Barvocuc 2.0 Documentation

Barvocuc supports the following picture formats: PNG, JPEG, BMP, GIF (and some others such as PBM, PGM, PPM, XBM, XPM, etc.; depending on the system under which you are running Barvocuc). Once you load a picture (by clicking on Barvocuc --> Add image... or directly on the Add image button in the Toolbar), the software will generate the following output:

1) Filename
2) Picture dimensions (Width, Height)
3) Three values for percentual ratios of achromatic colors present in the picture (% White, % Black, % Gray)*
4) Seven values for percentual ratios of chromatic colors present in the picture (% Red, % Orange, % Yellow, % Green, % Blue, % Purple, % Pink)*
5) Average values and standard deviations of the hue, saturation and lightness of all pixels present in the picture*
6) Average value of lightness counted from the picture with edge detection using the Sobel operator (Avg. Sobel)*
7) Total number of non-transparent pixels (Opaque Pixels) and the percentual ratio of the average amount of non-transparent pixels in the picture (% Opacity)
8) The last column prints an error if it occurs

*the transparent pixels are not included

Barvocuc creates a visible preview of the particular values in a number of windows, allowing for a quick and easy modification of the settings. The pictures can be loaded into the program one by one, or you can load the whole directory to be processed at once (Add directory). Once all the pictures are processed, the output can be copied to clipboard (Copy CSV) or saved to a CSV file (Save CSV) and further handled using any statistical software.
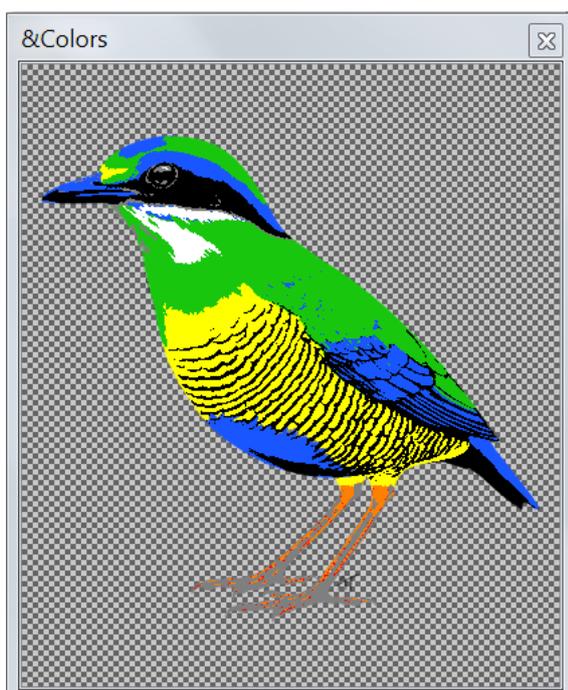
1. Setting the colors

