leader needs to upload the code to NTU COOL.
- R07654321/
  - **README file**
  - **All your codes** (including training & testing)
  - **Model file** (which can reproduce the result on the leaderboard)
- Compress all files in a zip file named StudentID.zip (e.g. R07654321.zip)
  - After TAs run "unzip R07654321.zip", it should generate one directory named R07654321.
- In README file, you need to clearly describe how to set up the environment and the steps to run your code (training & testing), so that TAs can reproduce the results.
  - If we can not reproduce your result on the leaderboard, you will receive 0 point in the performance part. Minor errors are acceptable.
- Deadline: 2023/06/06 23:59

Report Submission

- Only the team leader needs to upload the report to NTU COOL.
- The teams who are selected for final presentation need to upload your presentation slide in *pptx* format.
- The teams who are not selected for final presentation need to upload your report in *pdf* format.
- Deadline: 2023/06/09 23:59

Contact

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