IRL #5: Progress Review

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Team G: EXCALIBR

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Individual Progress

Overview

During last week, I focused on integration. FPN training process now is no connected with photo acquisition software and photometric calibration algorithm.

Sensor noise and photometric calibration pipeline

The whole pipeline is automatic except for some mechanical acts are required. Because our FPN algorithm based on the assumption that we can take pictures of a uniform light source, it is essential to make sure the light source is uniform. To provide it, we set up a light box (figure 1) and mounted a uniform surface (Figure 2) into the box. We can now simply put our camera in front of the box to collect better training inputs. (Figure 3)

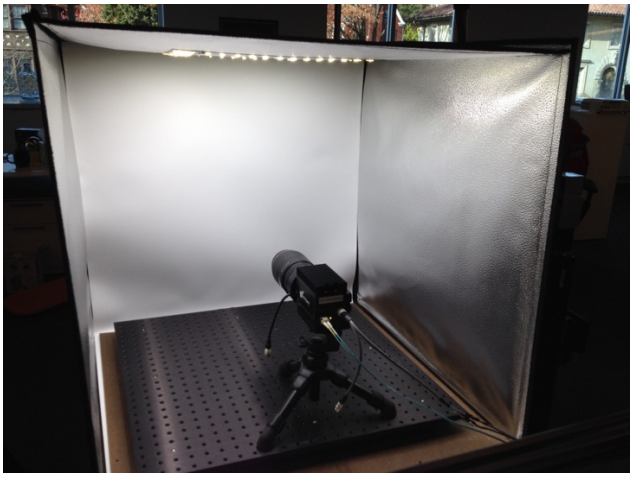

Figure 1 The original look of a light box

Figure 2 The uniform surface

Figure 3 The final outlook of the light box

Figure 4 shows the pipeline. For now, FPN parameters are stored in text files. Reading and writing in text file are pretty slow. Therefore, I will use binary file in the future to accelerate the process.

