Subject: Re: Fractional Pixels Origin?
Posted by David Fanning on Wed, 15 Feb 2006 21:03:03 GMT
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CJCrockett writes:

> A quick question. Does anyone know, definitively, what origin IDL uses
> when defining fractional pixels? Is (0.0,0.0) the center, bottom left,
> or other, of the pixel?

I don't think IDL *defines* fractional pixels, to
tell you the truth. I think somebody else must do
that. :-)

Cheers,

David

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

Subject: Re: Fractional Pixels Origin?
Posted by Wayne Landsman on Wed, 15 Feb 2006 21:31:13 GMT
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"CJCrockett" <ccrockett@astro.umd.edu> wrote in message
news:1140036794.188403.185210@g14g2000cwa.googlegroups.com.. .
> A quick question. Does anyone know, definitively, what origin IDL uses
> when defining fractional pixels? Is (0.0,0.0) the center, bottom left,
> or other, of the pixel?
>

As David said, this is a convention which is set outside of IDL, but seeing
that you have a "astro" E-mail address I'll say that the FITS convention is
that [0,0] locates the center of the pixel. (This differs from most other
image processing standards where [0.,0.] defines the lower lefthand corner.)

--Wayne Landsman

Subject: Re: Fractional Pixels Origin?
Posted by Craig Markwardt on Wed, 15 Feb 2006 22:28:30 GMT
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"CJCrockett" <ccrockett@astro.umd.edu> writes:

> A quick question. Does anyone know, definitively, what origin IDL uses
> when defining fractional pixels? Is (0.0,0.0) the center, bottom left,
> or other, of the pixel?

Greetings, fellow Terrapin! David is right, IDL treats graphics on
the *screen* as whole pixels.

The place where fractional pixels comes in is probably the
INTERPOLATE() routine. That routine definitely considers the place
where the pixel value is defined to be at the *lower left* corner of
the box.

Craig

--
---------- ----------
Craig B. Markwardt, Ph.D. EMAIL: craigmnet@REMOVEcow.physics.wisc.edu
Astrophysics, IDL, Finance, Derivatives | Remove "net" for better response
---------- ----------

Subject: Re: Fractional Pixels Origin?
Posted by rm on Thu, 16 Feb 2006 14:24:28 GMT
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How's about this

```
pro find_pixel_edge

  window, xsize=20, ysize=20
  count=intarr(1001)
  for i=0, 1000 do begin
    plots, [0.0, 0.01*i], [10,10], /device
    bits=tvrd()
    count(i)=total(bits ne 0)
  endfor

  print, where(count ne count(1:*))*0.01

end
```

I've tried on a couple of Linux platforms and versions of IDL and the
result I get is

```
   0.490000      1.49000      2.49000      3.49000      4.49000
```

5.49000
    6.49000   7.49000   8.49000   9.49000

So a new pixel starts at 0.5, 1.5 etc. which makes [0,0] the centre of
a pixel.

Subject: Re: Fractional Pixels Origin?
Posted by JD Smith on Thu, 16 Feb 2006 22:48:35 GMT
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On Wed, 15 Feb 2006 21:31:13 +0000, Wayne Landsman wrote:

>
> "CJCrockett" <ccrockett@astro.umd.edu> wrote in message
> news:1140036794.188403.185210@g14g2000cwa.googlegroups.com.. .
>> A quick question. Does anyone know, definitively, what origin IDL uses
>> when defining fractional pixels? Is (0.0,0.0) the center, bottom left,
>> or other, of the pixel?
>>
>>
> As David said, this is a convention which is set outside of IDL, but
> seeing that you have a "astro" E-mail address I'll say that the FITS
> convention is that [0,0] locates the center of the pixel. (This differs
> from most other image processing standards where [0.,0.] defines the lower
> lefthand corner.)

There are actually 3 conventions in common use, with the center of the
lower-left pixel at [0.0,0.0],[0.5,0.5], and [1.0,1.0]. In the first
case, you have negative fractional pixels as valid. In the last case,
[0.,0.] isn't valid.

Only the middle case gets it right in my opinion. I call this the
"ruler convention". I.e. if you had a ruler marked in pixels and
fractional pixels, you would lay it down on the screen or page, and
could directly read out the fractional pixel location.

FITS does indeed use [0.0,0.0]. I'd urge those of you making the
choice for your programs to save the world confusion, and adopt the
"natural" choice: pixels centered on [a.5,b.5].

JD

Subject: Re: Fractional Pixels Origin?
Posted by David Fanning on Fri, 17 Feb 2006 00:02:20 GMT
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Wayne Landsman writes:

> I'll say that the FITS convention is that [0,0] locates
> the center of the pixel. (This differs from most other
> image processing standards where [0.,0.] defines the lower
> lefthand corner.)

Then, JD Smith writes:

> FITS does indeed use [0.0,0.0]. I'd urge those of you making the
> choice for your programs to save the world confusion, and adopt the
> "natural" choice: pixels centered on [a.5,b.5].

I'm confused. :-(

I thought Wayne was saying that the center of the first
pixel was at [0,0], which would mean the pixel spanned
the distance (on my ruler) of -0.5 to 0.5. JD seems to
contradict this.

