Camera calibration Using Deltille Pattern

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Abstract—The pattern detection is one important part of the computer vision, for that a correct for that reason to obtain the best results in later steps it is necessary to have the best way to calibrate a camera, this changes depending on the proposed scenario, in this paper we try to implement a calibration form proposed in [1], to obtain more faithful results .

Index Terms—Deltille, Pattern, Calibration, monkey saddle, Machine Vision, Filter

1 Introduction

CAMERA calibration is one of the main steps in computer vision, it is useful to get information about the world from images. The are several ways to calibrate the Camera, in this work a method using a well known pattern and some images is used, this method was proposed by Zhengyou[2]

There are several ways to perform a detection of patterns, since the selection of what kind of pattern to use, it could be a mesh of squares or like in this work a mesh of concentric rings, to the selection of filter and its parameters.

The purpose of this paper is to perform a camera calibration using a deltille pattern, based on the paper of [1].

2 Steps

2.1 Space color

The raw image is converted to grayscale for two reasons, to reduce number of computations, and because the color in most situations does not provide any relevant information, in this particular scene to use the following filters is necessary work in just a single channel.

2.2 Preprocessing

Filters are used in order to remove unnecessary information or remove noise from the image or just to get relevant information depending on the application as was done in the calibration of normal patterns you also have to remove the unnecessary noise.

To remove noise for high frequency, a Gaussian filter is applied, See figure 1 Apart of that threshold filter is applied.

2.2.1 Adaptive Threshold

In this case just a Adaptative threshold is aplyed, tha reason id that in the proccess of building the program, find that the method works best when only this method is used, instead using an integral threshold resulted in less quality calibrations images.

Solve the problem of changes and lighting, obtaining a degree of error, but the use of this technique has a high computational cost.

Not all the noise is deleting but, we get better perform of the patter.

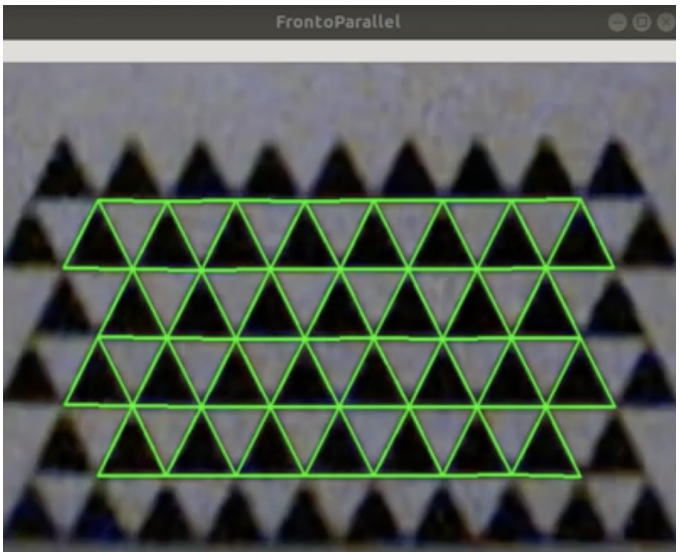

Fig. 1. Finding monkey saddle

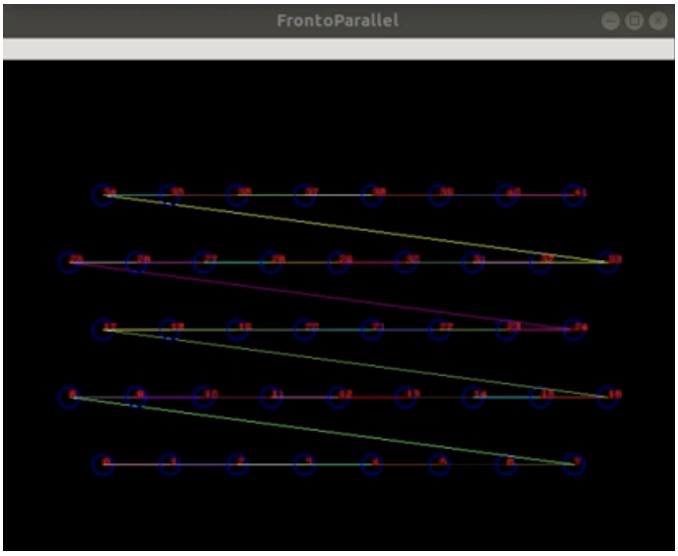

Fig. 2. Pattern Detection

2.3 Monky Saddle Detection

After having the image in a form with less noise, we go for the obtaining of the monkey saddle, the pipeline for the obtaining of these, is to try to find it with the equation, which is the intersection of the 3 planes, this to have a greater contrast we get a better saddle point and a better position of the true center, even when the image does not have an indicated resolution.

