Camera Calibration using OpenCV

Alumnos:

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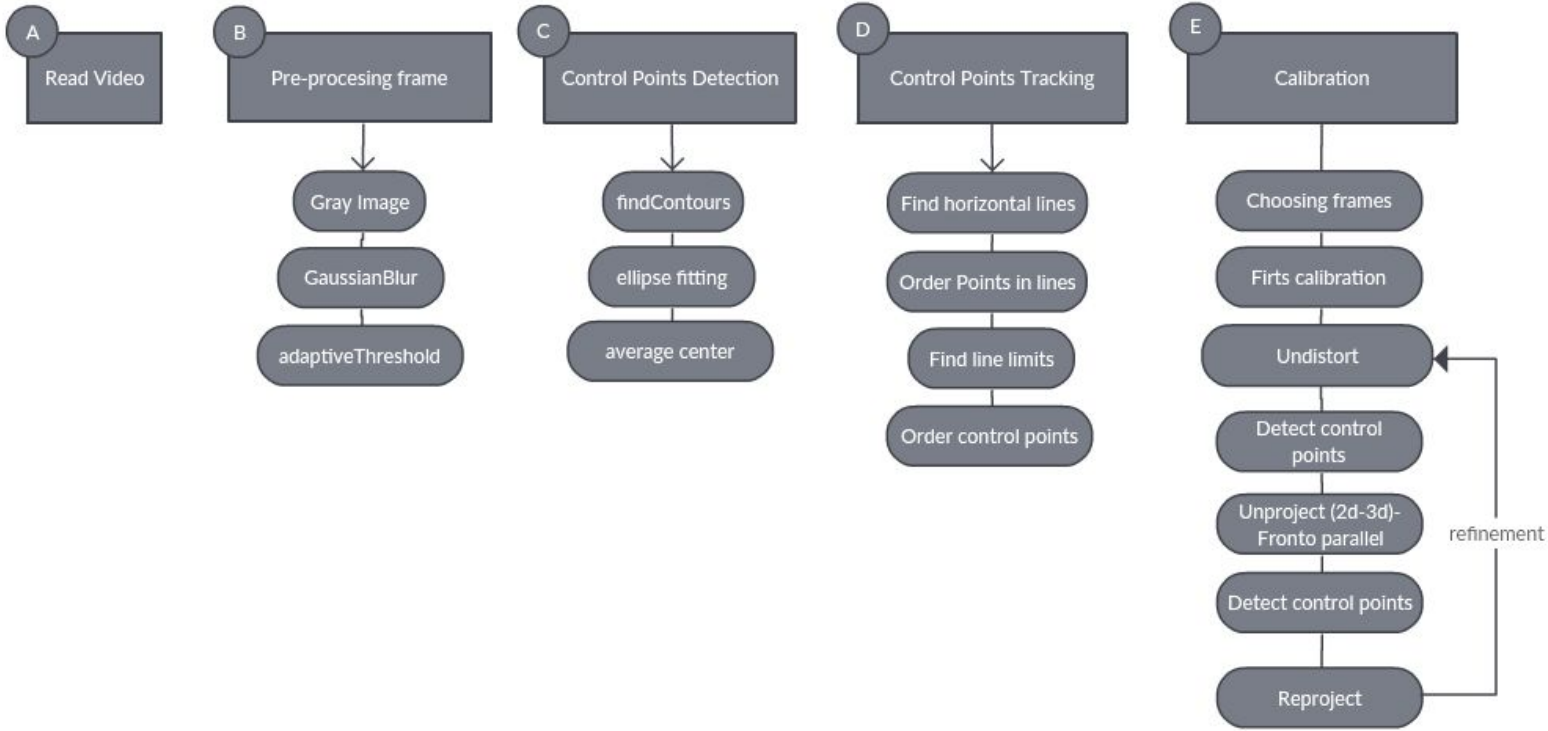
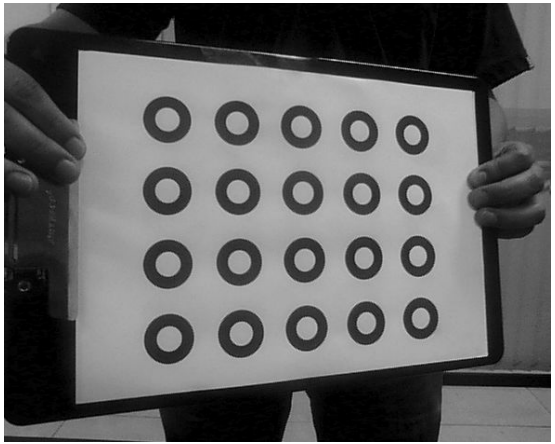
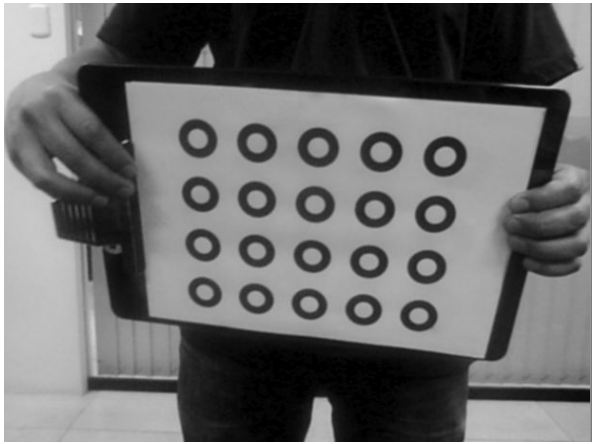
- **Javier Quispe Diego**

