

A-LOAM Adapt To Vanjee Data

1. Install dependencies

1.1 ubuntu ROS

1.2 Ceres Solver

1.3 PCL

2. Compile

This project was tested on ubuntu 20.04. Since the original A-LOAM algorithm was run on ubuntu 16.04/18.04, some modifications were made. If your environment belongs to ubuntu 16.04/18.04, you can follow the steps below to restore the original A-LOAM algorithm.

```
Replace camera_init in the 4 .cpp files in the ~/catkin_aloam/src/A-LOAM/src
directory with /camera_init;
```

```
Modify #include <opencv2/imgproc.hpp> in scanRegistration.cpp to #include
<opencv/cv.h>;
```

```
Modify cv::IMREAD_GRAYSCALE in kittiHelper.cpp to CV_LOAD_IMAGE_GRAYSCALE;
```

```
Comment out set(CMAKE_PREFIX_PATH, "/usr/include/opencv4") in CMakeLists.txt, and
change find_package(OpenCV 4.0 QUIET) to find_package(OpenCV REQUIRED).
```

Enter the following instructions to compile

```
cd ~/catkin_aloam
catkin_make
```

If your ubuntu 20.04 prompts a large number of Eigen-related errors when compiling

```
Replace #include <eigen3/Eigen/Dense> in the 4 .cpp files in the
~/catkin_aloam/src/A-LOAM/src` directory with #include <Eigen/Dense>;
```

3. Run

3.1 Run online

Modify the `pcap` parameter in the vanjee driver configuration file `~/catkin_aloam/src/config/config.yaml` to `nothing`, and configure the corresponding IP parameters. Enter the following command.

```
source devel/setup.bash
roslaunch aloam_velodyne aloam_vanjee.launch
```

3.2 Run offline

Modify the `pcap` parameter in the vanjee driver configuration file

`~/catkin_aloam/src/config/config.yaml` to `specified offline data packet path`, and fill in the corresponding `dest_port` parameter. Enter the following command.

```
source devel/setup.bash
roslaunch aloam_velodyne aloam_vanjee.launch
```

3.3 non-vanjee data

Change the `use_vanjee_data` parameter in the `~/catkin_aloam/src/A-LOAM/launch/aloam_velodyne_VLP_16.launch` file to false; and only start aloam.

```
roslaunch aloam_velodyne aloam_velodyne_VLP_16.launch
```

4. Save map

Wait for the map construction to be completed and execute the save map command.

```
cd ~/catkin_aloam
source devel/setup.bash
roslaunch save_map save_map.launch
```

`~/catkin_aloam/map` is the saving path, `[save_name]_map.pcd` represents the saved overall map point cloud, `[save_name]_corner.pcd` represents the saved corner point cloud, `[save_name]_surf.pcd` Represents the saved polygon point cloud, `[save_name]_path.pcd` represents the saved path point.

`[save_name]` can be modified in the `~/catkin_aloam/src/A-LOAM/launch/aloam_velodyne_VLP_16.launch` file.

5. Project Description

5.1 data flow

5.1.1

`vanjee_driver` publishes point cloud data (vanjee pointcloud format) to the topic `/wlr_720/cloud_points`.

5.1.2

`vanjee_to_velodyne` subscribes to the topic `/wlr_720/cloud_points`, converts the point cloud data into velodyne pointcloud format, and publishes it to the topic `/velodyne_points`.

5.1.3

`aloam_velodyne` subscribes to the topic `/velodyne_points` and uses point cloud data to build maps.

5.2 Folder description

`data` stores vanjee data

`map` stores mapping results

`src` stores project source code

5.3 vanjee_driver

Supports both online and offline working modes. Specific parameters are configured in the file `~/catkin_aloam/src/config/config.yaml`.

5.4 vanjee_to_velodyne

Convert [vanjee XYZIRT] to [velodyne XYZIRT/XYZIR/XYZI], the default is to [velodyne XYZIRT] format, the specific format selection can be configured in the `~/catkin_aloam/src/vanjee_to_velodyne/launch/vanjee_to_velodyne.launch` file.

5.5 aloam_velodyne

The specific parameters of the aloam algorithm are configured in `/home/wanji/catkin_aloam/src/A-LOAM/launch/aloam_velodyne_VLP_16.launch`.

5.5.1

aloam is not suitable for loop mapping. aloam does not have loopback function. At runtime, aloam stacks all map frames into a point cloud. When the vehicle body moves forward and backward to the same position, due to accumulated errors, the map frames acquired before and after the same place have been deviated. If map overlay is performed at this time, serious map ghosting may occur.

5.5.2

aloam is not suitable for long-term mapping. As mentioned in 5.4.1, aloam superimposes all map frames into a point cloud. As the number of map frames increases, the point cloud map stored in the algorithm will become larger and larger. Then during the matching process, the operation time of `downsampling` and `establishing kd-tree` of the map point cloud will gradually increase (will converge), resulting in a longer interval to complete the scan-to-map matching, and ultimately lead to Positioning lost.

5.5.3 Parameter modification

For indoor scenes, reducing the map downsampling step length (that is, reducing the `mapping_line_resolution` and `mapping_plane_resolution` parameter values) can improve the mapping accuracy and significantly reduce the height cumulative error, but it will cause the map point cloud size to grow faster.

Increasing the map downsampling step length or reducing the mapping frequency (that is, increasing the `mapping_skip_frame` parameter value) can increase the stable running time of the aloam algorithm. Both can slow down the growth rate of the map point cloud, but may lead to poor positioning accuracy. decline.