After thar we compute the polarities

In the Figure 1, we can see the Fronto Parallel representation in the image.

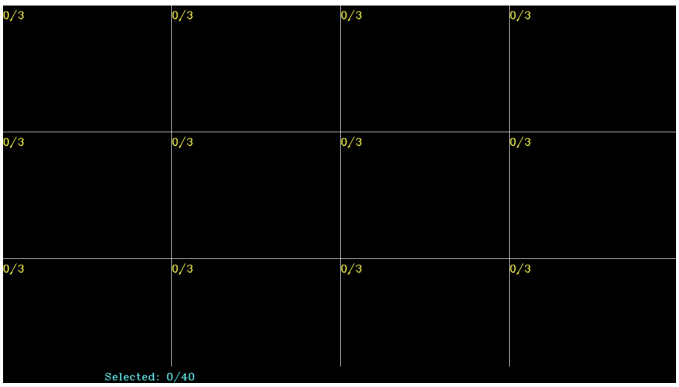

Fig. 3. Circle Distribution

3 Identification and tracking of pattern elements

3.1 Ditribution

To have a better calibration, we have to use a distribution method, this is done through circles in the calibration image where we assume the best frame is found as in de Figure 3.

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.

4 Pipeline

4.1 Initial State

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

This is the initial distribution window, it will go through different divisions to ensure that it is distributed correctly.

It is necessary to have a certain amount of frame to be able to start with the calibration, this calibration is an initial calibration that will only serve as a guide to start the iterations.

4.2 Final State

Once we obtain the necessary frames for the calibration, a first attempt is made to calibrate the camera, which we will improve iteratively,

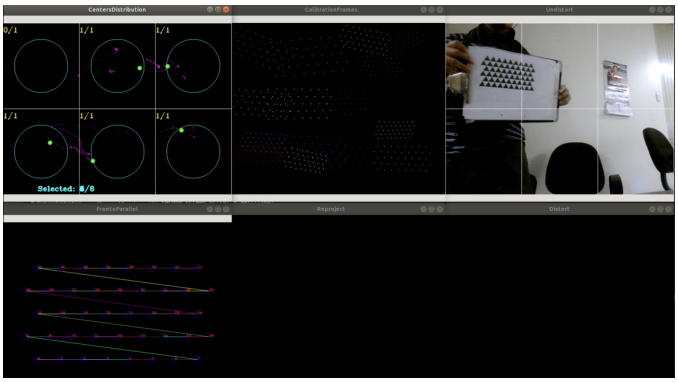

Fig. 4. Initial Program state

only taking the frames that we have correctly found, a refinement is made between the Parallel Fronto points and the reprojection .

This process is carried out by a certain number of iterations in order to improve the accuracy to some extent.

In the final distribution we can see how the pattern has moved through the image, in the circles they are the places where the frames are better defined.

we save the best located frames to use later.

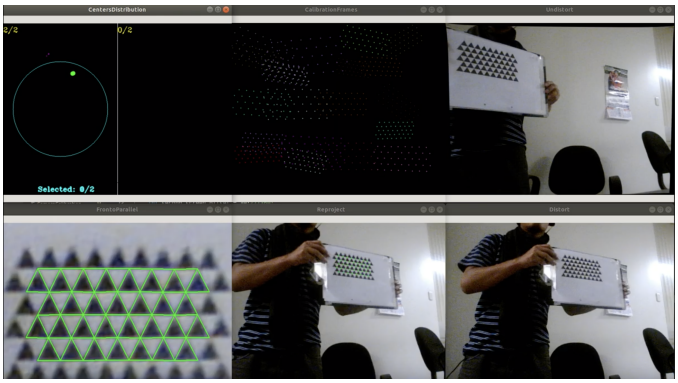

Fig. 5. Final recognition result

4.3 refinement State

After obtaining a complete distribution of all the distributed pattern homogeneously, they used the frames that we previously saved to refine the calibration process, taking the average between the points obtained in fronto parallel and in the image reprojected, this will create a better scenario to have the better approximation, this process does not provide an RMS of 0.167.

5 Conclusion

Using the deltille pattern a better result was obtained by finding the points that were used in the calibration, the approximation was substantially more precise, but it is counterbalanced with the greater time of harvest compared to the calibration with elipces.

The best point of the deltille detection is, with less definition blur ¿= 1, the error mean detetion keeping less.

References

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