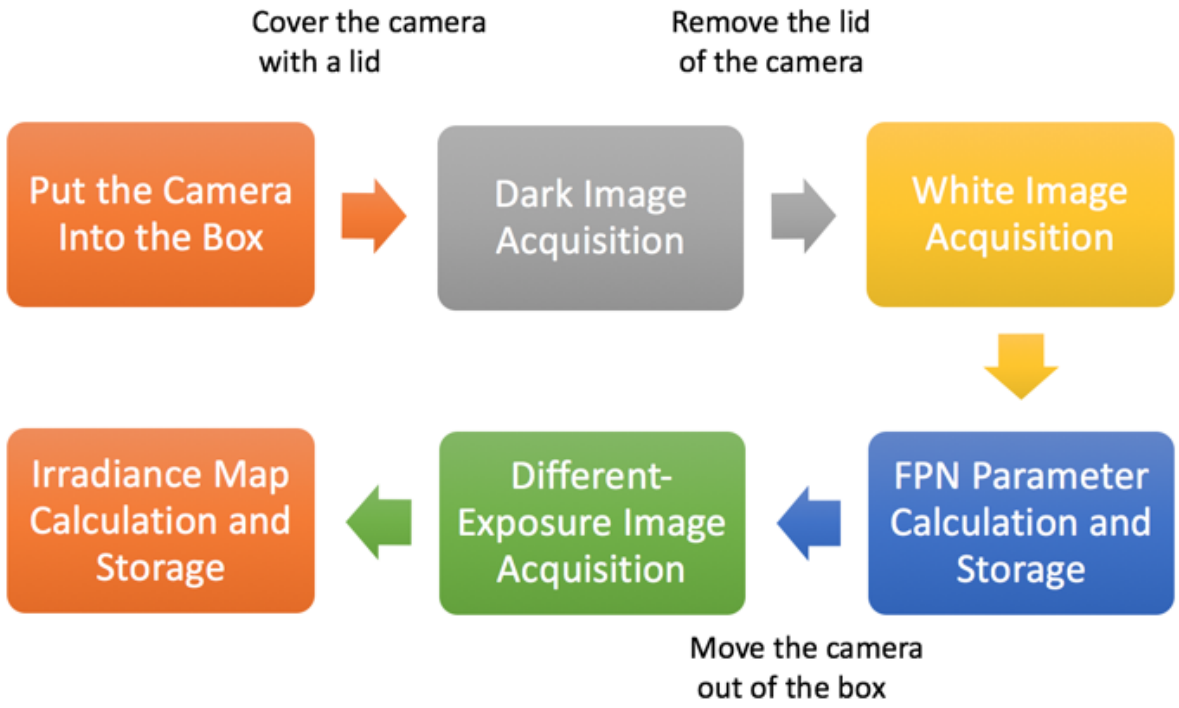

Figure 4 FPN and photometric calibration pipeline

Geometric calibration pipeline

FPN correction algorithm is now combined with geometric calibration process too. It can read FPN parameters and use the data to correct the images that will be used for geometric calibration.

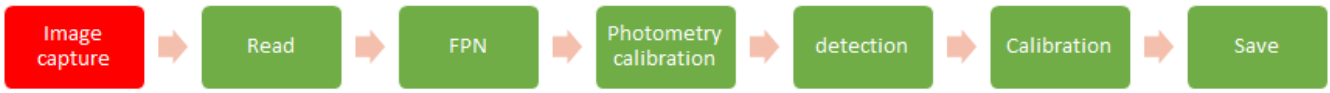

Figure 5 Geometric calibration pipeline.

Challenges

The validation problem has always been our major challenge. To validate the FPN results, we have been using variance. However, this is not enough for our case. Therefore, Fast Fourier Transform (FFT) has been suggested to use for evaluate the FPN result. I will work with Sid on this part. Since I am more comfortable with C/C++ while Sid prefers Python better. It might take some efforts for us to figure out a way to combine our works but we are now working on it.
Some preliminary results can be seen below,

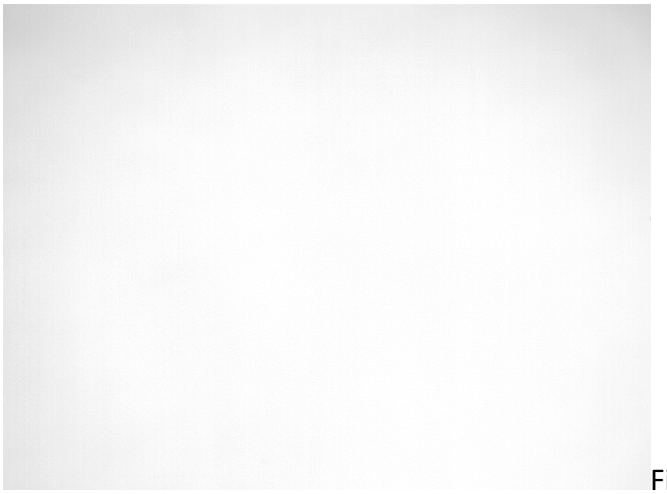

Figure 6 input data

We took a picture of an assumed uniform light source. Due to the lens and the noise in its sensors, the surface does not look like a uniform white image.

Figure 7 FFT of the input (figure 6) before FPN calibration

Figure 8 FFT of the input (figure 6) after FPN calibration
It can be seen that the higher frequencies are weakened and the center white part becomes larger, which means that FPN indeed remove some noises.

Teamwork

Peter:

1. Work on evaluation methods for the geometric calibration
2. Improve geometric calibration efficiency
3. Build up geometric calibration pipeline

Cece:

1. Photometric calibration evaluation
2. Integrate with FPN and geometric calibration

Sid

1. Study FFT method for FPN validation

Sam:

1. Generate AEROTECH robot trajectory
2. Integrate robot arm with camera setup
3. Further on ABB documentation

Future plan

1. Show 1. Visual result 2.FFT result 3. Variance result of FPN calibration.
2. Get familiar with Python

Reference

https://en.wikipedia.org/wiki/Fast_Fourier_transform