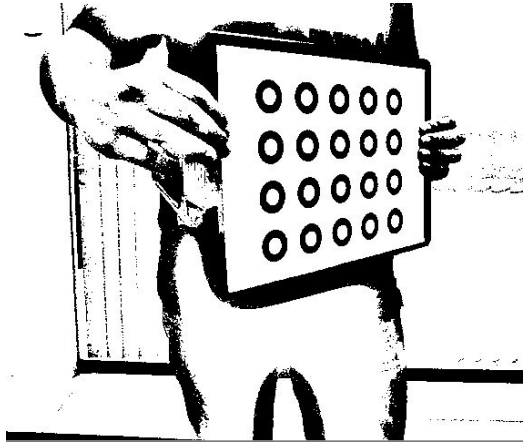
Pipeline


A
Read Video
B
Pre-procesing frame
Gray Image
GaussianBlur
adaptiveThreshold
C
Control Points Detection
findContours
ellipse fitting
average center
D
Control Points Tracking
Find horizontal lines
Order Points in lines
Find line limits
Order control points
E
Calibration
Choosing frames
Firts calibration
Undistort
Detect control points
Unproject (2d-3d)- Fronto parallel
Detect control points
Reproject
refinement

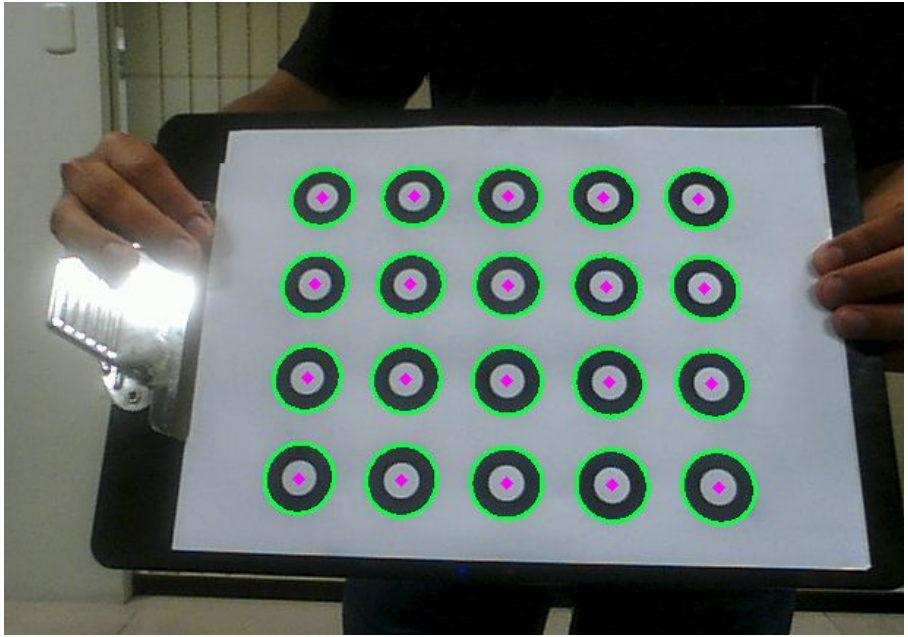
Pre-processing



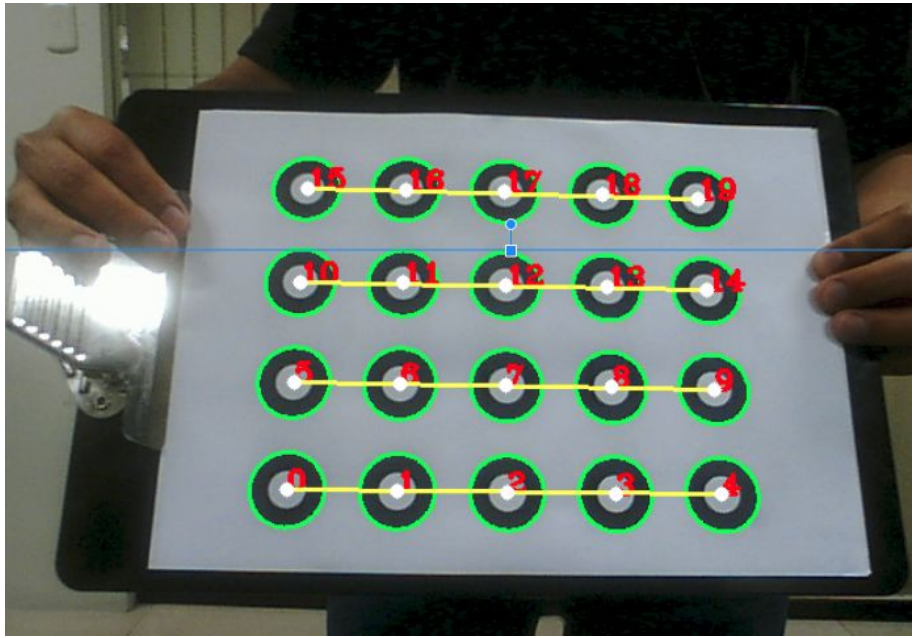




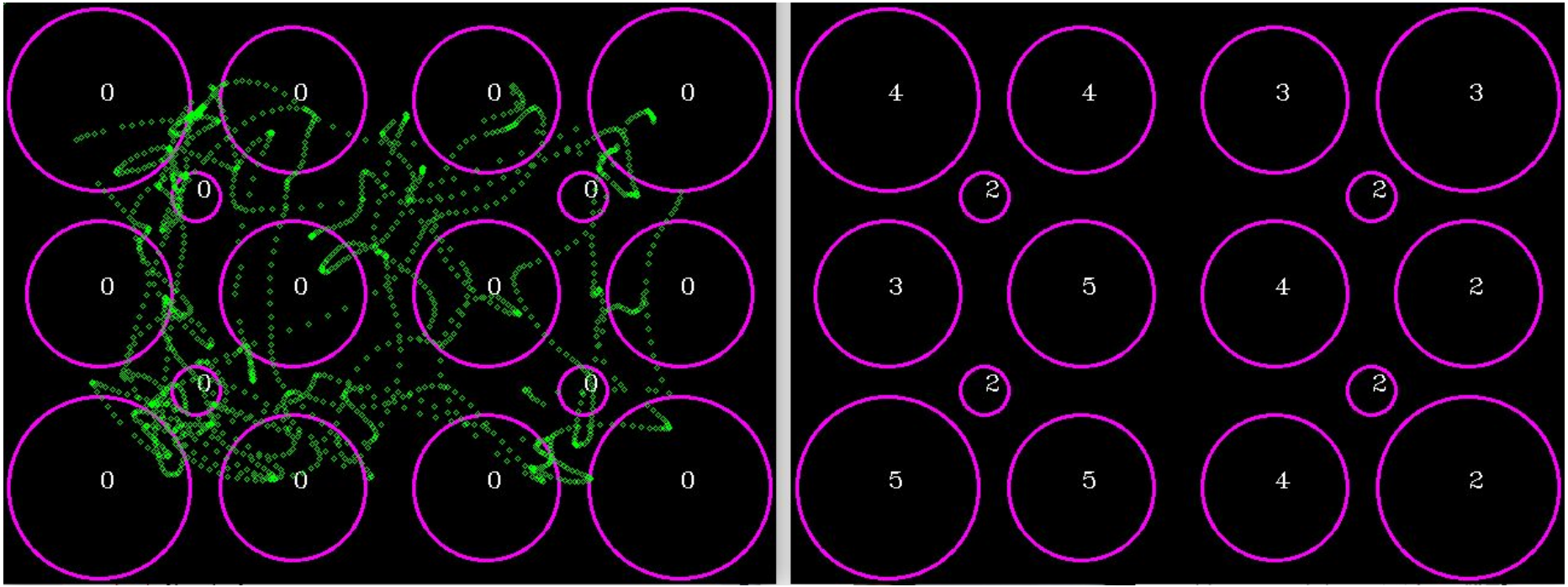
Control Point Detection



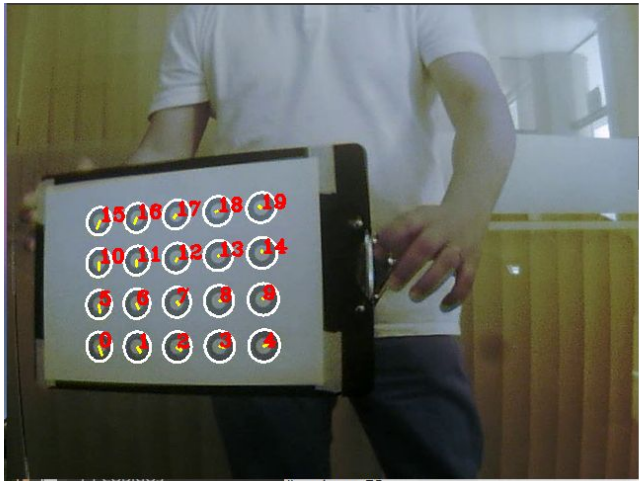
