



P2P Tools

Image Correction – IC Tool

User's Manual

Version 1.50

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June 17, 2013

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Acknowledgement

This material is based upon work supported by the National Science Foundation under Grant No. EAR-0907588. The P2P Tool software is a part of the NSF-funded project, titled “CAREER: Microtopography-Controlled Puddle-filling to Puddle-merging (P2P) Overland Flow Mechanism: Discontinuity, Variability, and Hierarchy.” Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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The land surface in a picture is often distorted due to view angles and other factors. For some applications, a corrected image of the surface is needed. The image correction (IC) software has been developed for this purpose. The program also is able to transform an image into grayscale, add neon/emboss/smooth/sharp effects to the picture, delete pixel values for any points, change the brightness of the picture, move/zoom/rotate the picture, and flip the picture horizontally or vertically.

1. Image Correction

Image correction involves fitting a hyperbolic paraboloid defined by the following bilinear equation:

$$f(x, y) = ax + by + cxy + d$$

The four coefficients ($a - d$) are determined so that $f(x, y)$ fits the known values at the four corner points, as shown in Fig. 1.

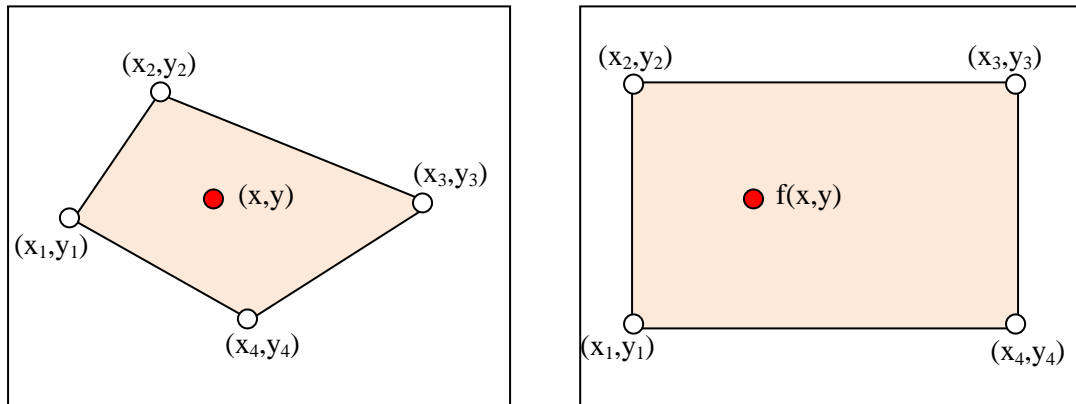


Fig. 1 Relationship between the distorted image and the actual surface

2. Pixel Interpolation

After determining the relationship between the distorted image and the real surface, each pixel value needs to be recalculated to create the corrected image. The image defines pixel values at integer lattice points. In this program, three methods can be utilized to interpolate the pixel values:

- 1) Nearest-neighbor method: it simply takes the value of the closest lattice point.
- 2) Bilinear method: it interpolates linearly between the four closest lattice points.

3) Bicubic method: it applies a piecewise polynomial function to a 4×4 neighborhood of nearby points.

3. Procedure

The flowchart in Fig. 2 shows the computational steps required to process an image and convert it from the distorted one to its actual/real image.

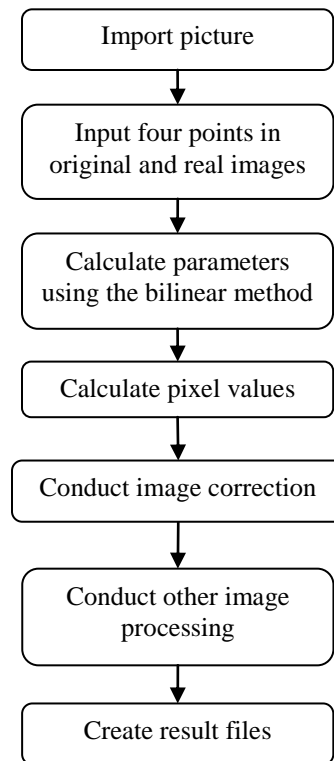


Fig. 2 Flowchart for image correction

1) Main Interface: From the main interface of the program (Fig. 3), users can load the original distorted image, input parameters required for image correction, execute the program, and select any image transformation options.

