
Subject: Re: color value interpolation from colorbar
Posted by [David Fanning](#) on Thu, 04 Dec 2008 17:38:37 GMT
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j.coenia@gmail.com writes:

- > I have a color-coded medical image.
- >
- > There is a colorbar on the image, for example a red-to-yellow gradient
- > valued from 1 to 100.
- >
- > There is **not** a one-to-one correspondence between the colors in the
- > colorbar and the colors in the image. There are many more
- > intermediate reds, oranges, and yellows in the image than in the
- > colorbar.
- >
- > What is the correct way to interpolate gradient values to all the
- > unknown image colors from the discrete colors/gradients defined in the
- > colorbar?

First of all, if there are colors in the image that are not in the colorbar, then the color bar is fairly useless to you. My guess is that this has been coded incorrectly. (There can be colors in the colorbar that are not in the image, of course, but not the other way around.)

I **suppose** a color bar could be drawn with discrete colors from the image, so that the user could be encouraged to interpolate values between colors, but this would be a lousy way to run a railroad and the programmer should probably have his IEPA card revoked.

- > (The documentation for INTERPOL and INTERPOLATE has not helped me so
- > far.)

No, I can imagine not. :-)

Cheers,

David

--

David Fanning, Ph.D.
Fanning Software Consulting, Inc.
Coyote's Guide to IDL Programming: <http://www.dfanning.com/>
Sepore ma de ni thui. ("Perhaps thou speakest truth.")

Subject: Re: color value interpolation from colorbar
Posted by j.coenia@gmail.com on Thu, 04 Dec 2008 19:15:36 GMT
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The images are digitized, unfortunately, from analog recordings of medical scanning sessions. This is the reason the colors are not true. There is no way to retrieve the *exact* colors as they presumably appeared on the original equipment screen.

Still, the recorded image quality on the tapes is considered good enough for review and even diagnosis. When radiologists look at these images, no one objects that the colorbars are incorrect, and that their reds and yellows don't exactly match the images' reds and yellows. No one can even tell, in fact. It is however clear to the human eye which areas are more yellow and which are more red. A computer should also be able to both find the image colors and assign interpolated colorbar values for more quantitative analysis.

Even without the errors introduced by analog recording onto tape and digitization, I can imagine a color-coded image with gradations from red to yellow too fine to discern with the human eye. A colorbar could be created with a smaller sampling of discrete representative hues from most yellow to most red, say 25 hues. A human observer could interpret such a colorbar. Isn't it possible to write a computer program to interpolate values to the unknown colors from the colorspace traversed by a partial colorbar?

Even in the very simple case of a two-hue colorbar, with yellow at 0 and red at 100, we would still interpolate a value for an orange somewhere between 0 and 100, probably 50, based on certain assumptions we hold about color gradients. With more intermediate hues and more gradient values, shouldn't it be possible assign a reasonable value for that orange?

It's clear that I do not know that much about color theory, but the motivation for this is that if a human observer can perform rough color interpolation on corrupted color-coded images, then a computer should be able to perform finer interpolation.

Thanks

Subject: Re: color value interpolation from colorbar
Posted by [David Fanning](#) on Thu, 04 Dec 2008 19:50:48 GMT
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j.coenia@gmail.com writes:

- > It's clear that I do not know that much about color theory, but the
- > motivation for this is that if a human observer can perform rough
- > color interpolation on corrupted color-coded images, then a computer
- > should be able to perform finer interpolation.

You may be too young to have learned the meaning of the term GIGO in your computer science classes, but I think it applies here. Personally, I think you are making an awful lot of assumptions about your data and the way the colorbar was constructed. Perhaps you are justified in that. But if it were me, I'd feel like I was treading on pretty thin ice. :-)

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting, Inc.

Coyote's Guide to IDL Programming: <http://www.dfanning.com/>

Sepore ma de ni thui. ("Perhaps thou speakest truth.")

Subject: Re: color value interpolation from colorbar
Posted by [Vince Hradil](#) on Thu, 04 Dec 2008 20:11:31 GMT
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On Dec 4, 1:15 pm, "j.coe...@gmail.com" <j.coe...@gmail.com> wrote:

- > The images are digitized, unfortunately, from analog recordings of
- > medical scanning sessions. This is the reason the colors are not
- > true. There is no way to retrieve the *exact* colors as they
- > presumably appeared on the original equipment screen.
- >
- > Still, the recorded image quality on the tapes is considered good
- > enough for review and even diagnosis. When radiologists look at these
- > images, no one objects that the colorbars are incorrect, and that
- > their reds and yellows don't exactly match the images' reds and
- > yellows. No one can even tell, in fact. It is however clear to the
- > human eye which areas are more yellow and which are more red. A
- > computer should also be able to both find the image colors and assign
- > interpolated colorbar values for more quantitative analysis.
- >
- > Even without the errors introduced by analog recording onto tape and
- > digitization, I can imagine a color-coded image with gradations from
- > red to yellow too fine to discern with the human eye. A colorbar
- > could be created with a smaller sampling of discrete representative
- > hues from most yellow to most red, say 25 hues. A human observer
- > could interpret such a colorbar. Isn't it possible to write a

