Opole University of Technology

Department of Mechanics and Machine Desing

Image analysis
Laboratory exercise manual

Image processing: scaling the measure and perspective correction

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1. The purpose of the exercise

The aim of the exercise is to verify the shape error of the image caused by the perspective view of the object being studied. The manual describes the calibration process and the measurement of the actual size of the object.

2. Preliminary information.

When the camera is not set perpendicular to the object being analyzed, image distortion appears called the perspective view (Figure 1).

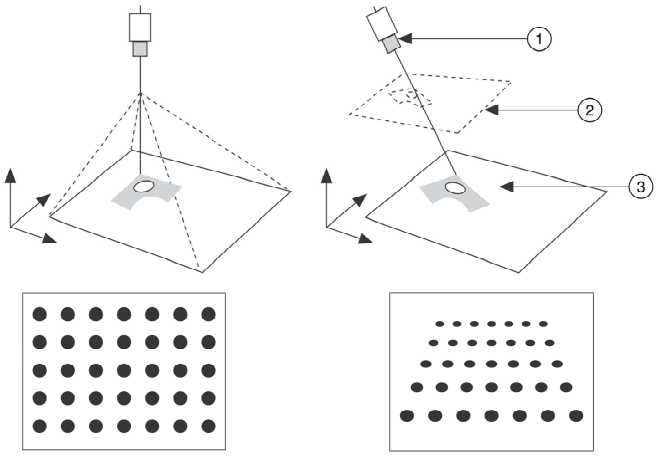


Fig. 1. Perspective view

In the case of such distortion, it is necessary to prepare a file containing the image used for calibration. Usually this is an image of a pattern made in exactly the same conditions in which measurements and analyzes will be performed later (Figure 2).

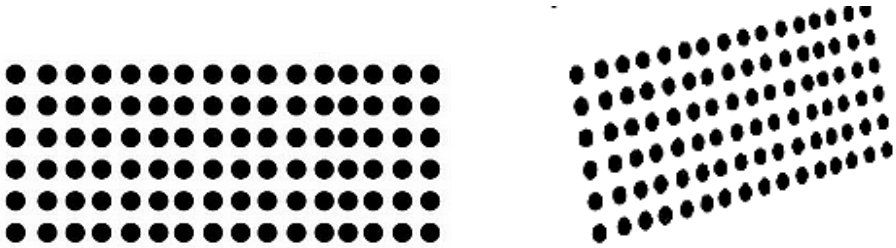


Fig. 2. Pattern and image of the pattern from the camera

The pattern has the form of points (circles) of known diameter and distance between rows and columns. To build a calibration file, one must also specify the rotation of the coordinate system between the pattern and its image (Figure 3).

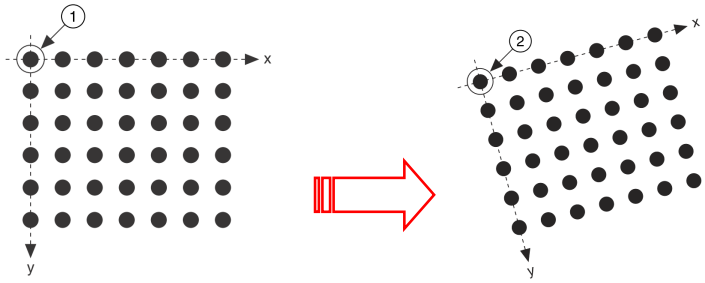


Fig. 3. Location of the coordinate system

3. The course of the exercise.

The exercise will be performed using the NI Vision Assistant module.

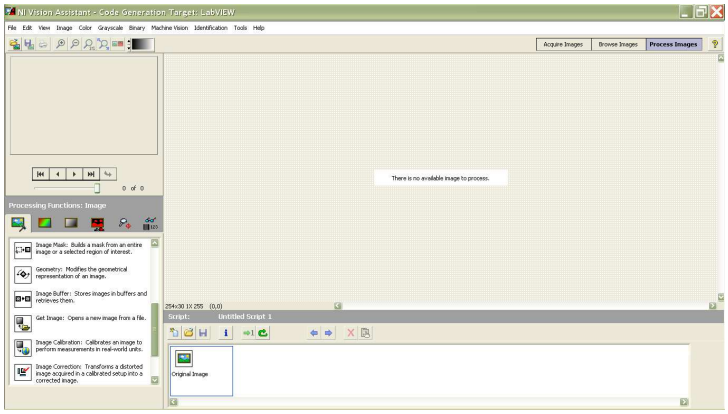


Fig. 4. NI Vision Assistant

3.1 STEP 1 - Load the image stored on the disk.

From the *ProcessingFunctions / Image* palette select the *Get Image* option and load the image showing the analysis object **l03obj.png**

