

Re: interpolation for a color image?

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- *From:* davem@xxxxxxxxxx (Dave Martindale)
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Thomas Richter <thor@xxxxxxxxxxxxxxxxxxxxx> writes:

It depends on what you think your image channels will be, and how to make use of their correlation. A typical way to do that is to first transform them to a different color space, for example YUV. The transformation between YUV (and related other spaces) is linear, and the bilinear interpolation filter is linear as well, but in a different dimension. This means that it actually makes **no** difference at all whether you first transform to YUV, run there a bilinear filter, then transform back, or run the bilinear filter on RGB itself. The result will be the same. But **only** because bilinear filtering is linear, and YUV to RGB is a linear transformation.

So far so good.

If you pick a nonlinear color space (say, CIElab) and/or a nonlinear filter (say, bicubic), things will be not so easy and the results will be different.

There's no problem with using a bicubic filter for resampling. Although it is based on cubic polynomials instead of linear polynomials, the process of resampling with a cubic is still a **linear transformation**. So the entire process of colour transform/interpolate/colour transform is still linear, in the linear transformation sense, and the choice of colour space doesn't make any difference to the result. (You won't get the same result as bilinear filtering, but the same result as the same bicubic filter applied in another colour space).

On the other hand, a nonlinear representation **will** change the results, often visibly. For example, a linear filter (in the linear transform sense, even if it's using cubic polynomials) will generally have a DC gain of one, so it leaves the average brightness of the image unchanged, or (more precisely) the mean pixel value will remain constant. In a nonlinear representation, keeping the sum of pixel values the same does not generally keep the brightness the same.

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Despite this, linear filters (e.g. resizing, Gaussian blur, unsharp mask) are often applied to nonlinear (gamma-corrected) data, usually with pleasing results.

There are non-linear filters too – many noise-reducing and edge-detecting filters are nonlinear (in the linear transform sense).

Dave

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