1.1 Chromatic colors

Barvocuc works with the so-called hue-lightness-saturation (HSL) colorspace. Hue values are similar to angles on a color wheel, in which certain angles correspond to certain colors. There are seven pre-defined colors: red, orange, yellow, green, blue, purple, and pink. Because the categorization of colors is highly arbitrary, Barvocuc allows the set up of hue angles of each of the pre-defined colors. This can be easily done after loading a picture, because once you change the angle values, the preview is immediately updated with the new setting. The angles can also overlap, so, for example, a color can
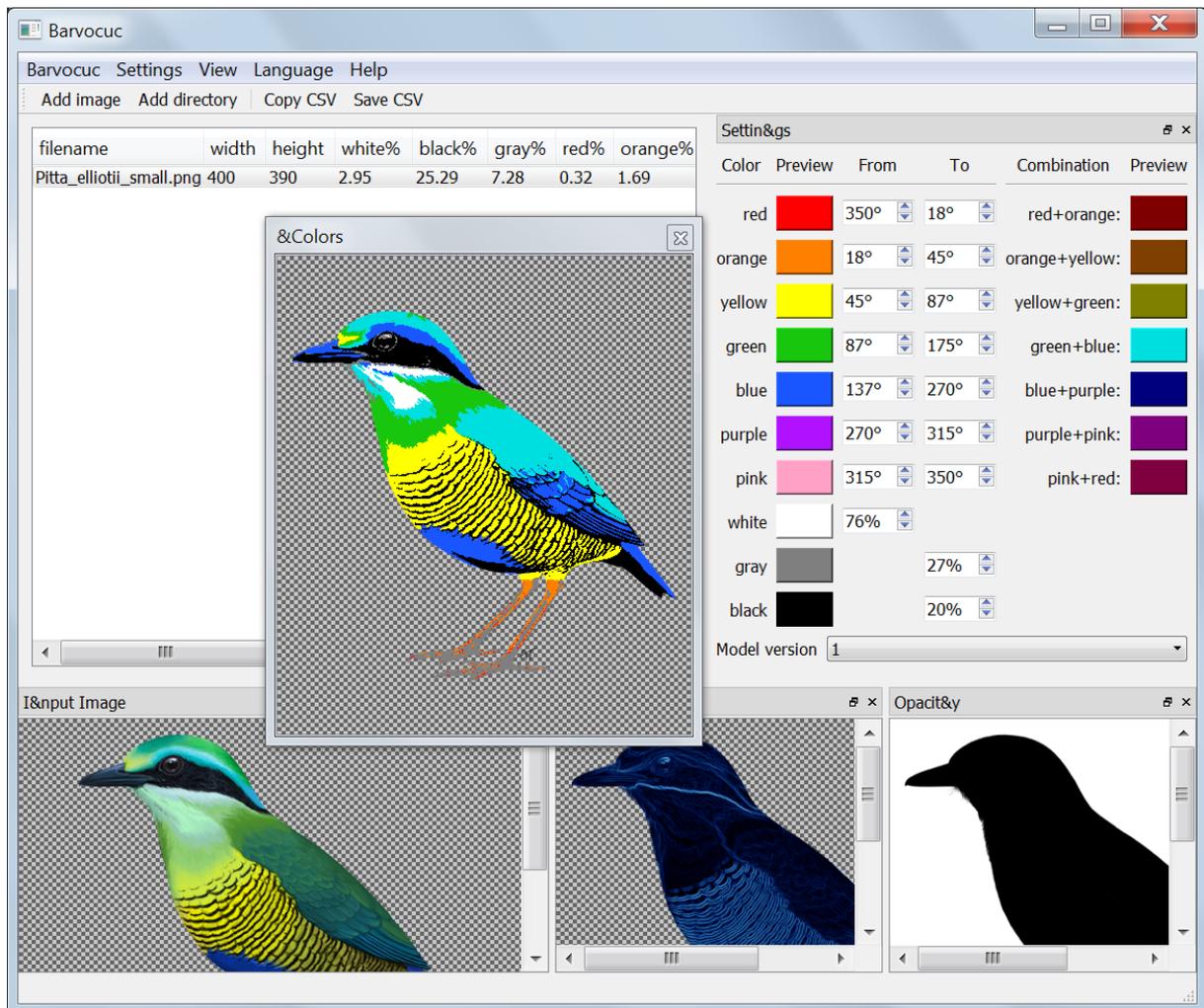
be considered both blue and green at the same time. In such a case the total sum of the seven chromatic colors % can exceed 100.

Tip: If you double-click the colored rectangles in the Settings window, you can change the preview color.

If you do not want the hue angles to overlap, select the angle of one color to end with the same degree as the next color begins with. For example, the green color to be 87°-137° and blue to 137°-270°. The "overlapping angle" is inclusive for the first color, i.e., in this case, for the green; the numbers are: <87°; 137°) for the green, <137°; 270°) for the blue. The preview picture shows that the colors do not overlap.

The picture of the Bar-bellied Pitta (*Pitta elliotii*) used as an example is adopted from Lišková, Landová & Frynta (2015), and is painted by Akela Taka.

1.2 Achromatic colors

The values for saturation (S) and lightness (L) cover the interval 0-1. Because pixels with extreme values of lightness and saturation are perceived as black/white and gray, respectively, three additional (achromatic) colors need to be defined. The pre-defined settings use L < 0.20 for black (20% black), L > 0.76 for white (76% white) and S < 0.27 for gray (27% gray).

