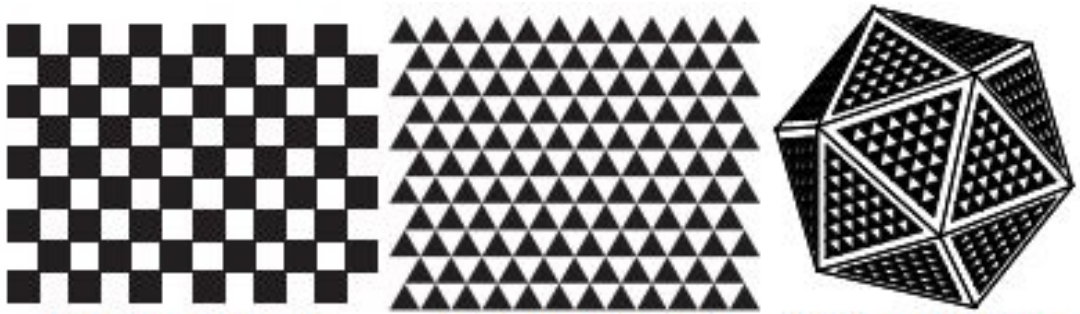
Deltille Grids for Geometric Camera Calibration

Introduction

Empirically demostrate that deltille grids (regular triangular tiling) produce the highest precision calibration of the possible tilings of Euclidean plane.

- Highly precise corner detection algorithm based on polynomial surface fitting
- Indexing scheme based on polarities extracted from the fitted surfaces

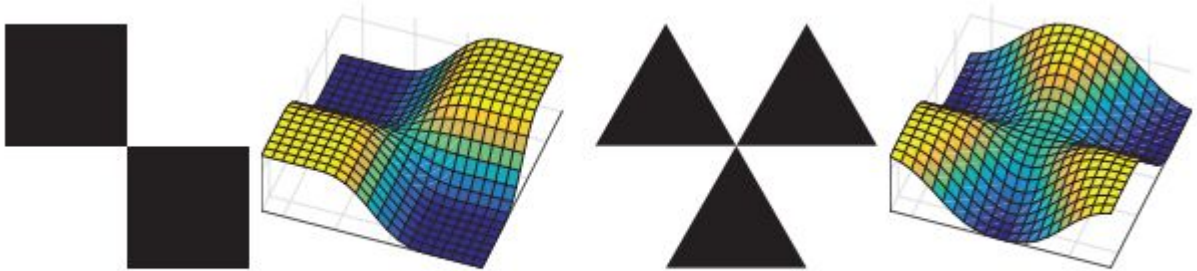


(a) Checkerboard (b) Deltille Grid (c) Icosahedron

Advantages

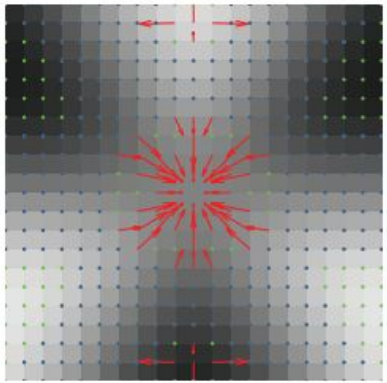
Principal advantages to deltille grids compared to checkerboards

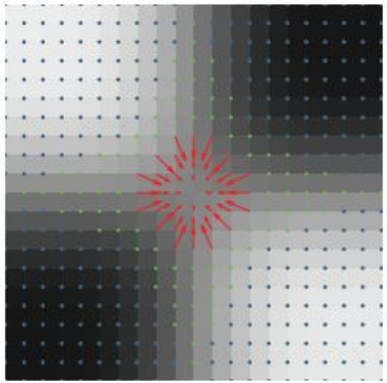
- Deltille grids have Higher density of elements
- Each fiducial is characterized by the intersection of three alternating edges
- Triangle is a more attractive primitive than a quadrilateral

