Vision Based Navigation Assignment 4

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Exercise 3

A loss function is used to handle outliers so that the fitted curve does not deviate too much from the ground truth thus becomes more robust. Loss function reduces the influence of residual blocks with high values which usually corresponds to outliers.

We didn't use a loss function for calibration because there we wanted to take all AprilGrid points into consideration. Here, we would like to eliminate negative effect of possible outliers.

Exercise 4

There are 4 different cases for detecting outliers.

1. Huge reprojection error: possible mismatch

2. Large reprojection error: possible mismatch

3. Landmarks that are too close to a camera center: possible mismatch or points stuck in local minima

4. Landmarks with too small z coordinate for some camera: possible mismatch or points stuck in local minima

Wrong matches would negatively affect optimization process. Points stuck in local minima are not useful for detection structure from motion as there is no motion for them.

Exercise 5
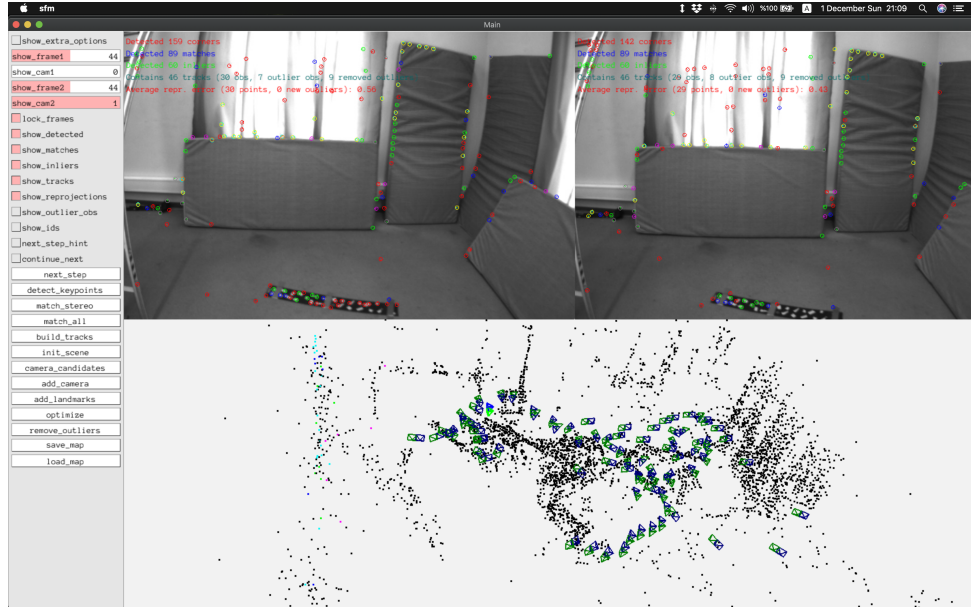
When it is run (without gui) from scratch without saved corners or matches, it took 80 seconds in total. Camera calibration taken 0.58 seconds as a separate process.

164 cameras are added to the map.

Only visibly time consuming steps were initial matching step and optimizations. With increasing points and observations, optimization step will take longer in later iterations.

One possible way to improve speed is to not optimize entire map at each iteration. Map can be optimized for a subset of points at each time, e.g. only visible points.