Subject: Re: Image Contrast Enhancement
Posted by David Fanning on Mon, 27 Feb 2006 15:46:23 GMT
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David Fanning writes:

> I've finally completed what I have been doing piecemeal over
> the past week or so: put ALL my new image contrast improvements
> into a single user interface, XSTRETCH.
>
> http://www.dfanning.com/programs/xstretch.zip

Sigh....

Big code changes always means a long shake-out time.
We MUST be getting close, now, though.

Anyway, if you are having problems. Try the latest.
I've got to hire some new quality assurance testers. :-(

Cheers,

David

--
David Fanning, Ph.D.
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Coyote's Guide to IDL Programming: http://www.dfanning.com/

Subject: Re: Image Contrast Enhancement
Posted by Patrick Broos on Mon, 27 Feb 2006 16:20:58 GMT
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David,

In case it helps I'll mention a three little facts (which you probably
already know very well) about the "astronomy market" for constructing
color composite images.

* The HASTROM tool in Landsman's library is useful for aligning
mulitple FITS images.

* Probably most of the color composites made during data analysis are
made by the "ds9" tool.

* Probably most of the color composites made for Education and Public
Outreach purposes are made by Photoshop using the FITS Liberator

plugin: http://www.spacetelescope.org/projects/fits_liberator/
(Photoshop's undocumented magic algorithm for combining images allows one to "combine" more than three data sets, e.g. you can have red, blue, green, brown, tangarine, chartreuse, etc. components.)

I'm delighted that you're taking seriously Robert Lupton's excellent criticism of the embarrassing saturate-to-white color model used throughout astronomy (including ds9 and Photoshop). A nice GUI to construct color composites the right way would be a help to astronomy. I've written a lame version of such a tool but I look forward to your more professional solution to the problem.

Best of luck,
Patrick
Chandra-ACIS Team at Penn State

Subject: Re: Image Contrast Enhancement
Posted by news.verizon.net on Mon, 27 Feb 2006 18:22:31 GMT
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I'm not sure if it has been mentioned that IDL code for using asinh scaling to combine 3 color images is available from http://astro.physics.nyu.edu/hogg/visualization/

Subject: Re: Image Contrast Enhancement
Posted by JD Smith on Mon, 27 Feb 2006 21:55:18 GMT
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On Sat, 25 Feb 2006 16:39:53 -0700, David Fanning wrote:

> Folks,
>
> I've finally completed what I have been doing piecemeal over
> the past week or so: put ALL my new image contrast improvements
> into a single user interface, XSTRETCH.
>
> http://www.dfanning.com/programs/xstretch.zip
>
> Using the image histogram as a guide, you can now threshhold
> your image values and perform a contrast stretch between those
> values using linear, power-law (gamma), log, or an inverse
> hyperbolic sine function as the scaling function. Moreover,
> the code has been re-organized so that I can easily add additional
> scaling functions as needed. This program works great with

> even the worst of the images I have in my perverse collection.

I haven't looked yet, but I wonder how you implement the cutoff in log scaling? Since the log of negative numbers is undefined, you are forced to shift things to be positive. The question becomes, what is the minimum value to which you shift? If it's too low, you waste all of your dynamic range on the low end where there are no data. If it is too high, you lose detail in the background. The method DS9 uses is really poor (which is why most people think sqrt() scaling is better than log() scaling). I've had good luck using 5% of the range (max-min) being thresholded as the magic minimum.

Regarding histogram equalization, the methods I've seen (and used) tend to reduce the dynamic range, creating "comb" effects in the histogram, i.e. not using the full range of value available. I feel like I've seen other tools which do not do this, but that may reflect more about the data than the tool.

Now that you've put in all the goodies, if you really want to cause astronomers to loose their minds and begin sending you offers to name their first born or their computer after you, allow reading FITS files into three channels RGB, with truecolor display, and allow separate or grouped scaling of each of those channels, using HREBIN/HASTROM as needed to put them onto the same scale, with output to a variety of image formats. Try "RGB Frame" in DS9 for an example.