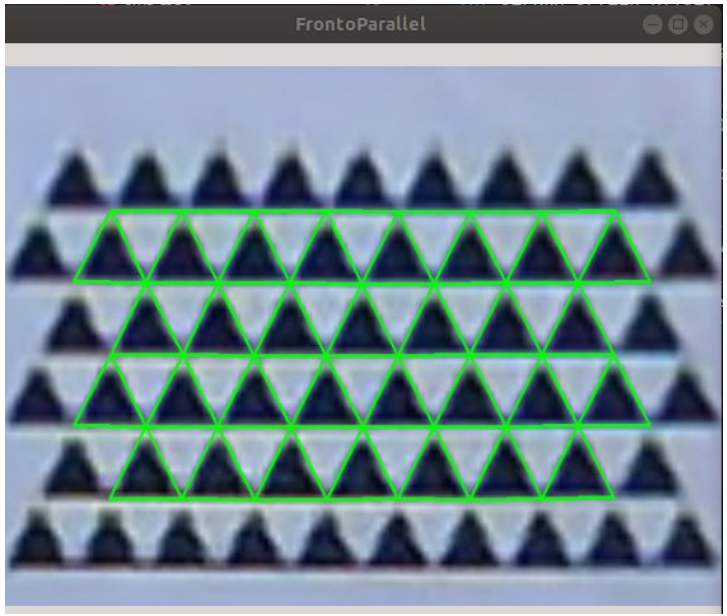


(a) Saddle surface (b) Monkey saddle surface

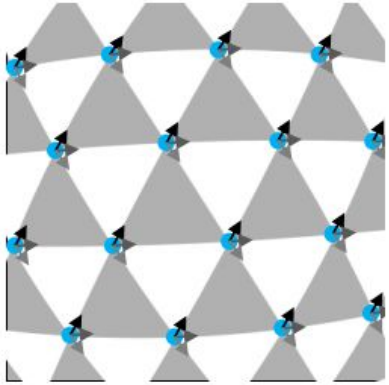
- Fitting a monkey saddle point surface



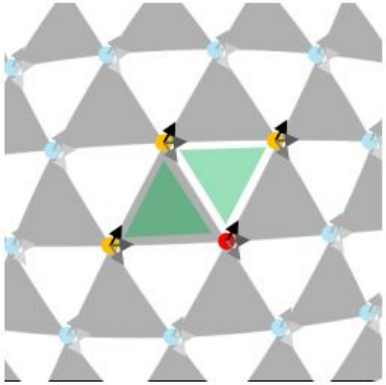




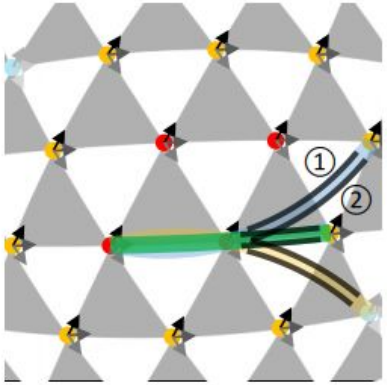
Deltille Grid Detection



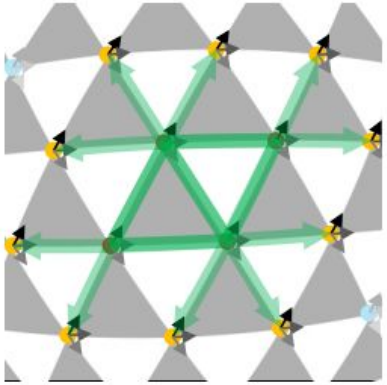
