

THE OPTIMAL METHOD OF STITCHING PANORAMAS FOR A VIRTUAL TOUR

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Panoramic picture - a kind of photography that allows you to create an image with a large viewing angle horizontally.

3D panorama is a panoramic photo that can be viewed by a shifting viewpoint and projected onto a sphere or cube. Basically, the panoramic photography mode is in simple digital cameras and mobile phones of the latest models. Manufacturers of photographic equipment often take into account only the picture horizontally, that is, cut off the top and bottom parts[1].

The basis of the spherical panorama is assembled from a plurality of individual image frames in the spherical or cubic projection. A characteristic feature of the spherical panorama is the maximum possible viewing angle of (360 × 180 degrees), i.e. it can convey a full picture of the surrounding environment. Panorama projected onto the inner surface of a sphere or a ball through a special program, i.e. the user, while in the center of the ball, rotating in either direction, considering it completely, can feel his presence just in this environment. Spherical panoramas can be created with the help of any camera, but it requires considerable skill, accuracy and skills, in addition, painstaking processing and elimination of errors that occur during processing are considered the basic requirements for creating a spherical panorama[2].

By combining several spherical panoramas can create a virtual tour, passing from one pan to another.

Now let's see what programs are more available on the market and what is more convenient for use by a simple user and what problems may arise in the process. Below is a table with the advantages and disadvantages of programs for creating panoramas

Table 1– Advantages and disadvantages of programs

The name of the program	Advantages	Disadvantages	Price
ArcSoft Panorama Maker 4 Pro	Easily and quickly finds nodal points of images	Can not save in high quality panorama, assembled in the trial version and	29-50\$

		does not have the function of re-making a vertically taken photograph into a horizontal one and vice versa.	
PTGui (Graphical User Interface Tools Panorama)	<ul style="list-style-type: none"> - From any number of original photographs, stitching of spherical, cylindrical or flat panoramas; - Full automation: create a panorama only by clicking several times on the mouse button; - The ability to preview in real time; - Panorama processing for visual and dialog editing; - Full technical support for 16 bit mode; - Create a panorama, suitable for editing in Photoshop; - Reading EXIF information from a snapshot taken by a digital camera; - Setting the lens parameters. 	In automatic mode, glues crooked panoramas	€79 (personal) / €180 (company); Pro: €149 (personal / €349 (company) (+taxes)
Autopano Pro/Giga	<ul style="list-style-type: none"> - Ability to work with multiple groups of images, you can more accurately change each project individually, save in different versions; - Stitching of spherical, cylindrical or flat panoramas; - Very easy working language; - The ability to preview in real time; - Setting the lens parameters; - The images are collected in the panorama very quickly and qualitatively; - The way to reflect the connection between images is simple and understandable, when you click on the button, a window for processing control points opens; 	The finished panorama remains for a long time.	€99/€200

	- Errors resulting from stitching can be edited bypassing Photoshop, dividing into several rows, and using the program, you can adjust the brightness and colors, which is usually done using Photoshop.		
PanaVue Image Assembler	For beginners very convenient interface	Few settings, just for creating simple panoramas	24\$/40\$
Image Composite Editor (ICE)	Easy to use for beginners	Can not handle Fisheyes, little function	free
Photostitch	Excellent thoughtful visual interface, simple. Fully automated process with the ability to unobtrusively intervene only where you do not harm	Few settings, just for creating simple panoramas	free
Hugin	The program is similar as PTGui	In automatic mode, poorly stitched panoramas	free
Panorama Factory	For beginners an excellent program but not for professionals	Complex menu, a lot of settings, slowly working	Free/140\$

In conclusion, I can highlight two programs Hugin and Autopano Pro/Giga. The first program has been selected since it is identical to PTGui and is free, but there is still a slight drawback Hugin in automatic mode, poorly stitched panorama[3]. But if you still can buy Autopano Pro/Giga, then you will get the opportunity to create a quality panorama.

Autopano Pro/Giga –program, mesmerizing his intelligence and wit. Autopano Giga differs from Autopano Pro with its advanced professional tools. The program is an indispensable find in stitching photos into one panorama. Advantage of the program - Ability to work with multiple groups of images, you can more accurately change each project individually, save in different versions. Stitching of spherical, cylindrical or flat panoramas. Very easy working language. The ability to preview in real time. Setting the lens parameters. The images are collected in the panorama very quickly and qualitatively. The way to reflect the connection between images is simple and understandable, when you click on the button, a window for processing control points opens. Errors resulting from stitching can be edited bypassing Photoshop, dividing into several rows, and using the program, you can adjust the brightness and colors, which is usually done using Photoshop. There is only one drawback - the finished panorama remains for a long

time, but the quality is excellent. Therefore, to create a panorama of good quality, photos are better stitched in this program.

References

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3. N. Graciosa, M. Mahoorb, S. Negahdaripourb and A. Gleason, "Fast image blending using watersheds and graph cuts", *Image and Vision Computing*, Vol. 27, Issue 5, 2 April 2009, Pages 597-607.