JD

Subject: Re: Image Contrast Enhancement
Posted by David Fanning on Mon, 27 Feb 2006 22:42:51 GMT
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JD Smith writes:

> I haven't looked yet, but I wonder how you implement the cutoff in log
> scaling? Since the log of negative numbers is undefined, you are
> forced to shift things to be positive. The question becomes, what is
> the minimum value to which you shift? If it's too low, you waste all
> of your dynamic range on the low end where there are no data. If it
> is too high, you lose detail in the background. The method DS9 uses
> is really poor (which is why most people think sqrt() scaling is
> better than log() scaling). I've had good luck using 5% of the range
> (max-min) being thresholded as the magic minimum.

One of the advantages of not being an astronomer is that I am free to to use brute force methods because I don't know any better. :-)

Following the example of Gonzalez and Woods, I just scale *everything* into the range 0 to 1 before I get started doing the real work. I can get away with this, because in the end I am scaling everything into the range of 0 to 255 anyway.

Now that I've barged into this arena, I'm learning all kinds of new things about it. Ideas are coming to me faster than I can work them out, which means, of course, I've got to rewrite this whole business as an object so it can become *really* useful to me. :-)

I did find, however, that I had to arbitrarily scale the data in AsinhScl into the range 0 to 1000, instead of 0 to 1 to make it work properly with the variety of images I was testing against. I'm not sure why this is so, except that -1 to 1 seems to be a strange zone in the inverse hyperbolic sine equation. I noted this, but haven't followed up, since it seems to *work* OK, even if I don't understand it. That is to say, the modification gave me results that looked right. However, I notice my results are different than the FITS Liberator, so I am looking at this again now.

> Regarding histogram equalization, the methods I've seen (and used)
> tend to reduce the dynamic range, creating "comb" effects in the
> histogram, i.e. not using the full range of value available. I feel
> like I've seen other tools which do not do this, but that may reflect
> more about the data than the tool.

Humm. I don't know. All the methods I've tried to use or implement seem to use the full dynamic range, although it is an inherently discrete, as opposed to smooth, process. Some bins are not filled in the new histogram. Perhaps this is what bothers you.

> Now that you've put in all the goodies, if you really want to cause
> astronomers to loose their minds and begin sending you offers to name
> their first born or their computer after you, allow reading FITS files
> into three channels RGB, with truecolor display, and allow separate or
> grouped scaling of each of those channels, using HREBIN/HASTROM as
> needed to put them onto the same scale, with output to a variety of
> image formats. Try "RGB Frame" in DS9 for an example.

This is what I have been working on today. But, I am still debating whether to write this as a widget program (which will be harder to maintain over time), or write it as the object program, which will take more time, but be more robust. As I say,

I have more ideas than I have the time to implement, which always suggests objects to me.

Anyway, I'm interested in getting famous, since I need a calling card to get that Astronomy Post-Doc position I hope someone is going to offer me. (Preferably in a Spanish-speaking part of the world, if you please. :-)

Cheers,

David

--
David Fanning, Ph.D.
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Subject: Re: Image Contrast Enhancement
Posted by JD Smith on Mon, 27 Feb 2006 23:21:32 GMT
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> Anyway, I'm interested in getting famous, since I need a calling
> card to get that Astronomy Post-Doc position I hope someone is
> going to offer me. (Preferably in a Spanish-speaking part of the
> world, if you please. :-)

When can you be in Tucson? I think it qualifies as Spanish speaking.

JD

Subject: Re: Image Contrast Enhancement
Posted by David Fanning on Mon, 27 Feb 2006 23:47:35 GMT
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JD Smith writes:

> When can you be in Tucson? I think it qualifies as Spanish speaking.

Uh, sometime before summer, OK. I grew up in Phoenix.
I *know* how hot it is in Tucson. I'm not sure even I
can play tennis at 4AM. :-(

Cheers,

David

--
David Fanning, Ph.D.
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