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Part 1: Camera models
The test/src/test_ex2.cpp file test if each camera model's project and unproject functions are correctly implemented. If they are, then after project and unproject, the target point would equal to the correspondent source point after normalized.

Part 2: Optimization

The difference between these Curve Fitting and Robust Curve Fitting is that the Curve Fitting method is sensitive to outliers. That is in presence of points that do not obey the noise model, the model's performance suffers. Robust Curve Fitting solves that problem by using a `Loss Function` to reduce the effect of outliers, just making the model more robust.

Technically, for Curve Fitting, in AddResidualBlock function, Loss function is Null:

E.g. problem.AddResidualBlock(cost_function, nullptr , &m, &c);

While, for Robust Curve Fitting, a Loss function is introduced (e.g CauchyLoss):

E.g. problem.AddResidualBlock(cost_function, new CauchyLoss(0.5) , &m, &c);

Part 3: Camera calibration
The command line parameters used:

- show-gui: whether to show the GUI for visualization of corners or not.
- dataset-path: path to dataset contains images for calibration along with detected corners, init intrinsics, and init poses.
- cam-model: choices among camera models (pinhole, double spheres, extended unified, Kannala-Brandt 4) for intrinsic calibration.

We can use Final Cost as a quantitative measure that can be used to determine how well the camera models fit the lenses that were used to collect the dataset. It measures how close re-projected points from the world coordinate to the 2D image space of the two cameras in all frames and detected corners. A smaller final cost indicates that the given camera model fits the real lenses used to collect that dataset better.

Summary and analysis of the calibration results:

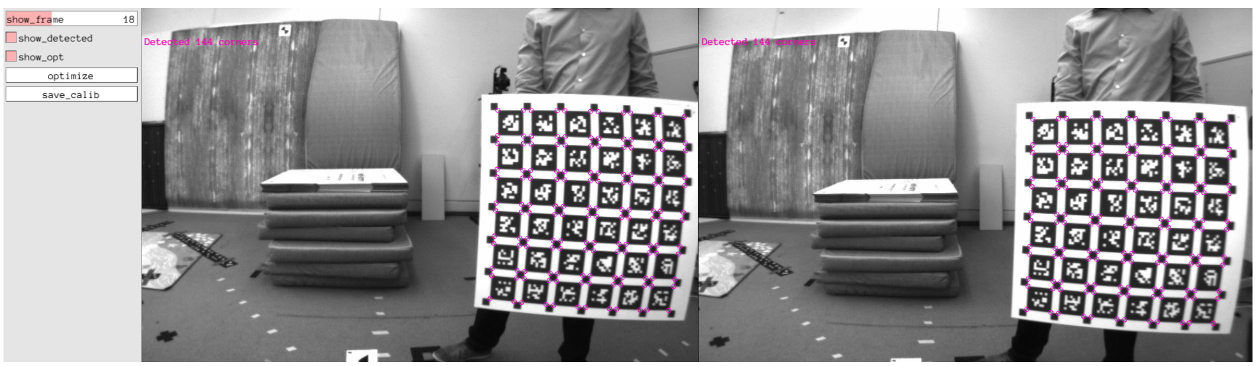
Model	**Pinhole**	**Double Spheres**	**Extended Unified**	**Kannala-Brandt 4**
Initial Cost	1.795667e+07	5.353182e+06	5.353182e+06	5.788049e+06
Final Cost	1.565735e+05	1.627482e+02	1.627604e+02	1.619844e+02

- Pinhole model's cost is high both at the start and in the end of optimization, which suggests it didn't fit real lenses very well.
- The other three models have a reasonable low final cost; they all fit the lenses quite well, and Kannala-Brandt 4 model performed a little better.

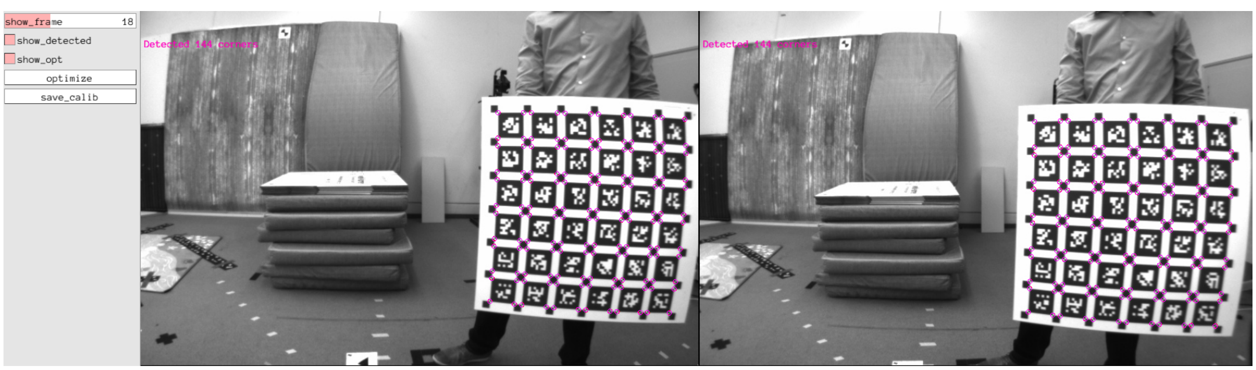
Qualitative results can confirm the analysis above. Projected points from the Pinhole model were a little bit off the detected corners, while in three other models, they were fitted almost perfectly.

- Pinhole

- Double Spheres



- Extended Unified



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