

# Exercise Sheet 2 Report

## Topic: Camera Models, Optimization, Calibration

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## Part2

### Difference between Curve Fitting and Robust Curve Fitting:

Both of the methods are used for non-linear least-square problems. However, if there are some outliers in the data, Robust Curve Fitting applies a loss function, such as CauchyLoss, with Ceres Solver. As the result, the Robust Curve Fitting method can be more similar to the ground truth curve.

## Part3

### Command line parameter:

```
app.add_option("--show-gui", show_gui, "Show GUI");
app.add_option("--dataset-path", dataset_path, "Dataset path")->required();
app.add_option(
    "--cam-model", cam_model,
    "Camera model. Possible values: pinhole, ds, eucm, kb4. Default: ds.");
```

The command line parameter is used for letting users deliver some parameters to the code. For example, ./ build / calibration -- dataset-path data/euroc\_calib/ --cam-model kb4 allow user to set the dataset-path in the program as data/euroc\_calib/, and set the cam-model as kb4

### Summary of the camera model

We can determine how well the camera models by looking at the Final Cost.

In my experiment, the lowest cost is the kb4 camera

#### Pinhole:

Initial	1.795667e+07
Final	1.565735e+05
Change	1.780009e+07

#### ds:

Initial	5.353182e+06
Final	1.627482e+02
Change	5.353019e+06

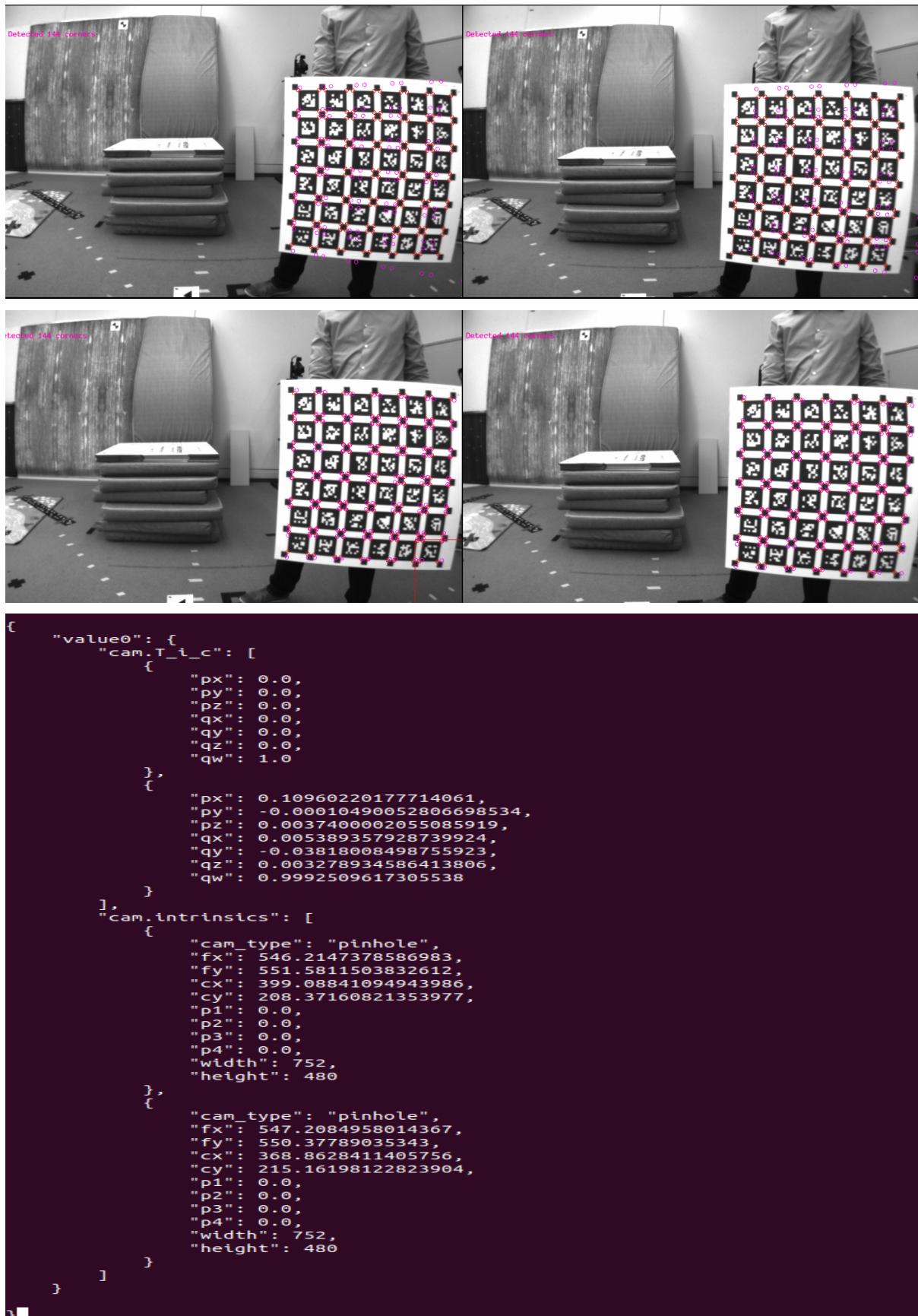
#### eucm:

