



Using the Lens Distortion Calculation Tool with ProAnalyst®

Revised: April 2011

Abstract

One of the best features of ProAnalyst is the Lens Distortion Calculator and associated image filter. This tool and filter combination allows users to calculate and remove unwanted radial distortion from their video images. This application note describes (1) the applicability of this tool, (2) the meaning of the information presented, and (3) instructions on how to use this powerful video processing feature.

What is Lens Distortion?

The function of a lens in videography is to create an exact replication of your desired scene on the camera sensor. Even the best lenses introduce known and quantifiable aberrations on the focal plane. These aberrations cause the replicated image to be an inaccurate mathematical representation of the scene, thus negatively manipulating your overall data.

Typical aberrations include color infidelity, softness at the corners of the image, image blur and radial distortion. Radial distortion is defined as the non-linear variance of field from the center of the image. Most people have encountered distortion in wide-angle lenses and in macroscopic photography situations. These two types of distortion are known as “pincushion”, in which a square object is made to look more like a “barrel” (indented on either side), or a square object is made to look more circular (beveled on either side). The amount and type of distortion is affected by focus (magnification), aperture setting and distance from the lens to the object.

The ProAnalyst Lens Distortion Calculation Tool and filter are designed to measure the amount of radial distortion caused by a lens and automatically correct the video with an equal and opposite mathematical compensation in order to get the most accurate data.

Lens Distortion Calculation Tool Fundamentals

The Lens Distortion Calculation Tool requires users to place a standard checkerboard-patterned object in the image field of view, and cover as much of the scene as possible for highest accuracy. The checkerboard can be made by simply printing an image of black and white squares on a suitably large piece of paper and affixing it to a rigid, flat board. A single snapshot of the checkerboard is then taken and saved as a *.jpg*, *.bmp*, or *.tif* file. ProAnalyst will then calculate and apply the proper mathematical coefficients necessary to correct the radial distortion present in the video image.

Note: These steps must be repeated for every camera/lens combination that you choose to use.

Calculating Lens Distortion

1. Capture a still image of the checkerboard and save it as a *.jpg*, *.bmp*, or *.tif* file.
2. Open the Lens Distortion Calculation Tool by selecting **Lens Distortion Calculation** from the Tools menu on the main menu bar.
3. Click the **Load Checker Image** button, then select and load the calibration image file.
4. Click the **Define Region** button. Click four points to form a quadrilateral around the *inside* of the checkerboard pattern in the image, as shown in Figure 1. Make sure that the four points are inside the outermost set of checkerboard squares. Do not extend the region outside of the checkerboard pattern.