> computer program to interpolate values to the unknown colors from the
> colorspace traversed by a partial colorbar?
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> Even in the very simple case of a two-hue colorbar, with yellow at 0
> and red at 100, we would still interpolate a value for an orange
> somewhere between 0 and 100, probably 50, based on certain assumptions
> we hold about color gradients. With more intermediate hues and more
> gradient values, shouldn't it be possible assign a reasonable value
> for that orange?
>
> It's clear that I do not know that much about color theory, but the
> motivation for this is that if a human observer can perform rough
> color interpolation on corrupted color-coded images, then a computer
> should be able to perform finer interpolation.
>
> Thanks

This is a very confusing thread 8^\

The idea of interpolation between colors is difficult because the color space is three-dimensional. If you say "from red to yellow" you have to specify what your path is. For instance:

```
r = replicate(255b,256)
g = bindgen(256)
b = replicate(0b,256)
tvlct, r, g, b
```

will give you a gradient from red to yellow (maybe "the simplest"?).

But so does `b = 2b*[bindgen(128),reverse(bindgen(128))]`, it just goes through purple.

Anyway, if this makes no sense just disregard it. I had trouble figuring out the answer to your question, so this is an answer I could come up with.

Cheers,
Vince

Subject: Re: color value interpolation from colorbar
Posted by j.coenia@gmail.com on Thu, 04 Dec 2008 21:06:26 GMT
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Thanks for the fast replies.

I agree that the input is garbage, at least relative to the ideal of

directly digitized lossless 30 fps video of 30 minute scanning sessions... Such data are not available here yet, not with our equipment, although the equipment is surely available elsewhere with new advances in frame grabbing and increases in storage capacity.

This garbage is still considered by many to be diagnostic-quality (or at least research-quality) garbage. The color even on the degraded recordings is not useless: the colorbars can and have for years been used to estimate color level in countless papers and for clinical diagnosis.

I am not asking for the best way to get data; I am asking for the best way to analyze degraded data.

Degraded data is not necessarily "useless" or "garbage" -- that's an exaggeration.

The challenge here is to extract something useful from it. Years of research says that useful information can be extracted by eye from these degraded recorded colors, although I am having problems doing it by computer, which is why I posted here in the first place. Or I could go back and tell the head of the research section to publish retractions for 15 years of publications... :)

Subject: Re: color value interpolation from colorbar
Posted by j.coenia@gmail.com on Thu, 04 Dec 2008 21:23:19 GMT
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Thanks. The red-to-yellow colorbar is already on the image -- I don't create it. The map of gradient values to the 3D colorspace would have to be determined from this colorbar, which also has errors in it (garbage in, as Dr. Fanning says.) I suppose this would be an irregular grid of gradient values within the 3D colorspace.

Basically, there's a color-coded image with a colorbar *on* the image. The colors, even those in the bar, often have errors because they were digitized from analog tape recordings. Still, it is possible to eyeball the images to determine color levels. I want the computer to do something more quantitative than the eyeball analysis.

Subject: Re: color value interpolation from colorbar
Posted by [Vince Hradil](#) on Thu, 04 Dec 2008 21:31:03 GMT
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On Dec 4, 3:23 pm, "j.coe...@gmail.com" <j.coe...@gmail.com> wrote:

> Thanks. The red-to-yellow colorbar is already on the image -- I don't
> create it. The map of gradient values to the 3D colorspace would have
> to be determined from this colorbar, which also has errors in it
> (garbage in, as Dr. Fanning says.) I suppose this would be an
> irregular grid of gradient values within the 3D colorspace.
>
> Basically, there's a color-coded image with a colorbar *on* the
> image. The colors, even those in the bar, often have errors because
> they were digitized from analog tape recordings. Still, it is
> possible to eyeball the images to determine color levels. I want the
> computer to do something more quantitative than the eyeball analysis.

Would it be possible for you to upload a sample image so that we can
get the idea of what you trying to do?

Subject: Re: color value interpolation from colorbar
Posted by [pgrigis](#) on Thu, 04 Dec 2008 21:35:42 GMT
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So your first step is to "digitize" the color bar:

Create 3 arrays of r,g,b with the colors as a function of pixel size
and an array x of the pixel index number.

Then, show us a plot of $r(x)$, $g(x)$, $b(x)$

Ciao,
Paolo

j.coenia@gmail.com wrote:

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> create it. The map of gradient values to the 3D colorspace would have
> to be determined from this colorbar, which also has errors in it
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