Control Point Tracking



Choosing Frames



Camera 1: Undisort + Remap

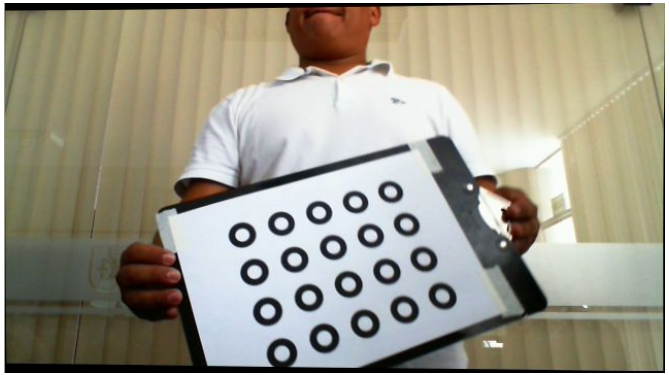


(a)Distorted image

(b)Correct image

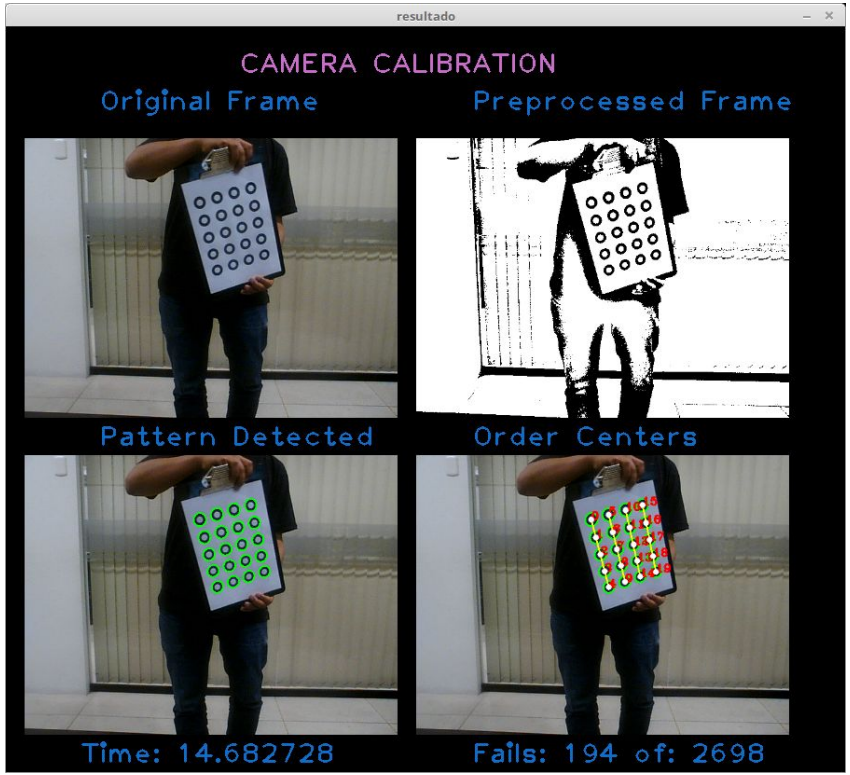
Camera 2: Undisort + Remap

(a)Distorted image



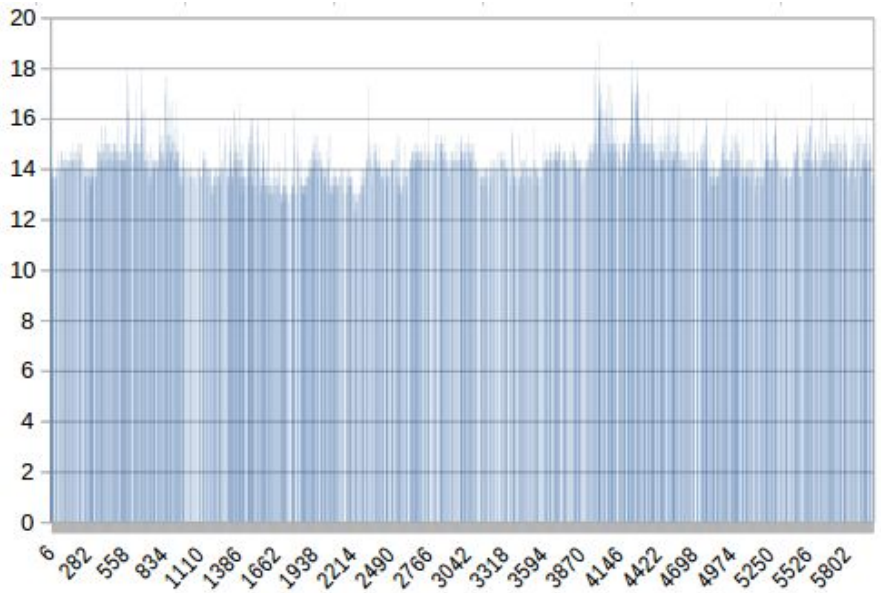
(b)Correct image