(a) Corners with polarities



(b) Initial quad detection



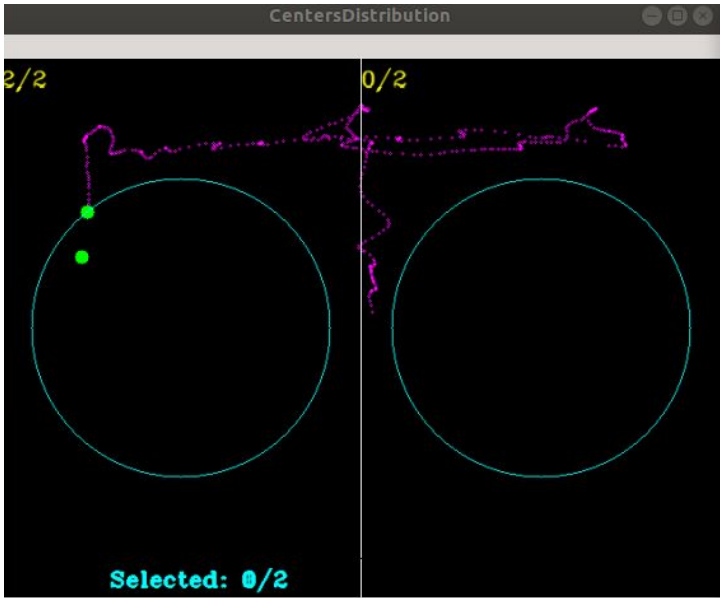
(c) Circle fitting



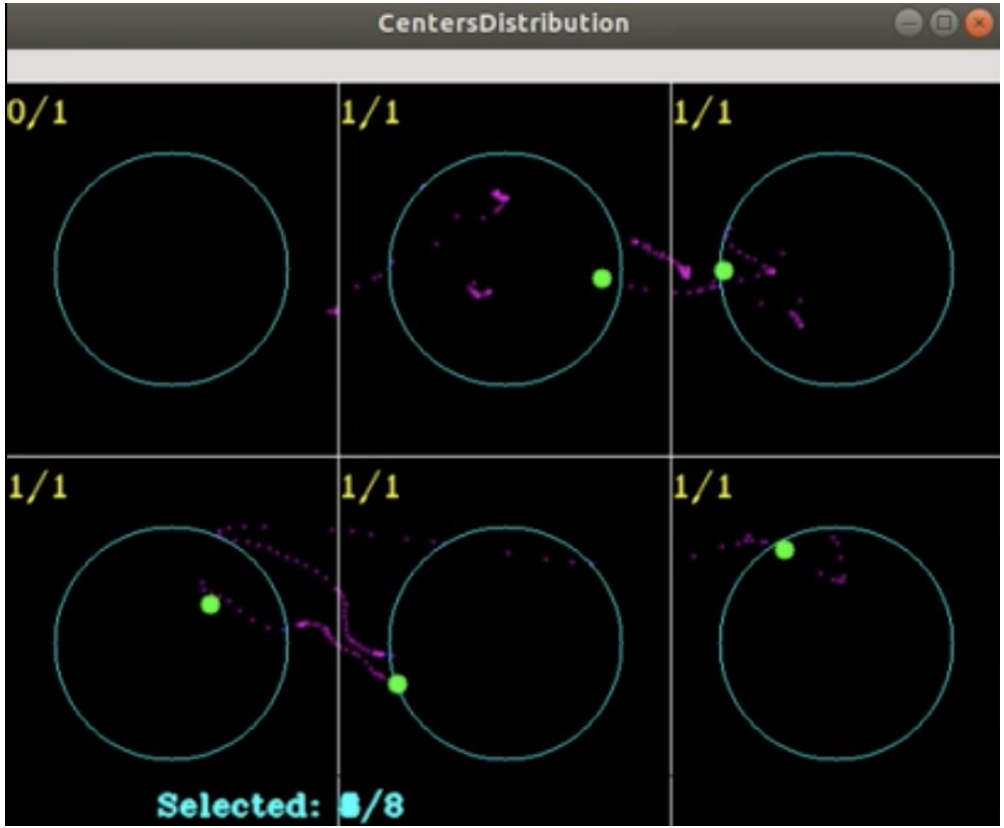
(d) Grid growing

The method to obtain better frames was to try to have a uniform distribution over the entire visual field of the camera.