I'm not sure when (if ever) I am going to *use* fractional
pixels, but I would like to understand it. :-)

Cheers,

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

Subject: Re: Fractional Pixels Origin?
Posted by Greg Hennessy on Fri, 17 Feb 2006 04:20:03 GMT
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On 2006-02-17, David Fanning <davidf@dfanning.com> wrote:
> I thought Wayne was saying that the center of the first
> pixel was at [0,0], which would mean the pixel spanned
> the distance (on my ruler) of -0.5 to 0.5. JD seems to
> contradict this.

Well, Wayne is right in that FITS convention says [1,1] is the center
of the pixel. JD argues that saying [0.5,0.5] makes sense, and likens
it to a ruler.

It comes down to history. If you do arrays like Fortran, you say that

[1,1] is the center of the pixel. Fortran programmers say the new millennium started in 2001.

C programers say the center of the pixel is [0.5,0.5], and that the millennium started in 2000.

Subject: Re: Fractional Pixels Origin?
Posted by David Fanning on Fri, 17 Feb 2006 05:15:33 GMT
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Greg Hennessy writes:

> Well, Wayne is right in that FITS convention says [1,1] is the center
> of the pixel.

I must be the only one *reading* Wayne's article. :-(

Let me quote it again:

"I'll say that the FITS convention is
that [0,0] locates the center of the pixel."

This whole thing just get curiousier and curiousier. :-)

Cheers,

David

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

Subject: Re: Fractional Pixels Origin?
Posted by Wayne Landsman on Fri, 17 Feb 2006 07:50:17 GMT
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> I must be the only one *reading* Wayne's article. :-(
>
> Let me quote it again:
>
> "I'll say that the FITS convention is
> that [0,0] locates the center of the pixel."
>
> This whole thing just get curiousier and curiousier. :-)

Well, you must not take Wayne too literally. The correct statement is that the FITS convention is that [1,1] locates the center of the pixel. My conversion of the "first pixel is [1,1]" in FITS (or FORTRAN) to "first pixel is [0,0]"
of IDL is so automatic that I hardly think about it, and I was just pointing out that in FITS an integer value refers to the center of the pixel (whereas in a "ruler" convention it refers to a corner of a pixel).

The main reason this matters in astronomy is for conversion between the X,Y pixel centroid of a star to longitude, latitude. So I suppose the poster's original question is also relevant for the MAP_PROJ_INVERSE, MAP_PROJ_FORWARD routines in IDL.

--Wayne

Subject: Re: Fractional Pixels Origin?
Posted by Greg Hennessy on Fri, 17 Feb 2006 13:06:59 GMT
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On 2006-02-17, David Fanning <davidf@dfanning.com> wrote:
> Greg Hennessy writes:
>
>> Well, Wayne is right in that FITS convention says [1,1] is the center
>> of the pixel.
>
> I must be the only one *reading* Wayne's article. :-(
>
> Let me quote it again:
>
> "I'll say that the FITS convention is
> that [0,0] locates the center of the pixel."

Well, FITS starts counting at 1, not 0.

Fits has the center of the pixel being the integral value.

Subject: Re: Fractional Pixels Origin?
Posted by mmiller3 on Fri, 17 Feb 2006 13:36:24 GMT
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>>>> > "David" == David Fanning <davidf@dfanning.com> writes:

> Then, JD Smith writes:

>> I'd urge those of you making the choice for your programs
>> to save the world confusion, and adopt the "natural"
>> choice: pixels centered on [a.5,b.5].

Here, here! JD - if you were running for office on that platform,
I'd vote for you!

> I'm not sure when (if ever) I am going to *use* fractional
> pixels, but I would like to understand it. :-)

I used to feel the same way, but then I started working on
multimodality medical image registration. In nut shell, I create
registration transformations for each image from pixel
cooridinates to space coordinates. When I want any image
intensity at any point in space, I use the inverse transforms to
take my space coordinates to pixel coordinates and then
interpolate the original data at those pixel coordinates. If I
use integer pixel coordinates, I natually get nearest neighbor
interpolation. If I want to use some other interpolation method,
I need to use fractional pixel coordinates.

Now my main problem is that every time I see a discussion like
this, I have an anxiety attack about whether or not my code
consistently does what I think it does!

Mike

Subject: Re: Fractional Pixels Origin?
Posted by JD Smith on Fri, 17 Feb 2006 21:25:04 GMT
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On Thu, 16 Feb 2006 17:02:20 -0700, David Fanning wrote:

> Wayne Landsman writes:
>
>> I'll say that the FITS convention is that [0,0] locates the center of
>> the pixel. (This differs from most other image processing standards
>> where [0.,0.] defines the lower lefthand corner.)
>
>
> Then, JD Smith writes:
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>> FITS does indeed use [0.0,0.0]. I'd urge those of you making the choice
>> for your programs to save the world confusion, and adopt the "natural"
>> choice: pixels centered on [a.5,b.5].
>
> I'm confused. :-(

Sorry, I had it backwards, FITS centers the first pixel at [1,1], and the Nasa library uses [0,0] (which is called "IDL convention"). If you have a choice, don't choose the FITS standard ([1,1]), or the "IDL convention" ([0,0]), but the natural "I'm a tiny ant living on the surface of your detector and measuring pixel positions from the edge with my tiny little ruler": [0.5,0.5]. The only disadvantage is all pixel centers are now fractional.

Wayne is very careful to document the convention in all of the NasaLib routines, so if confused be sure to read the useful doc headers (as I just did to remedy my confusion!).

JD