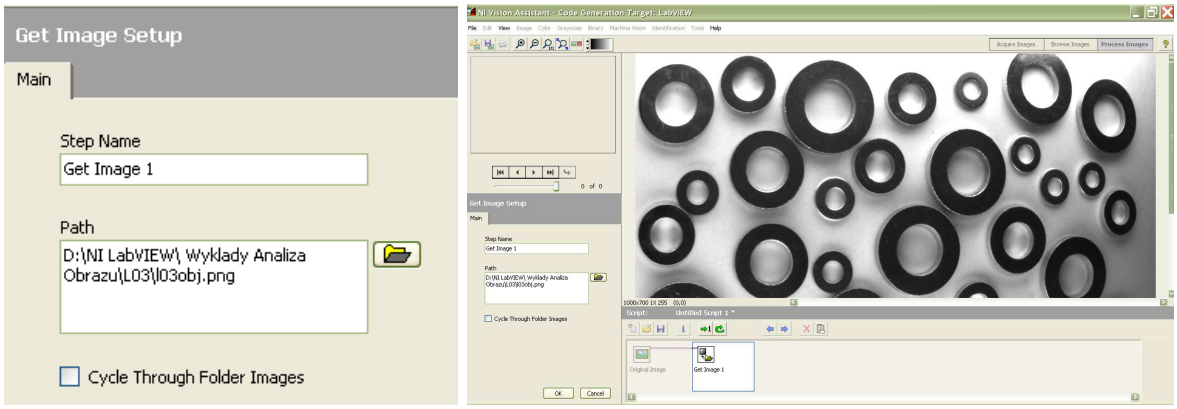


Fig. 5. Loading the image for analysis

3.2 STEP 2 - Image calibration.

From the **ProcessingFunctions / Image** palette, select the **Image Calibration** option and load the image and the template made for the analyzed example: **l03cal.png**

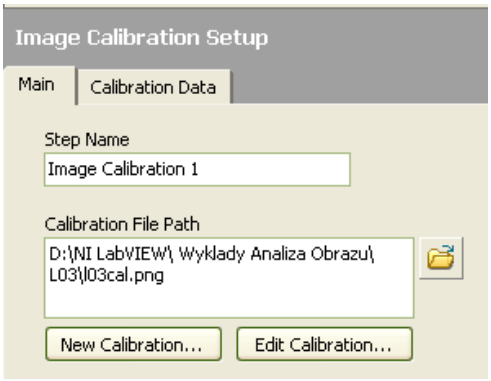


Fig. 6. Loading the pattern image

Next, a new configuration of the system calibration is created using the *New Calibration* key. From the options available, select the *Distortion Model (Grid)* method, which takes into account camera optics errors and camera settings at an angle. Further steps are available by pressing the *NEXT->* key.

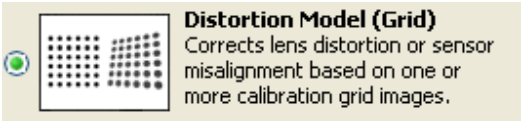


Fig. 7. Calibration method

In the *Select Image Source* window, indicate the pattern image. After pressing the *Load Image from File* button, it opens the file search window (the file l03cal.png must be loaded here). Double-clicking on the loaded image marks it with a red border as selected for further processing.

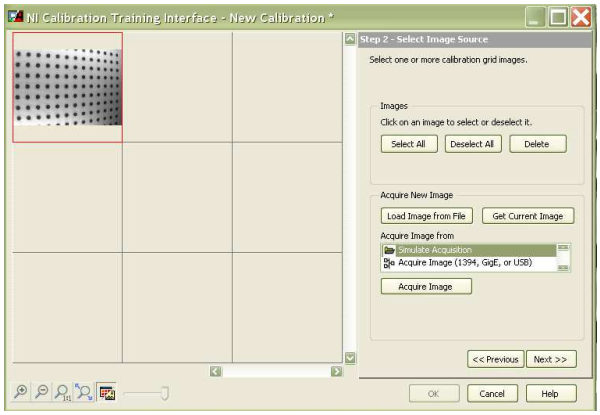


Fig. 8. Loading a pattern image

The next step allows you to extract points from the image that will be used to calibrate the distance and position of the coordinate system. Use the **Rectangle ROI (Region of Interest)** picker to select the area containing the entire picture.

