Image Processing Class #1.1 — Image Aquisition

Pitchaya Thipkham · Follow

Published in Towards Data Science

3 min read · Nov 5, 2018

▶ Listen   ↑ Share

Hello everyone! My name is Pitchaya. I'm a 4th-year student of Biomedical Engineering Department, Mahidol University.

> I created the articles aim to summarize the lessons I have learned in Medical Image Processing Class or EGBE443. If I made any mistake, please corrected me. Thank you.

Let's start with the first topic, *Image Acquisition.*

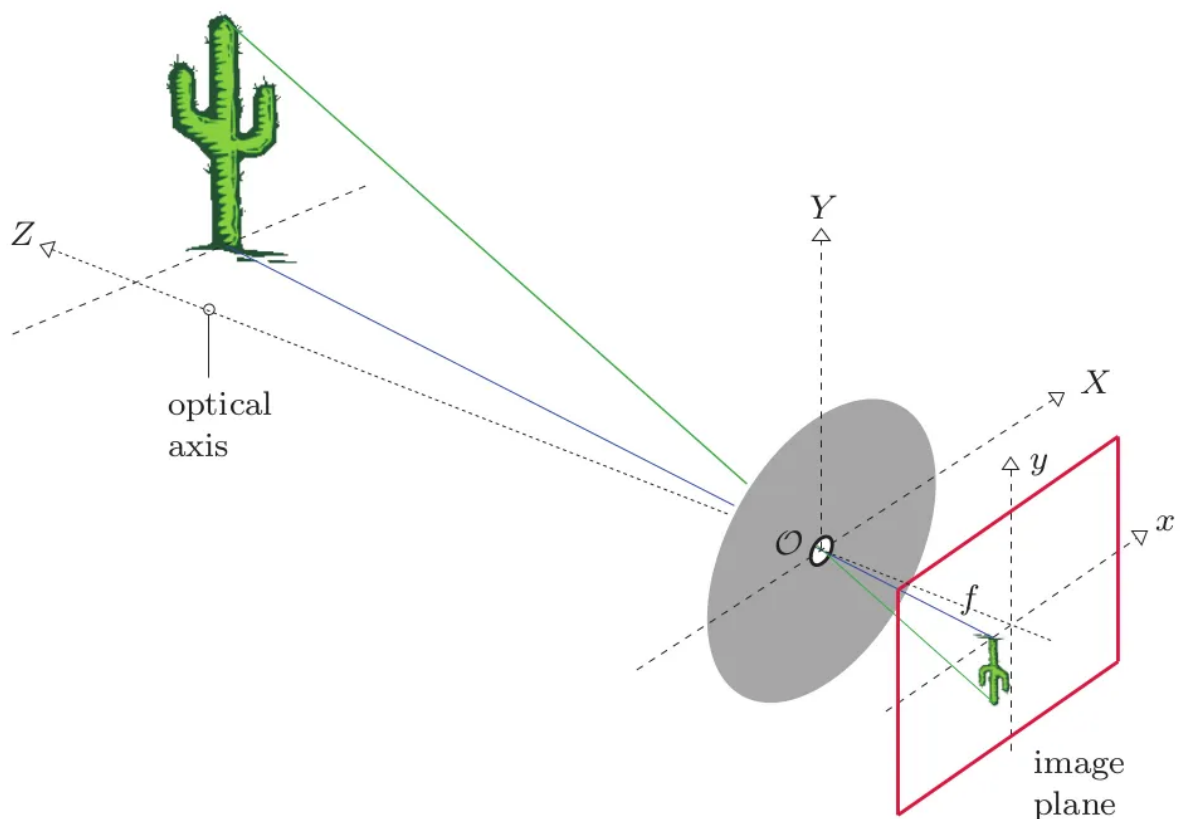
Image from NOPO Pinhole Camera

What is Image Acquisition process?

Image acquisition is a process to construct an image. There is a simple model to perform this process is call *"Pinhole Camera Model"*.

Pinhole Camera Model

P inhole camera is the simplest tool to generate an image. And it easy to make since its components just consist of a pitch-dark chamber, a small hole called "Pinhole" and a scene. To form the image, the light passing through the pinhole and incident to the scene. This makes the image smaller and inverted.