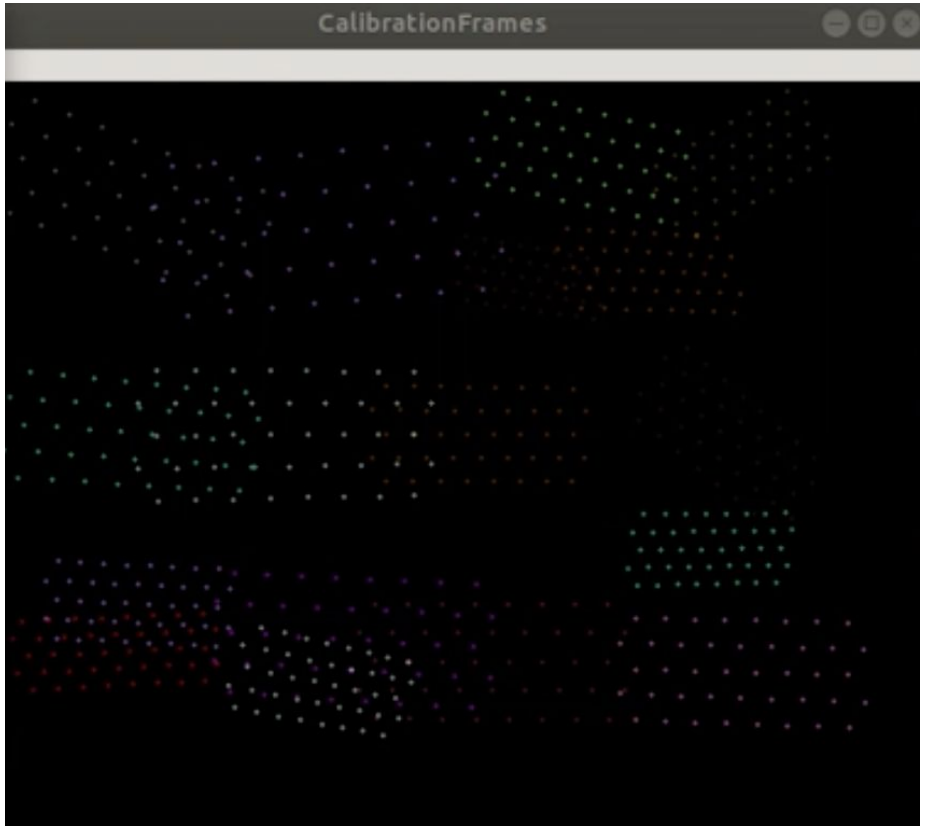
For this we first divide the window, take the center of the pattern and check if it is within one of the divisions.