General View Application

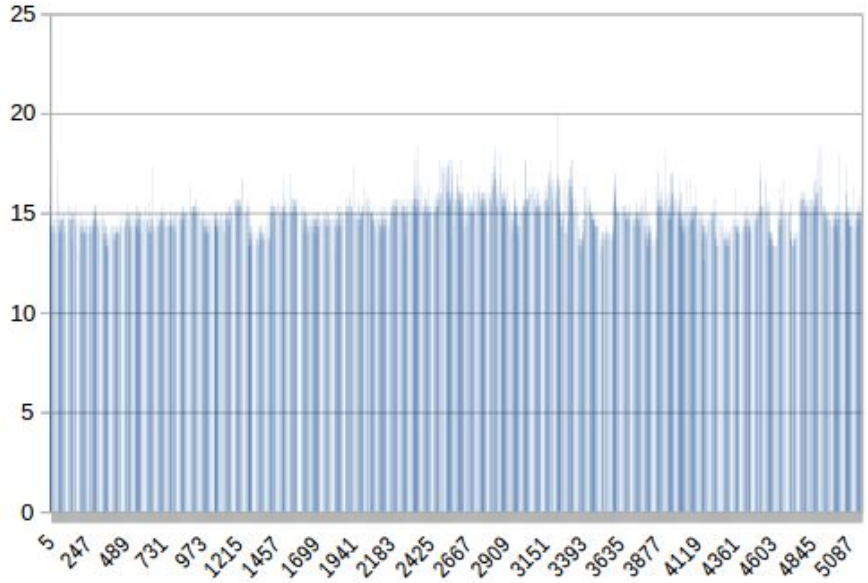


RESULTS

PATTERN 1: FRAME VS TIME



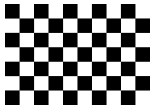
Pattern 2: Frame vs Time



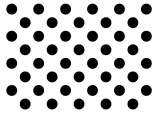
Results: Tracking

	Patrón 1	Patrón 2
Time	5.01ms	5.06ms
Frames	Fail 467 of 5972	Fail 413 of 5144
Accuracy	92.18	91.97