Initial	5.353182e+06
Final	1.627604e+02
Change	5.353019e+06

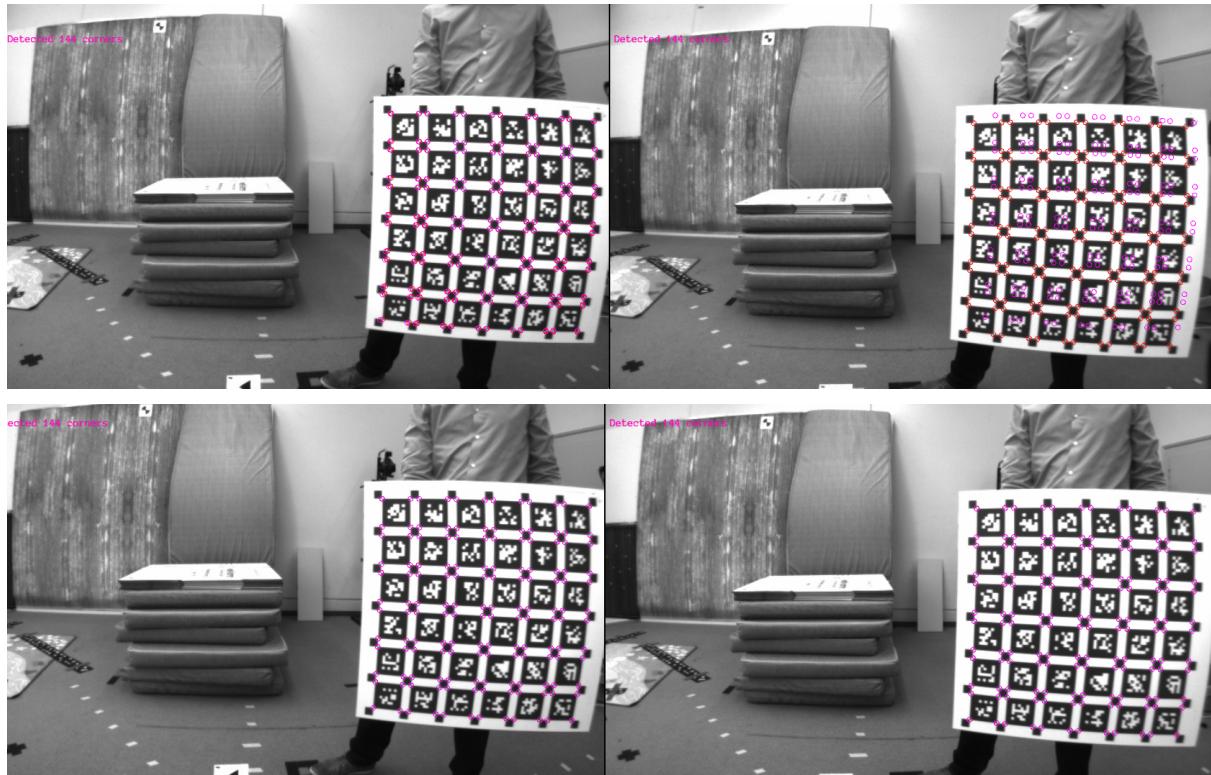
#### kb4

Initial	5.788049e+06
Final	1.619844e+02
Change	5.787887e+06

## Pinhole:

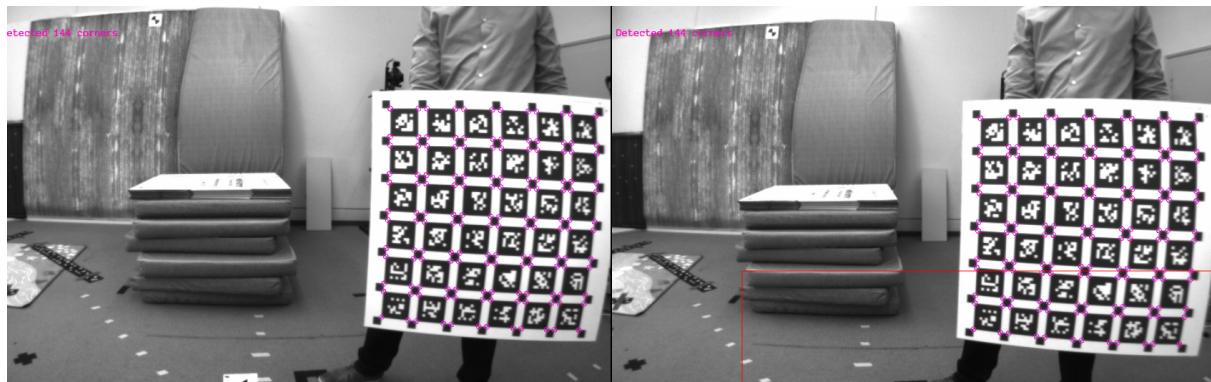
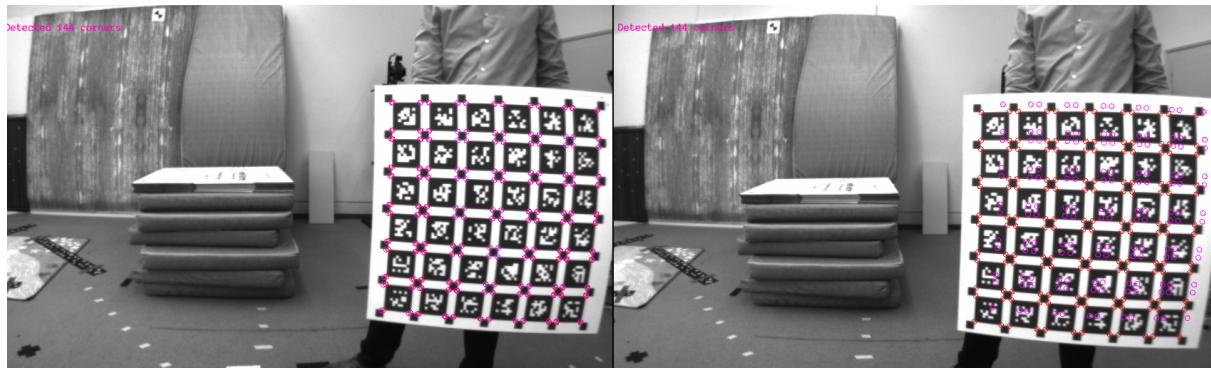


DS:



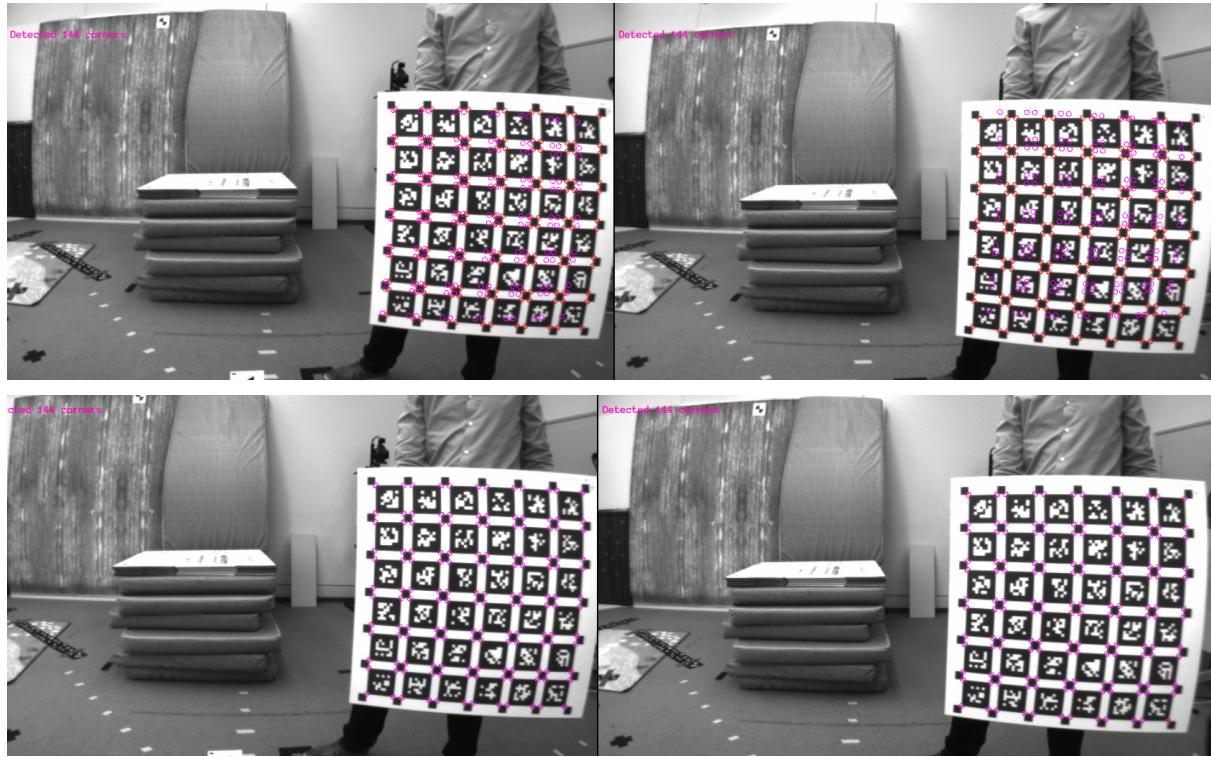
```
"value0": {
    "cam.T_i_c": [
        {
            "px": 0.0,
            "py": 0.0,
            "pz": 0.0,
            "qx": 0.0,
            "qy": 0.0,
            "qz": 0.0,
            "qw": 1.0
        },
        {
            "px": 0.11002674958788138,
            "py": -0.0002891377986657827,
            "pz": 0.0002466250499198808,
            "qx": 0.0071236589880659078,
            "qy": 0.0006289220699999347,
            "qz": 0.0010774952115908249,
            "qw": 0.9999738481299002
        }
    ],
    "cam.intrinsics": [
        {
            "cam_type": "ds",
            "fx": 351.03728321687216,
            "fy": 350.0074555977407,
            "cx": 365.88809735482138,
            "cy": 249.34573836993605,
            "p1": -0.2385312817269874,
            "p2": 0.5678694845290973,
            "p3": 0.0,
            "p4": 0.0,
            "width": 752,
            "height": 480
        },
        {
            "cam_type": "ds",
            "fx": 362.9532887030644,
            "fy": 361.85685537441239,
            "cx": 379.35501913798876,
            "cy": 256.0392416777185,
            "p1": -0.2106378372305513,
            "p2": 0.5776109411992833,
            "p3": 0.0,
            "p4": 0.0,
            "width": 752,
            "height": 480
        }
    ]
}
```