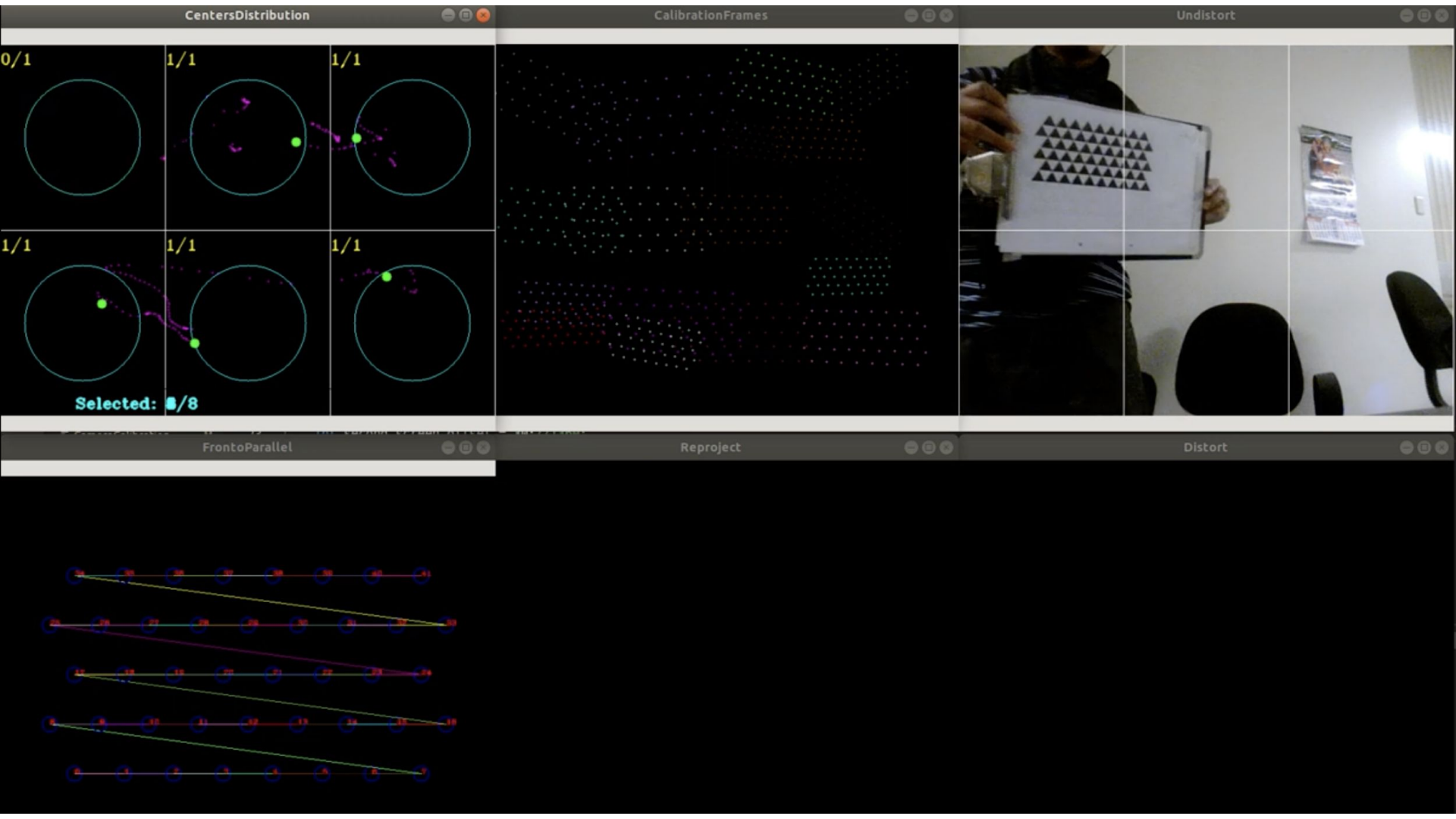


We go through different divisions to ensure the best distribution.



In the end we get a distribution equal to this, where we take the best frames of the entire video.