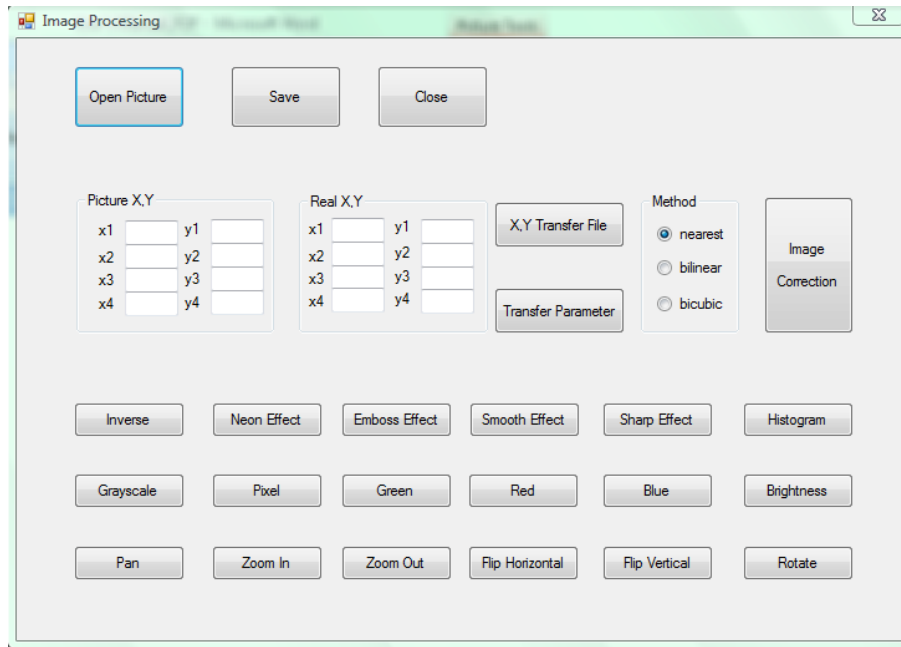


Fig. 3 Main interface of the IC tool

- 2) Open/Load Image: Click the button “Open Picture” to select the picture to be processed. The picture can be in any format, such as *.bmp, *.jpg, and *.jpeg. Once the picture is imported, all the remaining buttons will be activated.
- 3) Reference Points: To process the distorted picture, users must select four reference points whose locations in both the distorted picture and the actual corrected image are known. Users can either manually input these parameters in the corresponding textbox (Fig. 4) or load the parameters from a file by clicking the button “X, Y Transfer file.” The data in the file are organized in four rows and four columns. The first and second columns are the x and y locations of the four reference points in the distorted picture, while the third and fourth columns are the x and y locations of the four reference points in the actual or corrected image. Then, click the button “Transfer Parameter,” which will determine the relationship between the distorted and actual images.

Picture X,Y		Real X,Y	
x1	0	y1	272
x2	371	y2	0
x3	798	y3	198
x4	481	y4	569

Fig. 4 Coordinates x and y of the four references points

- 4) Image Correction: Three different methods (nearest method, bilinear method, and bicubic method) are available for selection to process the image. After choosing the method, click the button “Image Correction.” The corrected picture will then be displayed. The processed picture can be saved by right-clicking on the picture and selecting “Save Image.”
- 5) Additional Image Effect Functions: After loading a picture, users can click any of the following buttons to change the picture or add image effects. The processed image can be saved by right-clicking on the picture and selecting “Save Image.”

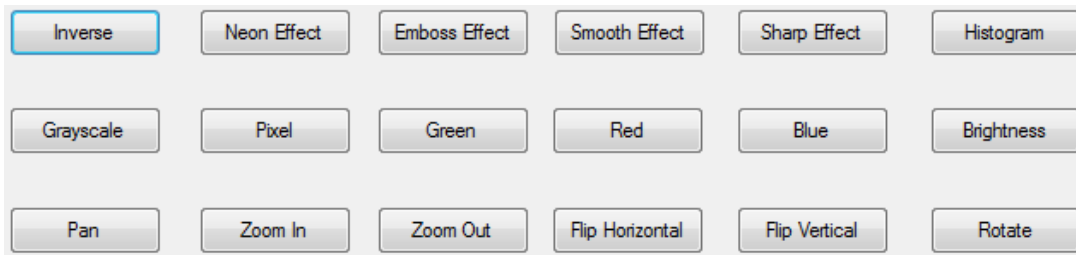


Fig. 5 Additional image effect functions in the IC tool

4. Examples

- 1) Image Correction Example: Fig. 6a shows the original, distorted image. The image was corrected by using the IC tool and the corrected image is shown in Fig. 6b.



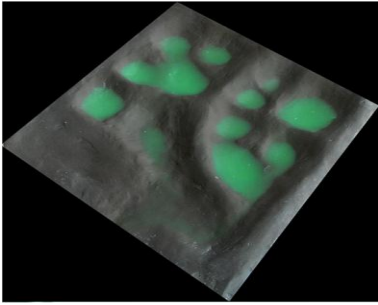
(a) Original distorted image

(b) Actual corrected image

(c) Saved image

Fig. 6 Example for Image correction

- 2) Image Effect Example: Fig. 7 shows some image processing effects (e.g., inverse, gray scale, and smooth).



(a) Inverse



(b) Gray scale



(c) Smooth

Fig. 7 Examples for image processing effects