Stitching for scanned images such as maps

In case of digital camera shots, the size of image is the same such as $6,000 (W) \times 4,000 (H)$ pixels.

In general, if each image has different size, a large number of lenses are assigned by Hugin. Hugin stitching assumes to apply to same lens. Therefore, Hugin outputs overlapped images, not flattened.

Before loading image files, make sure if all the sizes of images are the same. If not, make them the same by image cropping.

In images obtained by scanning, a certain portion of the surface is wavy vertically as well as horizontally, not flat, unlike camera shots. This causes unsuccessful stitching result such as broken lines. Make the surface flat as much as possible by putting heavy rectangular board over map on scanner glass.

Map is normally folded multiple times to store. Therefore, creases are made and is normally stained.

Such creases can be used an alignment index when scanning.

All the scanned images must be rotated to be holding right angle horizontally and vertically before stitching.

As an example, I applied a folded map of San Jose printed in 1975 that I bought at San Jose Community (not International at that time) Airport in 1976 in the middle of the way to visit Olivetti Corporation of America, Harrisburg, PA. having a μ PD1205 development related meeting.

The sales price was 39 cents!





In this example,

A map is scanned 14 times and 14 image files, "11.jpg" through "17.jpg and "21.jpg" through "27.jpg" (Notation of 27.jpg; X=2, Y=7; (X,Y).jpg etc.) are made keeping sufficient scan area overlay to ease Hugin stitcher processing.

Sequence of Hugin Stitcher Handling

Run Hugin.

"Photos" tab

- Load 14 files scanner generated.
- Enter 1 to specify HFOV(v) (Horizontal Field Of View) and "Equirectangular" as "Lens type".

(Digital camera images include the camera dependent HFOV(v) in image files but scanned images do not)

Camera and Lens data

No or only partial information about field of view was found in image file									
Please enter the horizontal field of view (HFOV) or the focal length and crop factor.									
Lens type: Equirectar	ngular 🗸	Load lens data							
Enter horizontal field of	f view (HFOV) or focal length and crop factor:								
HFOV (v): 1	degrees								
Focal length: 1458.7	9 mm Focal length multiplier: 1	x							

- Select all image files to apply the following settings.

- Select "Equirectangilar" as "Lens type".
- Select "Custom parameters" as "Geometric" of "Optimize". "Optimizer" tab appears beside "Photos" tab.

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Photo	os Masks	Control I	Points C	Optimizer	Stitcher				
#	Filename	Width	Height	Anchor	# Ctrl Pnts	Lens no.	Stack no.		Fun est interferer
0	11.jpg	2546	3498	AC	0	0	0		Expert Interface
	12.jpg	2546	3498		0	0			Group by:
	13.jpg	2546	3498		0	0			None ~
	14.jpg	2546	3498		0	0			Display
	15.jpg	2546	3498		0	0			Display
	16.jpg	2546	3498		0	0			General
6	17.jpg	2546	3498		0	0	6		O EXIF data
	21.jpg	2546	3498		0	0			
8	22.jpg	2546	3498		0	0	8		
9	23.jpg	2546	3498		0	0	9		C Lens parameters
10	24.jpg	2546	3498		0	0	10		
	25.jpg	2546	3498		0	0			C
12	26.jpg	2546	3498		0	0	12		
13	27.јрд	2546	3498		0	0	13		
Lens	type								Selected Image
		Ler	ns type: E	quirectar	ngular			\sim	
ŀ	\dd images	Focal	length:	1458.787	mm Foca	l length m	ultiplier: 1	x	
Feat	ure Matchin	g							
Sotti	age Hugin's	CPFind				```	(Create c	ontrol points	

Optimize

pumeo		
Geometric:	Custom parameters ~	Calculate
Photometric:	Low dynamic range \checkmark	Calculate

"Optimizer" tab

- Select all image files loaded.
- Click "Reset" and reset all.
- Check box of "Hfov (v)" of "Lens Parameters"

Photos Masks Control Points Optimizer Stitcher

Geometric optimizer

Any variables below which are marked [x] will be optimized. Unmarked variables [] will act as references or anchors.

Only use control points between activated images.

Equirectangular 🖂 1

Ignore line control points

Image Orientation

Lens 0

+

#	Filename	Yaw (y)	Pitch (p) Roll (r)	X (TrX) Y (TrY)	Z (TrZ)	Plane	e yaw	Plane pitch	Camera translation	
0	11.jpg	0	0	0	0	0	0	0		0	not active	^
1	12.jpg	✓0	0	0	0	0	0	0		0	not active	
2	13.jpg	✓0	0	0	0	0	0	0		0	not active	
3	14.jpg	0	0	0	0	0	0	0		0	not active	
4	15.jpg	0	0	0	0	0	0	0		0	not active	
5	16.jpg	✓0	0	0	0	0	0	0		0	not active	
6	17.jpg	0	0	0	0	0	0	0		0	not active	
7	21.jpg	0	0	0	0	0	0	0		0	not active	
8	22.jpg	✓0	0	0	0	0	0	0		0	not active	
9	23.jpg	0	0	0	0	0	0	0		0	not active	
10	24.jpg	✓0	0	0	0	0	0	0		0	not active	
11	25.jpg	✓0	0	0	0	0	0	0		0	not active	
12	26.jpg	✓0	0	0	0	0	0	0		0	not active	
13	27.jpg	✓0	0	0	0	0	0	0		0	not active	
												~
Lens F	Parameters	8										
#	Filename	Lens type	e (f)	Hfov (v)	a	b c	d	е	g	t		



Reset

"Photos" tab

- Select #0, #1, #7, #8.