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0/1
1/1
1/1
1/1
1/1
1/1
Selected: 8/8
CalibrationFrames
Undistort
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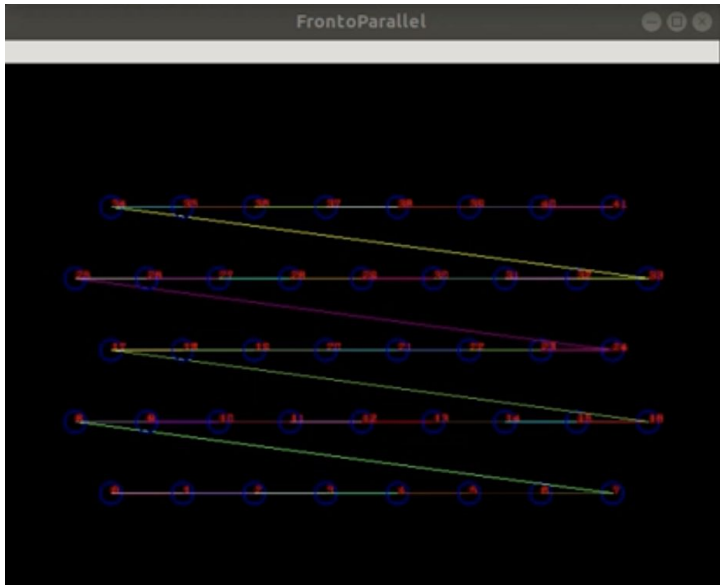
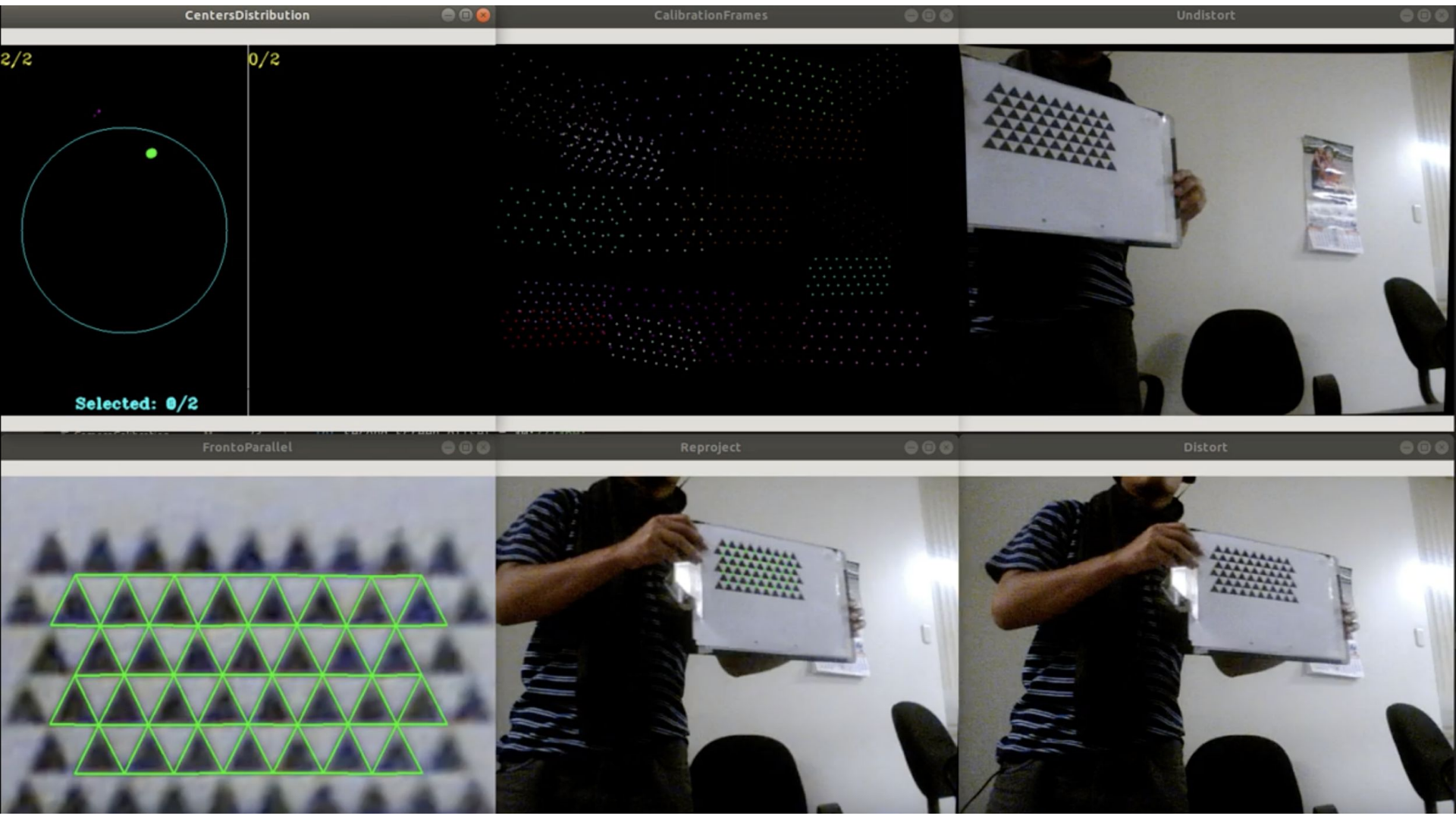


Once we obtain the necessary frames for the calibration, a first attempt is made to calibrate the camera, which we will improve iteratively, only taking the frames that we have correctly found, a refinement is made between the Parallel Fronto points and the reprojection .


