

# Exercise 04 Team13

## Part3: Bundle Adjustment

Huber Loss behaves like a squared loss near zero and like an absolute loss away from zero, which reduces the influence of outliers

In BA, where data can be noisy and contain significant outliers, Huber loss provides a balance between robustness and efficiency. But in camera calibration, where we have relatively cleaner and more precise data.

## Part 4: Outliers filtering

There are 4 kinds of criterions to decide whether to filter outliers out.

Criteria for Outliers:

OutlierReprojectionErrorHuge

OutlierReprojectionErrorNormal

OutlierCameraDistance

OutlierZCoordinate

### 1.OutlierReprojectionErrorHuge

It is a reprojection error that is substantially larger than typical errors.

Such large errors could be due to incorrect initial landmark estimation, significant changes in the environment, or errors in the camera's calibration.

Extremely large reprojection errors can significantly distort the structure and geometry of the map

### 2.OutlierReprojectionErrorNormal

It is a reprojection error that is relative normal and not so severe as "huge" category.

Causes might include minor inaccuracies in camera calibration, slight environmental changes

if not addressed, can accumulate and lead to a gradual distortion of map quality

### 3.OutlierCameraDistance

Landmarks too close to the camera beyond a certain threshold

error in position estimation.

landmarks very close to the camera can affect the depth estimates and the scale and perspective calculations of the map

### 4.OutlierZCoordinate

landmarks with a Z-coordinate that is too small

might be due to errors in depth measurement

Removing such data points ensures depth accuracy in the map's representation.

## Part 5 : mapping

There are 164 cameras can be added into map. Totally takes it about 38s. The optimization step takes the most time. We can just reduce the min\_iteration time for ceres-optimization to speed up.

Regarding the results of using match\_bow , the difference is mainly the number of added cameras(154) , 10 is left because shared track threshold 10 is not fulfilled.