- Click "Create control points".

Photo	os Masks	Control F	Points C	ptimizer	Stitcher				
#	Filename	Width	Height	Anchor	# Ctrl Pnts	Lens no.	Stack no.		Export interface
0	11.jpg	2546	3498	AC	0	0	0		
1	12.jpg	2546	3498		0	0	1		Group by:
2	13.jpg	2546	3498		0	0	2		None ~
3	14.jpg	2546	3498		0	0	3		Display
4	15.jpg	2546	3498		0	0	4		
5	16.jpg	2546	3498		0	0	5		() General
6	17.jpg	2546	3498		0	0	6		◯ EXIF data
7	21.jpg	2546	3498		0	0			
8	22.jpg	2546	3498		0	0	8		
9	23.jpg	2546	3498		0	0	9		○ Lens parameters
10	24.jpg	2546	3498		0	0	10		O Photometric parameters
11	25.jpg	2546	3498		0	0	11		
12	26.jpg	2546	3498		0	0	12		*
13	27.jpg	2546	3498		0	0	13		-1
Lens	type							Se	elected Image
		Ler	ns type: E	quirectar	igular			\sim	
Add images							1. I. 1		
Focal length: 1450.707 mm Focal length multiplier: 1 x									
Feat	ure Matchin	g							
Settir	ngs: Hugin's	CPFind				~	Create	control points	

Continue creating control points for four adjacent image files as follows looking at the table below.

- Select #1, #2, #8, #9.
- Click "Create control points".
- Select #2, #3, #9, #10.
- Click "Create control points".
- Select #3, #4, #10, #11.
- Click "Create control points".
- Select #4, #5, #11, #12.
- Click "Create control points".
- Select #5, #6, #12, #13.
- Click "Create control points".

6 17	13 27							
5 16	12 26							
4 15	11 25							
3 14	10 24							
2 13	9 23							
1 12	8 22							
0 11	7 21							
Stack#								
vs.								
(X	(,Y)							

"Optimizer" tab

- Click "Optimize now!".

Click "View" > "Control point table". "Control point table" sub-window appears.

1	Control P	oints			— [\times				
G	CP#	Left	Right I	P CP#	Alignment	D 🛆	^	1			
	320	2	3	20	normal	0.61					
	245	1	8	45	normal	0.61					
	145	1	8	20	normal	0.61					
	45	1	7	20	normal	0.62					
	20	0	1	20	normal	0.67					
	345	3	9	20	normal	0.74					
	754	12	13	4	normal	22.07					
	753	12	13	3	normal	31.84					
	751	12	13	1	normal	51.31					
	750	12	13	0	normal	55.17					
	752	12	13	2	normal	131.74	\sim				
	Delete										
	Select by Distance										

If too big numbers are listed on "Control point table" as above, delete (CP#750 to CP#754) because they are ghosts improperly produced.

- Click "Optimize now!" again.

-

Tontrol F	oints				-	ЦΧ
G CP#	Left	Right I	P CP#	Alignment	Distance \triangle	^
42	1	7	17	normal	0.08	
552	3	11	2	normal	0.08	
519	10	11	19	normal	0.08	
15	0	1	15	normal	0.08	
524	10	11	24	normal	0.09	
320	2	3	20	normal	0.09	
245	1	8	45	normal	0.09	
145	1	8	20	normal	0.09	
45	1	7	20	normal	0.09	
20	0	1	20	normal	0.10	
345	3	9	20	normal	0.11	~

Smaller "Distance Δ " should be produced.

Click "Stitcher".

Photos	Masks	Contro	Points Optin	nizer Stitche	r		
	Proje	ction:	Equirectangul	ar			~
	Field of	View:	Horizontal:	12	Vertical:	2	Calculate field of view
	Canvas	Size:	Width:	3000	Height:	500	Calculate optimal size
		Crop:	Left:	0	Тор:	0	
			Right:	3000	Bottom:	500	Fit crop to images
				3000 x 50	0=1.5 MP. 6:1		

- Click "View" > "Fast Panorama preview window".
- On "Stitcher", adjust "Horizontal" and "Vertical" of "Field of View".
- On "Fast Panorama preview window", click "Move/Drag". Cross hair cursor appears.
- Move the map at center.
- Adjust "Horizontal" and "Vertical" of "Field of View" repeatedly to get a appropriate size of the map display.







Cross hair cursor appears

Move the map at center

Image size adjusted by updating "Field of View"

- Click "Calculate optimal size" to get optimized canvas size of the map image.

Photos	Masks	Contro	l Points	Optimi	zer Stitch	ner			
	Proje	ection:	Equirect	angula	r				~
	Field of	f View:	Horizo	ontal:	0.4		Vertical:	0.2	Calculate field of view
	Canva	s Size:	W	/idth:	8442		Height:	5476	Calculate optimal size
	Crop:		Left:		0 Top:		Тор:	0	
			F	Right:	8442		Bottom:	5476	Fit crop to images
					8442 x 54	76=46 MF	P, 1.54:1		

Although only two digits are displayed on "Field of View", actual numbers specified contains decimal fractions. Detailed adjustment is required.

- Click "Stitch!".
- A map stitched in this example

Downloadable Files