

Perspective Correction and Panoramas

These notes are for the digital editing meeting as a follow up to the October field trip – photographing buildings.

Firstly, a brief discussion of lens distortion is appropriate. Some of the correction methods and tools discussed can deal with the geometric corrections required; others require you to do it separately.

All real world lenses have various distortions. In prime (fixed focal length) lenses, the manufacturer will attempt to minimize these. However with very wide-angle lenses, there is inevitably significant distortion, usually “barrel” (see below) distortion at the edges. Zoom lenses show the most distortion at the ends of their zoom ranges, especially the wide end. Like everything else, better quality lenses generally have less distortion.

Lens distortion falls into two main types, chromatic (colour) and geometric (barrel or pin-cushion, or comma). We will only deal with geometric distortion. In barrel distortion the edges of the image bow outward so that straight lines near the edge are curved outwards in the middle. Pin-cushion distortion is the opposite, where the lines bow inwards at the middle. While this may not be noticeable in landscapes, it may be obvious in photographs of buildings where we know the edges are (generally) straight. (Comma distortion is not relevant to his discussion – circular points are rendered as distorted shapes, typically a “comma” like artefact)

Photoshop has tools to adjust lens distortions in individual frames. Other software also does this, sometimes using lens/camera combination data (i.e. DXO).

Some panorama software packages have complex means of removing distortion based on matching common points in adjacent frames. These are optics independent methods and use individual data from image pairs rather than “average” data from lens tests on a small sample of lenses. It can be argued that a good implementation of this method is better than correcting individual images and then assembling them into a panorama. (You are also “moving the pixels” only once, with less averaging errors introduced.)

Demos

We will look at perspective correction in Photoshop (crop, lens correction) and RectilinearPanorama, a simple panorama in Photoshop, and then using AutoPano. Photoshop has only 2 options, select images (no thumbnails) and the type of projection. So make the selection and let it go at the files.

Simple perspective correction: one image

This can easily be done in Photoshop using the crop tool:

- Select the crop tool and optionally set the image size/resolution
- Outline the general area you want to retain
- Hold the mouse button down with the cursor just outside the crop mask and drag to rotate the entire crop area if required
- Check the “perspective” box in the toolbar
- Using the corner grips, move each corner independently until the sides of the crop are parallel to the “straight line” in the image
- You will end up with a trapezium (quadrilateral), with no sides parallel
- Then hit “enter” and the crop will be effected and the resulting image will be rectangular again, but with arbitrary dimensions (unless you set the dimensions in the first step)
- Resize it using Image/Size, and resample to the ppi value you require.

That's it, you've done it – the image will now appear with vertical/horizontal lines. This works well for simple corrections where the error is not too big. However, if there is a lot of distortion the result can look strange especially if there are reference objects of known shape, such as the car in the demonstration images.

Complex distortion correction: one image

Using Photoshop's /Filter/Lens Correction filter you can do lens distortion and perspective correction at once. The advantage of this is that the crop method cannot deal with lens distortion (pincushion/barrel), but this tool does!

The options are barrel/pincushion, vertical and horizontal perspective (it also does chromatic aberration and vignetting).

This is a slider or numeric input screen with a preview (it replaces some of what was available in Image Align) that shows you what the final image will look like.

Another option is to use a software package like RectilinearPanorama (www.altostorm.com \$69 Home (8bit/RGB only), \$179 Commercial, 16bit RGB, CYMK etc.) This is a Photoshop plug-in that allows you to define complex curves (or simple straight but non-parallel lines) to be converted to straight and parallel lines. You use the handles embedded in the lines to align them to the edges that should be straight. In this way you can create a quadrilateral from curved edges. There are 2 types of lines, 3-point curves and Bezier curves, the latter are more flexible. This method can deal with lens distortion but in an undefined way.

You can also use these tools to further refine images after assembling a panorama.

Shooting panoramas

Refer to the handout from the shoot, to recap:

- Image plane parallel to the plane of the target (lens horizontal, lens axis at right angles to target plane)
- Overlap about 30%
- Position the “optical centre” of the lens at the point around which the lens is rotating
- Manual exposure, the same for all frames (test this first)

Panorama software

The objective of panorama software is to simplify the process of “stitching” images together. In doing so, some software also deals with distortion as discussed above.

Software choices:

Photoshop (CS, later versions) – file/Automate/PhotoMerge, few options, select images and let it run, works with simple panos. (Quote from the PS help files)

1. Auto

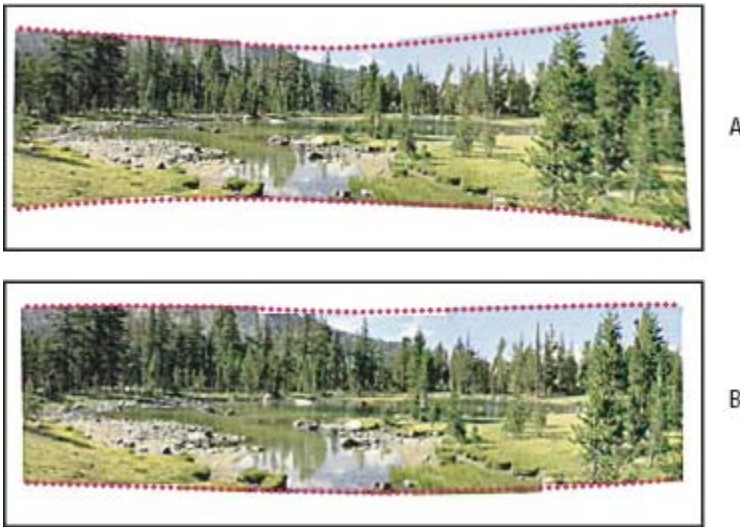
Photoshop analyzes the source images and applies either a Perspective or Cylindrical layout, depending on which produces a better photomerge.

Perspective

Creates a consistent composition by designating one of the source images (by default, the middle image) as the reference image. The other images are then transformed (repositioned, stretched or skewed as necessary) so that overlapping content across layers is matched.

Cylindrical

Reduces the “bow-tie” distortion that can occur with the Perspective layout by displaying individual images as on an unfolded cylinder. Overlapping content across layers is still matched. The reference image is placed at the center. Best suited for creating wide panoramas.



Note: check which layers are turned on after processing, you only want either each image on it's own layer, or the blended image, not both! (Applies to AutoPano etc. as well)

Panorama Tools (PTAssembler) – PTAssembler is a gui front end to the original text based PanoTools package. Complex, very flexible, deals with distortion.

See Max Lyons pages at <http://www.tawbaware.com/maxlyons/index.html>
and PT Assembler at <http://www.tawbaware.com/ptasmbler.htm>

AutoPano – claims to be...first software to automatically detect pictures belonging to a panorama, first software to perform HDR stitching, first software to really correct color and exposure variations between source images. Claims to be fast and not a memory hog (uses swap files). (Autopano.net Cost is €99)

AutoPano has a number of options including:

- Automatic selection of images within a folder
- Detection quality
- # of control points per image(and clean-up of bad points)
- Lens distortion correction
- Degree of Optimisation
- Auto selection for cropping, rendering, colour correction and save/close
- Preview quality selection
- Type of colour correction
- Support for HDR images
- Support for RAW formats
- Final image interpolation/blending, format (including PSB for large images > 2gb), bit depth and layer options, final file destination and auto naming options

There also several other lower technology packages, some distributed “free” with digital cameras.

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