

Computing Anaglyphs using Least Squares Approximation in CIE Color Space

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We describe a simple algorithm for computing anaglyphs that is very effective and fast. It is vastly superior to the well-known Photoshop and modified Photoshop algorithms in that it produces superior colors and is based on the properties of the monitor and the anaglyph glasses. The method uses least squares approximation in CIE color space and is the work of Eric Dubois at Ottawa U. It is designed for LCD monitors using LCD spectral distribution data and filter transmission functions collected by Vu Tran, also at Ottawa U. We have found it to be satisfactory for CRT monitors and for most red/cyan anaglyph filter glasses.

Let C_L be the RGB colors of the left eye image at a pixel and let C_R be the RGB colors of the right eye image at the same pixel. Then perform the matrix multiplication using the 3 x 3 conversion matrices P_1 and P_2 as follows:

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = P_1 C_L + P_2 C_R$$

where

$$P_1 = \begin{bmatrix} .4155 & .4710 & .1670 \\ -.0458 & -.0484 & -.0258 \\ -.0545 & -.0614 & .0128 \end{bmatrix}, P_2 = \begin{bmatrix} -.0109 & -.0365 & -.0060 \\ .3756 & .7333 & .0111 \\ -.0651 & -.1286 & 1.2968 \end{bmatrix}$$

This may produce colors R , G and B that lie outside the RGB unit cube: colors that are less than zero or greater than 1. Be sure to clip or set those less than zero to zero, and those that are greater than 1 to 1. Then multiply R , G and B by 255 and round the result. This will produce RGB values between 0 and 255. Perform this calculation for every pixel in the image(s).

If the resulting image is a bit dark, use gamma correction to modify the intensities. We will publish a method using uniform approximation for calculating anaglyphs in the forthcoming EI '06 Stereo Imaging proceedings. The method produces brighter images but requires considerably more calculation. A linear program must be solved at each pixel.

Test your program on the following example:

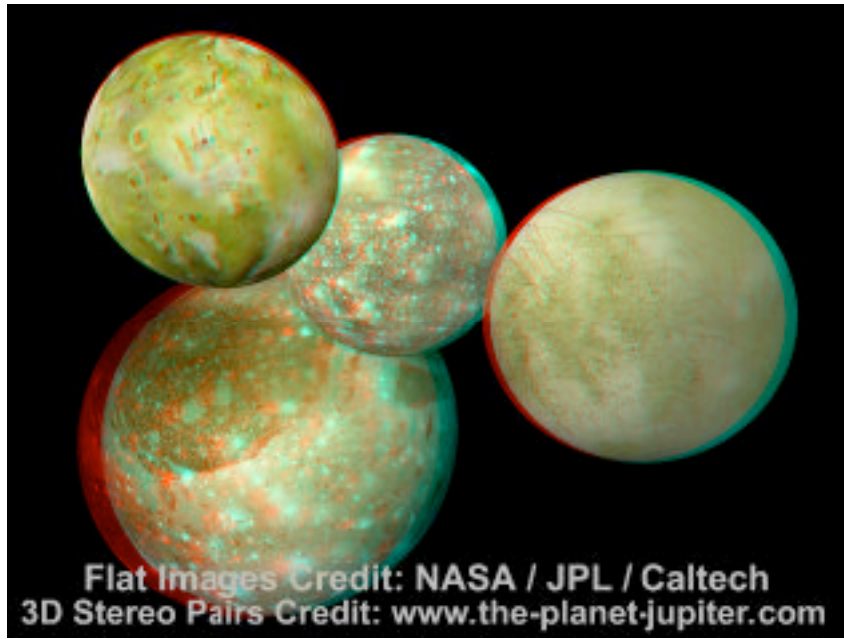
Jupiter, left eye image:



Jupiter, right eye image:



Jupiter, anaglyph:



Flat Images Credit: NASA / JPL / Caltech
3D Stereo Pairs Credit: www.the-planet-jupiter.com

