A Stereoscopic Image System for Circular Objects recognition in Agricultural Environment

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Abstract. As main characteristic of the stereoscopic imaging is the recovery of the depth information that is lost when an image is obtained. The proposed system is used to recognize circular patterns through Hough transform and to measure its depth, to recover the metrics of the elements in agricultural environments, as the application of the quality control of fruits in the orchard.

1. Introduction

The stereoscopic imaging has a purpose of the three-dimensional reconstruction (3D) of an object of a scene, starting from two images.

The modeling of a stereoscopic system uses a geometry Epipolar of two cameras positioned side by side and previously gaged, as it illustrates the Figure 1.

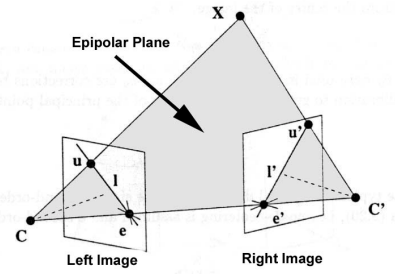

Figure 1 – Geometry Epipolar for two cameras.

The process of recovery of the three-dimensional coordinates X, Y and Z, when the coordinates of the pixel of the image 1 is (x_1,y_1), and of the image 2, (x_2,y_2), starts in the equation 1 to calculate the coordinate Z, and the equations 2 and 3 for the reconstruction of X and Y, respectively [1] .

$$Z = d - \frac{d t_c}{x_2 - x_1} \qquad (1) \qquad X = \frac{x_1}{d}(d - Z) \qquad (2)$$

$$Y = \frac{y_1}{d}(d - Z) \qquad (3)$$

where d is the distance among the two cameras, t_C is the distance of the lenses to the device of CCD (Charge Coupled Device).

2. Materials and Methods

The system is composed by two cameras Creative® Webcam connected in a portable computer of the type IBM-PC through USB (Universal Serial Bus).

The acquisitions of the images are accomplished in an alternated way among the two cameras, before the filtering of the type "Average" to its enhancement and the histogram equalization. The next stage is finding the correspondence pixels of the two images, through the correspondence block procedure. It uses the approach of the mean square error calculation between blocks of two images[2].

After the recognition of the correspondence pixels, it is applied the method of the stereoscopic imaging to the three-dimensional reconstruction and the real objects size determination. After that, the Hough transform is applied and the circular objects information extracted.

3. Possible Applications and Conclusions

After the three-dimensional recovery of images it is possible to accomplish several applications, as example, the quality control of circular fruits directly at the orchard. This control can accomplished through the attendance of the size of the fruit, where techniques of image processing, as Hough transform, are used for automatic recognition of circular patterns of interest.

The tests that are being accomplished for the acquisition of stereoscopic images, using the proposed system indicates that the tools guarantee its flexibility and reliability for applications in agricultural environment.

References

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