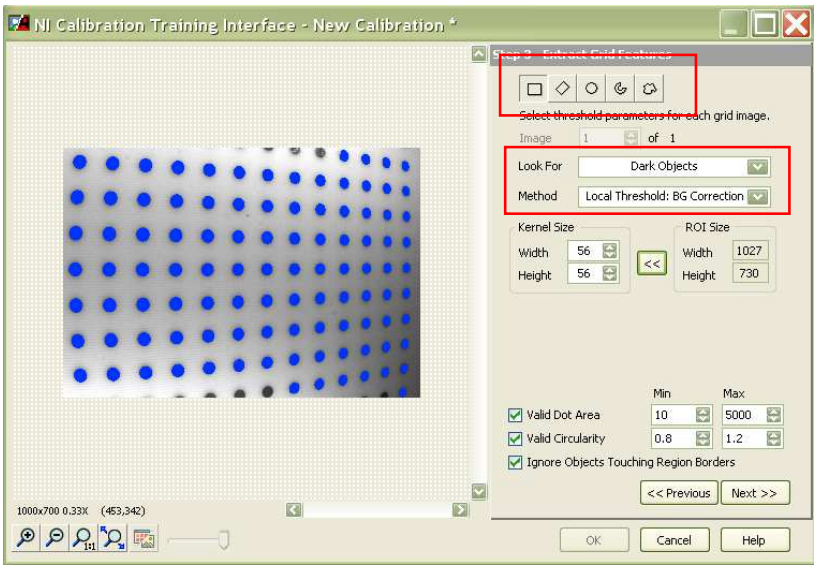


Fig. 9. Extracting points

The *Look for* option lets you specify which objects will be extracted: in this case, dark (*Dark Object*). The *Method* option allows you to select a particular picture form (low sharpness, small points and others). The *Local Threshold* method: BG Correction allows you to use images with **uneven lighting**. Other parameters affect the accuracy and number of selected points (leave unchanged).
Pressing the *NEXT→* key opens the window for configuring the distance between rows and columns and specifying the units of measurement. In this case:

X Spacing = 10
Y Spacing = 10
Units: milimeters

The next step allows you to determine the quality of the calibration performed by specifying *the Distortion Model*. The *Display* option allows you to choose one of the methods for evaluating calibration models, eg the *Corrected Image* option shows the image after the correction with the currently set calibration has been performed.

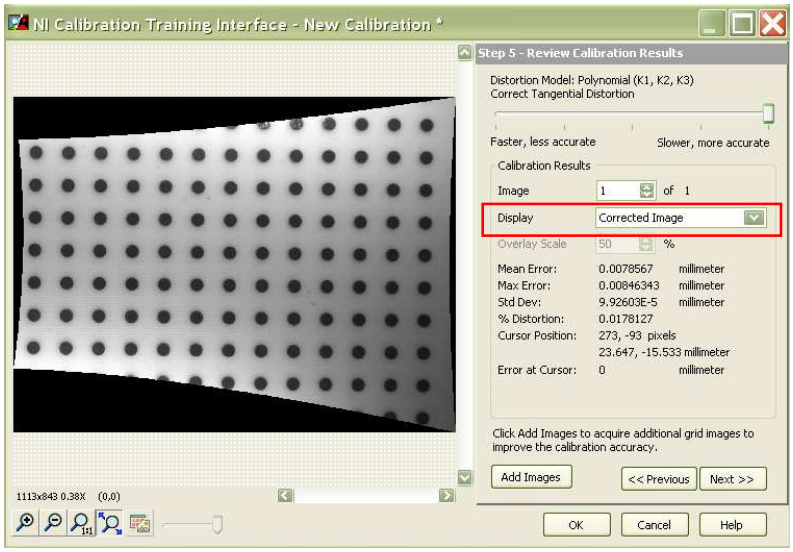


Fig. 10. Verification of the calibration model

The *Specify Calibration Axis* window is used to determine the actual position of the coordinate system relative to the corrected image pattern. In this case, the image was taken for a horizontal and vertical image of the reference frame. This is necessary to correctly determine the distance in the direction of the system axis.
It should be noted that in the image analysis the coordinate system is usually located in the upper left corner, and the positive direction of the Y axis is directed downwards.

When defining the coordinate system, two points should be indicated: the origin of the system and the point on the X axis in the positive direction, and enter the value of the angle between the x-axis of the co-ordinating system in the image and the actual directions.

