# Maestría en Ciencias de la Computación
# Camera Calibration using OpenCV

Diego Alonso Javier Quispe , David Choqueluque Román

Universidad Católica San Pablo

{ diego.javier, david.choqueluque}@ucsp.edu.pe

Arequipa,Perú

*Abstract*— The are many applications to machine vision, and is important to know the relation between the image of some object and its physical dimension in the space. The main idea to this work is obtain a good camera calibration procedure using a special grid determinated by circles. We developed the algorithm in c++ using OpenCV.

*Key words: Canny algorithm, OpenCV*

## I. INTRODUCTION

There are many methods to detect the edges in the images some of these are described in Theoretical Framework. We introduce the first step to camera calibration, the edge detection.

## II. THEORETICAL FRAMEWORK

### II-A. Canny algorithm

The canny algorithm was developed in 1986 and their main objective is the edge detection. This algoritm has three criteria, there are:

1. A **detection** criterion express the fact of avoiding the elimination of important edges and not suppying false edges.
2. The **location** criterion establishes that the distance between the real position and the location of the edfe should be minimized.
3. The **answer** criterion that integrates multiple answers to corresponse a unique edge.

## III. METHODS

### III-A. Canny

We tried the OpenCv function **CannyThreshold** to get the edges and show the result. You could see the detected edges in the **Fig. 1**.

### III-B. Find Contours

We use the OpenCv function **threshold** and **findContours** to get all the contours. You could see the detected edges in the **Fig. 2**.
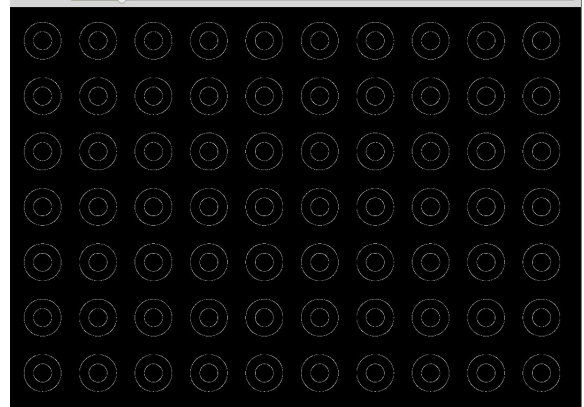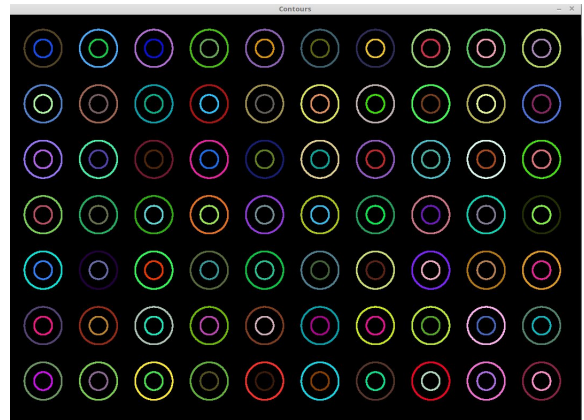


Fig. 1. Canny Algorithm.



Fig. 2. Find Contour.

### III-C. Find Centers

To calculate the centers of the ellipses we analyze two options, use moments and calculate the center of mass of the ellipses (cvMoments) or apply the ellipses fitting technique of [3].

- **Center of mass:** The center of mass or centroid is the point in which the region will be perfectly balanced, in the case of the ellipse, the centroid corresponds to its center.
- **Ellipse fitting:** Takes in a set of input points of a boundary or closed curve, and determines all the parameters of an ellipse that best fits the input set of points.
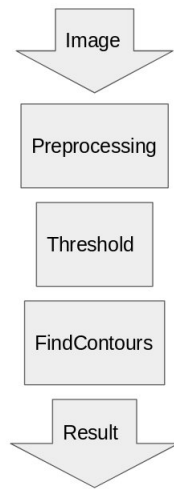
*III-D. Pipeline*



Fig. 3. Find Contour.

REFERENCES

[1] Zhengyou Zhang,"A Flexible New Technique for Camera Calibration", 2000.
[2] Ankur Datta, "Accurate Camera Calibration using Iterative Refinement of Control Points", 2009.
[3] Prakash, Çamera Calibration using Adaptive Segmentation and Ellipse Fitting for Localizing Control Points", 2012.