Manual for Depth Map Automatic Generator 7 (DMAG7)

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DMAG7 is an implementation of Fast Bilateral-Space Stereo [1]. The interested reader is strongly invited to visit [3] for a quick overview of the method.

Assuming you have a left and right picture of a stereo pair in a directory somewhere on your computer, the files `dmag7.bat` and `dmag7_input.txt` which can be found in the directory `dmag7_test` must be copied to that directory. The file `dmag7.bat` must be modified so that the path to `dmag7.exe` is the correct one for your computer. It is always recommended to align/rectify the images in Stereo Photo Maker [4] prior to using DMAG7.

The format of `dmag7_input.txt` is as follows:

```
Left image of stereo pair
Right image of stereo pair
Minimum disparity
Maximum disparity
Spatial sample rate
Range sample rate
Radius
Lambda
Maximum number of iterations in L-BFGS
Hash table size
Noise parameter epsilon
Image of disparity map (output)
```

The image names cannot have spaces in them. They should not be in full path format (like `C:\this_dir\that_dir\image.png`). I also wouldn't use a point in the body of the name (`image_left.png` is ok but `image.left.png` is not). The supported image file formats are: tiff, png, and jpeg.

The minimum and maximum disparities can be obtained with Disparity Finder 2 (DF2) [2] or Photoshop and the likes. The minimum disparity is found by matching points that are the farthest in the background. The maximum disparity is found by matching points that the closest in the foreground. If the minimum disparity (background) is larger than the maximum disparity (foreground), it can only mean that the left and right images have been swapped.

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The spatial sample rate is referred as s_s in [3]. The (left) image is (square) gridded and the dimension of each square cell is equal to the spatial sample rate. For example, if the spatial sample rate is 8, each grid cell is 8x8 pixel square. All the pixels contained in a given cell will have the same depth/disparity (the one given to the cell by the program). If the spatial sample rate is set to an extremely large value, like the image size, the depth/disparity map is going to be one solid color as all pixels will have the same depth/disparity. If set to a large value, say 256, the disparity map will look very blocky, each block being 256x256 pixels. As you down in value (256, 128, 64, 32, 16, 8, 4, 2, 1), the blocks become smaller and smaller until the blocks are actually pixels (spatial sample rate equal to 1). I kinda like using 8 as a starting point for the spatial sample rate.

The range sample rate is defined as s_r in [3]. If set to its maximum value (256), the depths/disparities appear smoothed/blurred without considering color variations (not edge preserving at all). In other words, it behaves like a classic blur and the object boundaries appear quite fuzzy. As you down in value (256, 128, 64, 32, 16, 8, 4, 2, 1), the smoothing of the depths/disparities appears to be more and more color aware, that is, the blur occurs within areas which are more and more similar in color. I kinda like using 32 as a starting point for the range sample rate.

The radius is the radius of the "and" filter used to filter the match volume. Allowable values for the radius are 0, 2, 4, 7, and 12. The diameter is actually twice the radius plus one, so a radius of 0 makes sense although I wouldn't use it. The larger the radius, the more reliable the matches but the fewer the matches. The radius should relate to the size of the images. If the image size is small, the radius should reflect that and be small as well. If the image size is large, the radius should be large.

Lambda balances the smoothness cost and the data matching cost [3]. The smaller the lambda, the smoother the disparity map but the less accurate. A good value for lambda seems to be between 0.01 and 0.1 although smaller or larger values can be used as well.

The maximum number of iterations in L-BFGS determines how accurate the solution is going to be but also how long it is gonna take to get the depth map. Lower values mean a faster result but L-BFGS may not have converged. Inversely, larger values mean a slower result but the odds of proper convergence are better. A good value is 1000 although it can certainly be reduced to maybe 500 (especially when testing parameters).

The hash table size dictates the speed at which the bilateral space vertices are created. The higher the number, the faster it is going to be at the expense of memory usage. A good value is 10000 but it should be increased (say, to 100000) if the number of bilateral space vertices per hash table bucket becomes too large (say, more than 100).

The noise parameter epsilon enables to deal with differences in color/illumination between the two images. Good values are 4, 8, or 16.

At this point in time (this may change as the code is improved upon), it is not recommended to use images that are too big due to memory constraints. I personally recommend images that are in the one to two megapixels range although one can certainly try with larger images.

If you cannot scroll to the beginning of the command window (DMAG7 prints out useful info as it runs), you need to increase the screen buffer size of the command window by right-clicking on the icon in the upper left and then click on Properties, clicking on the Layout tab, increasing the Screen Buffer Size Height to the maximum (9999), and clicking OK. You

should now be able to get to the beginning of the printouts next time you run DMAG7.

References

[1] Jonathan T Barron, Andrew Adams, YiChang Shih, and Carlos Hernández. Fast bilateral-space stereo for synthetic defocus. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pages 4466–4474, 2015.

[2] Ugo Capeto. Disparity finder 2 (df2). `http://3dstereophoto.blogspot.com/2013/06/disparity-finder-2-df2.html`. Accessed June 20, 2015.

[3] Ugo Capeto. Fast bilateral-space stereo for synthetic defocus. `http://3dstereophoto.blogspot.com/2015/06/fast-bilateral-space-stereo-for.html`. Accessed June 20, 2015.

[4] Masuji Suto. Stereo photo maker. `http://stereo.jpn.org/eng/stphmkr/`. Accessed June 20, 2015.