CentersDistribution
2/2
0/2
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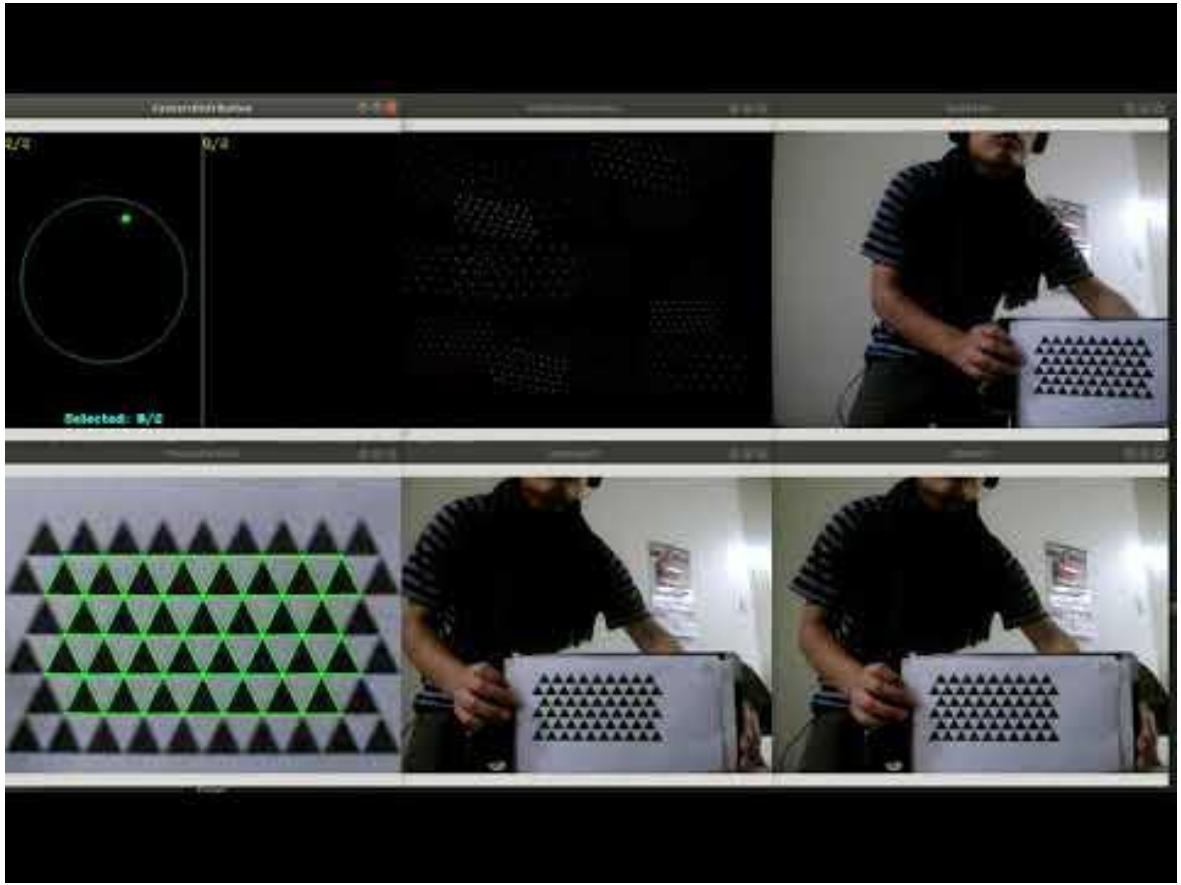
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