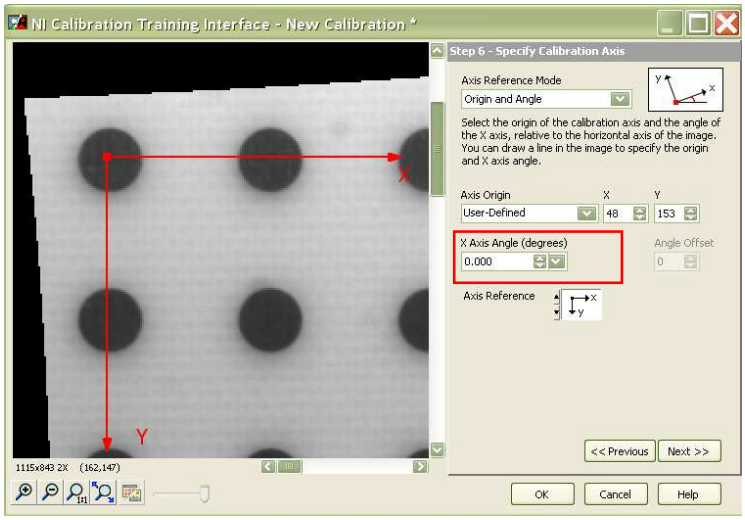
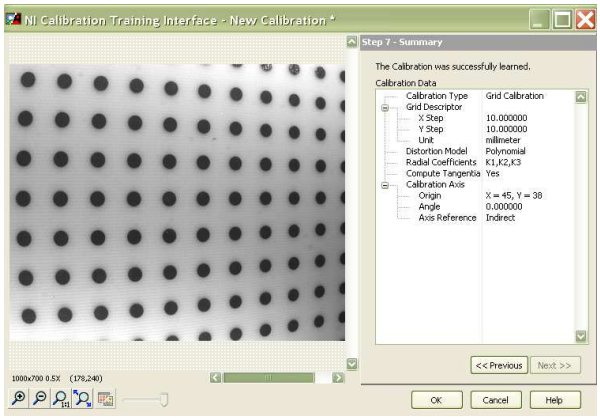


Fig. 11. Definition of the coordinate system

In the last window, you can verify the calibration summary. Calibration is confirmed with the OK key giving the new file name where it will be saved (enter the **calibration** file name).



Rys. 12. Calibration summary

A script will appear on the screen containing image loading and calibration.

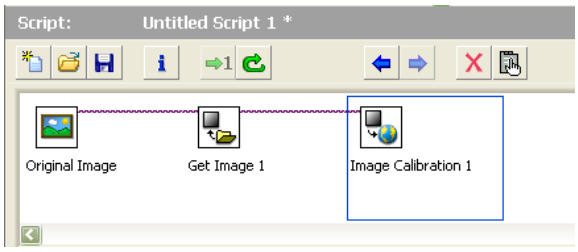


Fig. 13. Image processing script

3.3 STEP 3 – Image processing.

From the *Processing Functions / Image* palette, select the *Image Correction* option, which will allow you to get the analyzed image after correction based on the previously configured calibration procedure.

3.4 STEP 4 - Measurement.

In order to make measurements, the **Clamp** option should also be selected from the *Processing Functions / Machine Vision* palette.

Then specify two corners defining the area of interest. The distance will be given as *Current Distance* (here 19.45mm). **Using the *Process icon*, you can change the type and direction of measurements.**

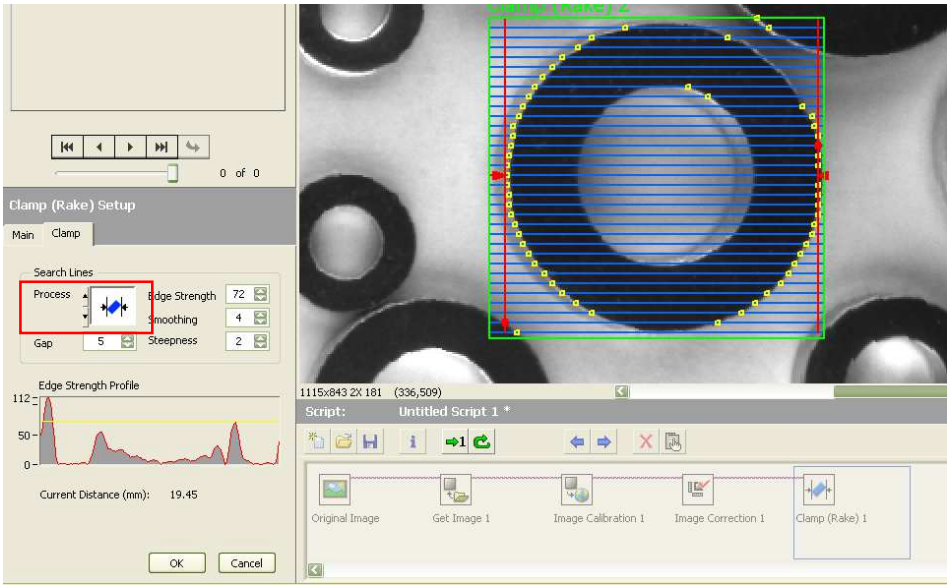


Fig. 14. Distance measurement

4. Task to do.

1. Measure the diameter for several objects in the horizontal and vertical directions. Do vertical and horizontal measurements give the same results, what is the error?

2. Some objects are the same size, measure several objects and compare.