The geometric properties of pinhole camera are quite easy as shown below in the figure.
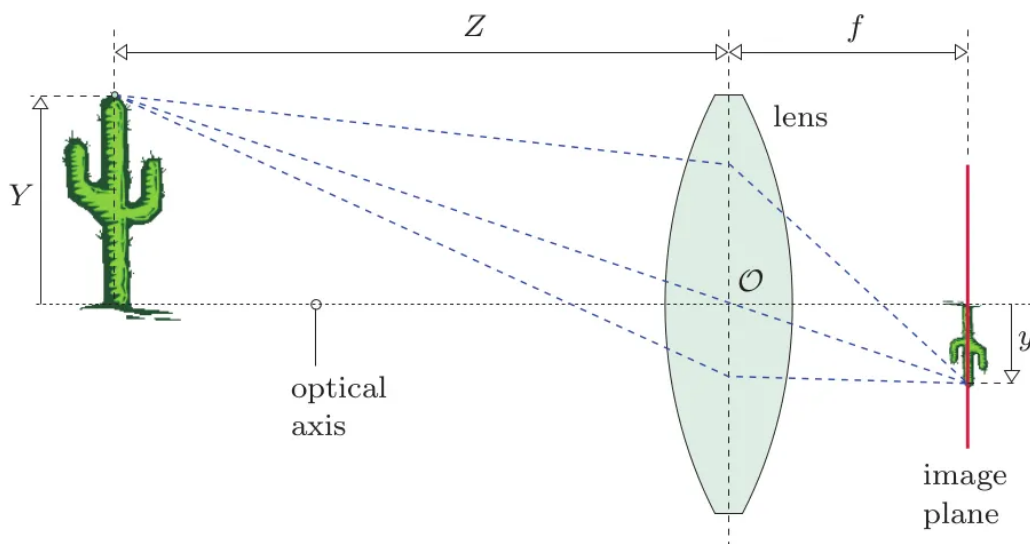

Geometric properties of the image from pinhole camera

From the figure, the object located at a horizontal distance Z from the pinhole and vertical distance Y from the optical axis. And f is the distance between the pinhole and the scene. We found the relationship between object coordinates X, Y, Z and image coordinates x,y, and focal length f by similar triangle principle.

$$y = -f\frac{Y}{Z} \qquad \text{and} \qquad x = -f\frac{X}{Z}$$

The relationship between object coordinate and image coordinate.

However, the pinhole camera is not practical to use as expected. The smaller hole produces the sharper image and it comes along with longer exposure time. So the *optical lens model* is used for these reasons. For use, we need to replace the pinhole with a thin lens. We assumed that it is infinitely thin. So the geometry of the image is similar to the image from the pinhole camera. The geometric properties of the thin lens model are shown in this figure.

The geometric properties of thin lens model

And this video will show you how to make Pinhole Camera and the result of image acquisition process.

My friends in our group and me built a pinhole camera and test the first prototype in different distance and speed shutter. These are the results in each criterion.
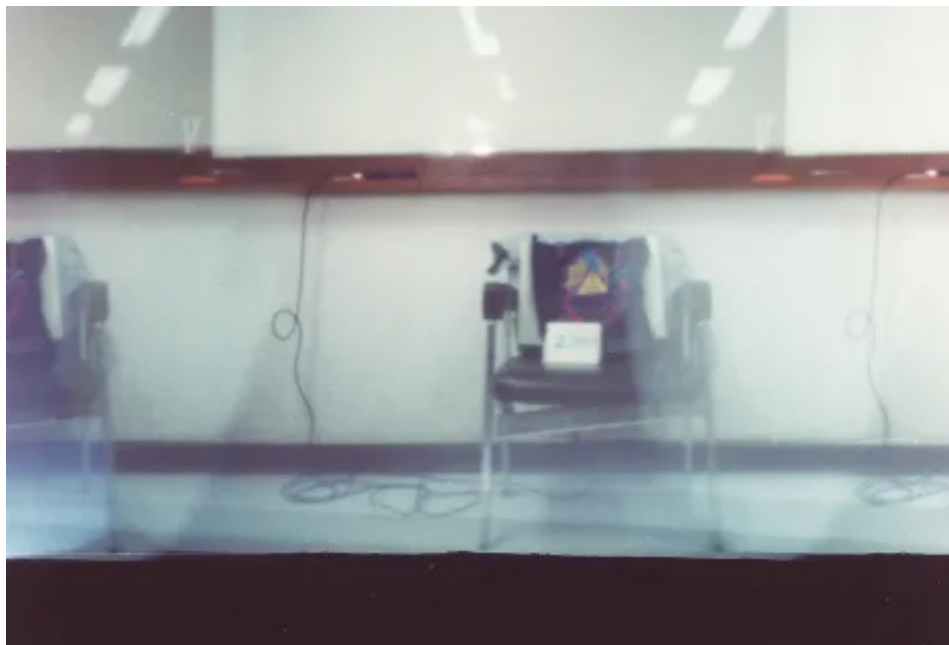
- Distance from object = 1 m. Speed shutter = 5 sec

- Distance from object 1 m. Speed shutter 10 second

- Distance from object 2 m. Speed shutter 5 second

- Distance from object 2 m. Speed shutter 10 second

As you see, it's easy to make! Let's do it and enjoy your camera! :)

Anyway, image which is adjustable must be the digital image. So in the next chapter, I will explain about this topic. It makes you understand how it suits for modify in this form.

Here is the next article. Please click on it to go :)

Image Processing Class #0.2 — Digital Image

This article is for sum up the lesson that I have learned in medical image processing class (EGBE443).

medium.com

Photography   Image Processing   Biomedical Engineering   Pinhole Camera