Calibration: camera 1



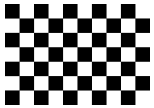
OpenCv implementation (ChessBoard)(rms=0.5972)		
674.10767	0	309.26380
0	67345705	262.5772
0	0	1



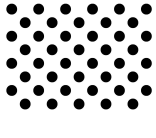
OpenCv implementation (Assymetric)(rms=0.7987)		
751.7648	0	348.8548
0	755.7854	263.02961
0	0	1

Our implementation (rms=0.2918)		
705.0014	0	351.4085
0	701.6671	258.9697
0	0	1

Calibration camera 2



OpenCv implementation (ChessBoard)(rms=0.5308)		
514.5797	0	335.1768
0	514.8973	181.4782
0	0	1

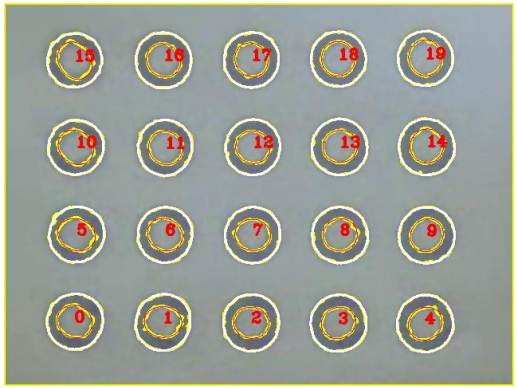


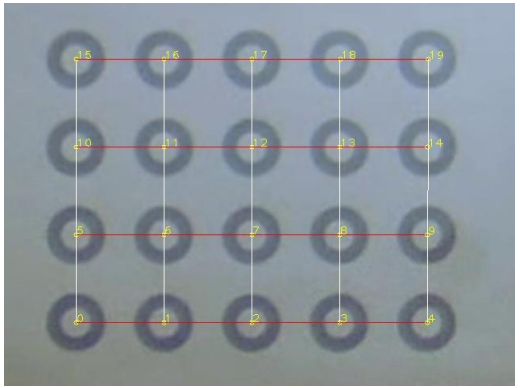
OpenCv implementation (Assymetric)(rms=0.2783)		
492.4746	0	328.70143
0	493.9645	175.3383
0	0	1

Our implementation (rms=0.3781)		
508.94199	0	300.25258
0	509.63553	184.21757
0	0	1

Iterative refinement

1. First Calibration
2. Undistort and Unproject
3. Localize control points
4. Unproject (Fronto Parallel)
5. Localize control points
6. Reproject
7. Control points Refinement





Refinement

Normal

1 points:
(reprojected) Red

Average

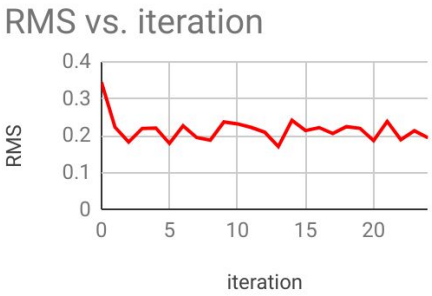
2 points:
(reprojected) Red,
(original) Green

Baricenter

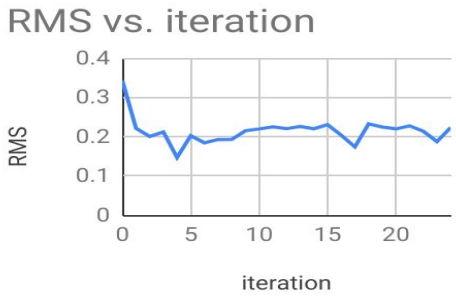
3 points:
(reprojected) Red,
(intersection) white,
(original)Green

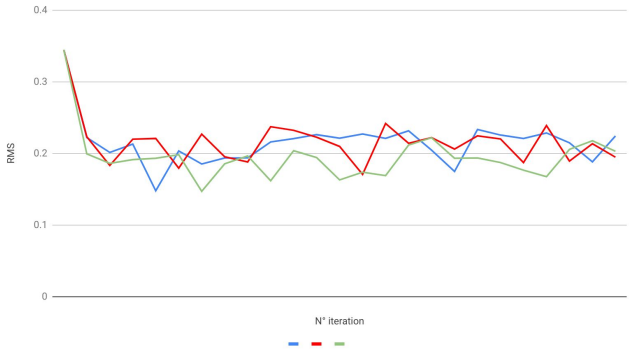
Refinement - Camera 1

Normal



Average





Baricenter