Using the Settings --> Save settings.../Load settings... option in the menu allows you to save the settings and reload it next time.

2. Other functions

2.1 Avg. Sobel

The portion of contrasting patches on a picture is measured through the edge detection processed using the math function of Sobel operator (Sobel 1978). Each contrasting patch of pixels is detected as an edge and "drawn" on the picture as a light outline – the higher the count of such contrasting patches, the more light outlines there are generated on the picture. The final value (Avg. Sobel) corresponds to the overall lightness of the generated picture (The lighter the picture, the more complex pattern is present in the picture).

2.2 Model versions

Under the option Model version 1 Barvocuc counts the colored pixels with a minor error present in the previous versions of the software. It is present here to allow for the reconstruction of previously generated data. If you are new to Barvocuc, you definitely want to use the Model version 2.
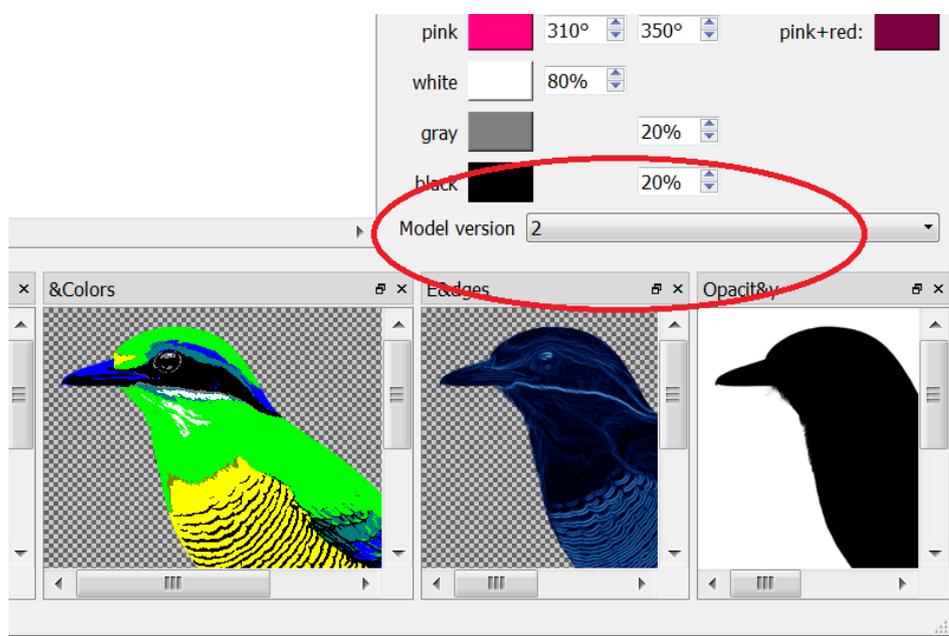
3. Citation

You can cite the software as follows:

Rádlová, S., Viktorin, P., & Frynta, D. (2016). Barvocuc 2.0, Software for Color Image Analysis. Available for download at: http://www.nudz.cz/en/w_group/wg-on-emotions-and-phobias-triggered-by-animals/

4. References

Sobel, I., (1978). Neighbourhood coding of binary images fast contour following and general array binary processing. *Computer Graphics and Image Processing,* 8, 127-135.

Sample publications that used the software:

Lišková, S., & Frynta, D. (2013). What determines bird beauty in human eyes?. *Anthrozoös*, 26, 27-41. http://dx.doi.org/10.2752/175303713X13534238631399

Lišková, S., Landová, E., & Frynta, D. (2015). Human preferences for colorful birds: Vivid colors or pattern?. *Evolutionary Psychology: an International Journal of Evolutionary Approaches to Psychology and Behavior*, 13, 339-359. http://dx.doi.org/10.1177/147470491501300203

Ptáčková, J., Landová, E., Lišková, S., Kuběna, A., & Frynta, D. (2017). Are the aesthetic preferences towards snake species already formed in pre-school aged children?. *European Journal of Developmental Psychology*,14, 16-31. http://dx.doi.org/10.1080/17405629.2016.1144507