## Eucm



```
"value0": {
    "cam.T_i_c": [
        {
            "px": 0.0,
            "py": 0.0,
            "pz": 0.0,
            "qx": 0.0,
            "qy": 0.0,
            "qz": 0.0,
            "qw": 1.0
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        {
            "px": 0.11002631815223622,
            "py": -0.00028908964378215185,
            "pz": 0.00024618114440034465,
            "qx": 0.007123595350702447,
            "qy": 0.0006300007991472097,
            "qz": 0.0010774305748141574,
            "qw": 0.9999738479738504
        }
    ],
    "cam.intrinsics": [
        {
            "cam_type": "eucm",
            "fx": 460.97949866208628,
            "fy": 459.62650958263296,
            "cx": 365.8867492896418,
            "cy": 249.346486044204,
            "p1": 0.5916648096407775,
            "p2": 1.124112539944131,
            "p3": 0.0,
            "p4": 0.0,
            "width": 752,
            "height": 480
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        {
            "cam_type": "eucm",
            "fx": 459.7960643487621,
            "fy": 458.40630958578478,
            "cx": 379.35442505013966,
            "cy": 256.04009949802289,
            "p1": 0.6060839010938557,
            "p2": 1.088350919730379,
            "p3": 0.0,
            "p4": 0.0,
            "width": 752,
            "height": 480
        }
    ]
}
```

## kb4



```
{  
    "value0": {  
        "cam.T_i_c": [  
            {  
                "px": 0.0,  
                "py": 0.0,  
                "pz": 0.0,  
                "qx": 0.0,  
                "qy": 0.0,  
                "qz": 0.0,  
                "qw": 1.0  
            },  
            {  
                "px": 0.11002263076486114,  
                "py": -0.00028831176294505194,  
                "pz": 0.00025193738175607514,  
                "qx": 0.007129648722668703,  
                "qy": 0.0006308484199464044,  
                "qz": 0.0010771978182017243,  
                "qw": 0.9999738045490108  
            }  
        ],  
        "cam.intrinsics": [  
            {  
                "cam_type": "kb4",  
                "fx": 461.1581901632605,  
                "fy": 459.8080285947972,  
                "cx": 365.89723869011746,  
                "cy": 249.35492318319005,  
                "p1": -0.004593052532205192,  
                "p2": 0.02753243203702877,  
                "p3": -0.036977671770998438,  
                "p4": 0.018610217245569099,  
                "width": 752,  
                "height": 480  
            },  
            {  
                "cam_type": "kb4",  
                "fx": 459.744806865198,  
                "fy": 458.35350534633877,  
                "cx": 379.3639614954641,  
                "cy": 256.0435254270624,  
                "p1": 0.004549588612680704,  
                "p2": 0.002485490491601374,  
                "p3": -0.010601348784717297,  
                "p4": 0.010781041140886462,  
                "width": 752,  
                "height": 480  
            }  
        ]  
    }  
}
```