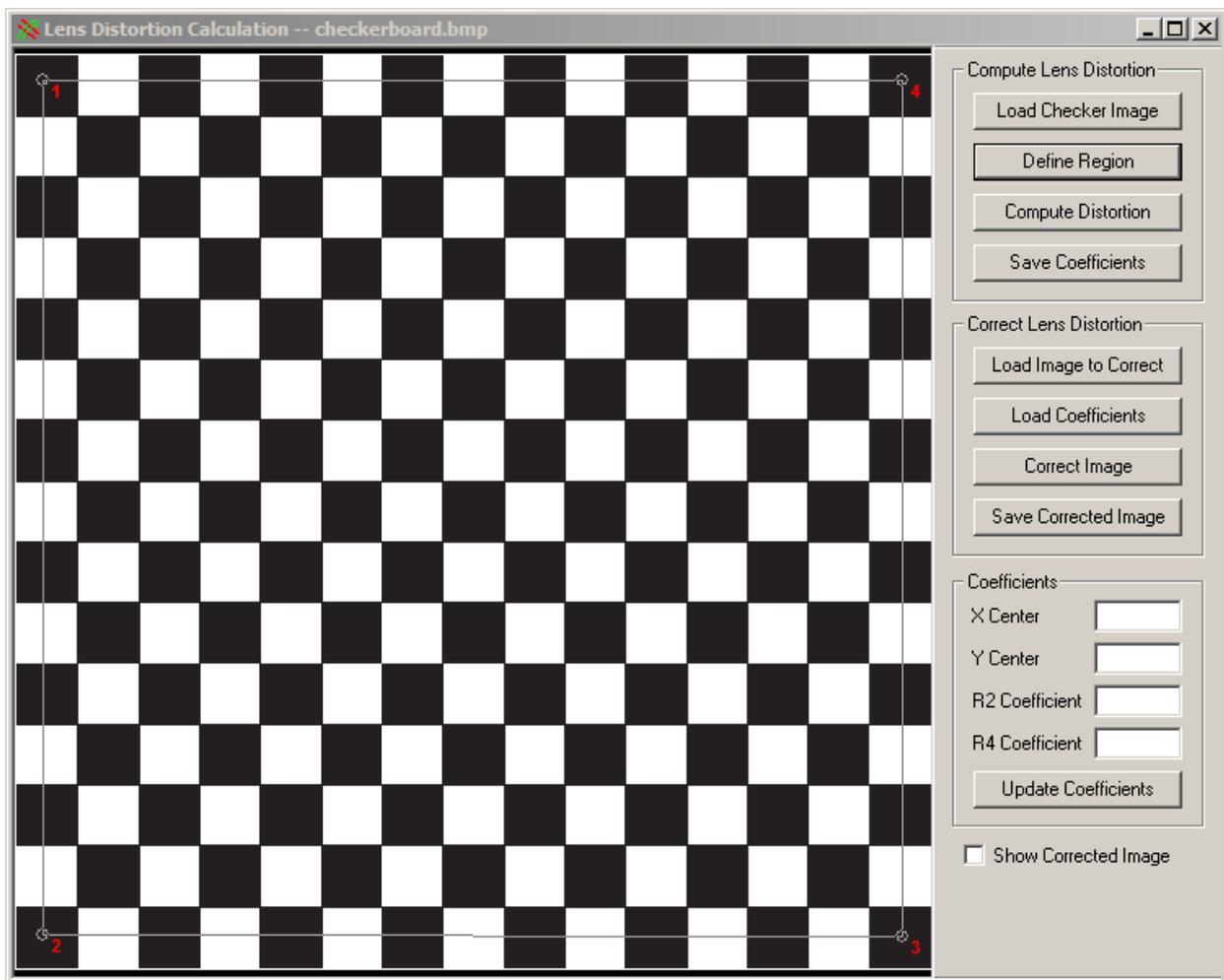


Figure 1. Defining region to compute lens distortion

5. If you would like to redefine the region, click **Define Region** and click the four points again.
6. With the region of the checkerboard defined, click the **Compute Distortion** button to calculate the distortion coefficients. A dialog box prompts you to click the Correct Image button. Click **OK**.
7. Click the **Correct Image** button to view the corrected image.
8. Click the **Save Coefficients** button to create a lens coefficient (*.lens*) file. A dialog box informs you that the distortion coefficients have been saved to the file. Click **OK**.
9. Close the Lens Distortion Calculation window.

Applying Lens Distortion Correction to a Video

1. Open a video captured with the same lens and camera as the checkerboard image.
2. Open the Image Filtering control panel by clicking the  icon on the Measurement Window toolbar.
3. Click the **Add** button.
4. Add a **Lens: Radial Distortion** filter to the Image Filter list by checking the box next to the filter. Click **OK**.
5. On the Image Filtering panel, click the  icon next to the **Lens: Radial Distortion** filter to open the Filter Settings window.
6. Click the **Load Lens Coefficients File** button. Select the *.lens* file you created in Step 7 of the previous section, Calculating Lens Distortion. The **X Center**, **Y Center**, **R2 Coefficient** and **R4 Coefficient** values are updated in the Properties section of the Filter Settings window, as shown in Figure 2.

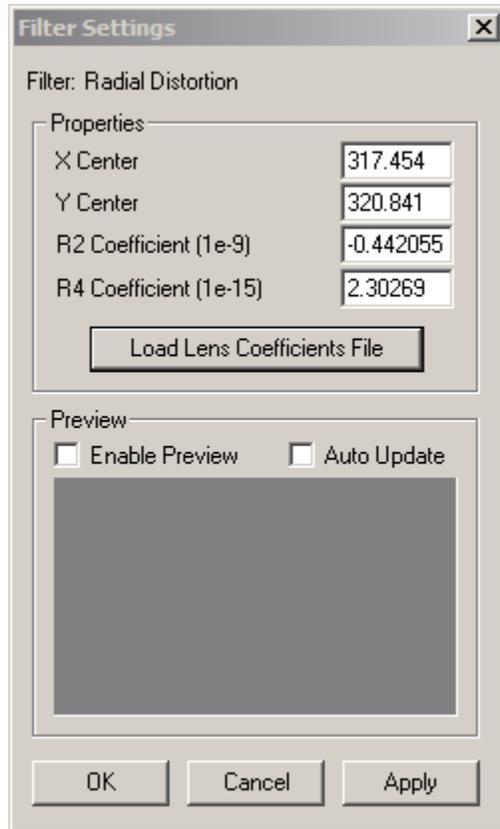


Figure 2. Filter Settings window with updated values

7. Click the **Apply** button, followed by the **OK** button.
8. To deactivate the Radial Distortion filter, uncheck the box in the Image Filter list.

*Note: Applying Lens Distortion Correction slows down analysis processing. If the **R2** and **R4** coefficients are **zero**, then lens distortion correction is negligible.*

This tutorial is copyrighted by Xcitex Inc. and is supplied without specific warranty to any purpose and based on information currently available at the time of this writing. All specifications stated herein are subject to change without notice.

ProAnalyst is a registered trademark of Xcitex Inc. All rights reserved.

For further information on Xcitex products, visit www.xcitex.com or send an email to info@xcitex.com.

Xcitex Inc.
25 First Street, Suite 105
Cambridge, MA 02141 USA

