Subject: Problem array subscripting Posted by GRI on Mon, 16 Aug 1999 07:00:00 GMT

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Hello everybody.

I have a little problem I want to solve using array subscripting (if possible), but I haven't been able to do it without using a FOR statement:

I have a 3D array (dimX, dimY, n_images), which represents a time-series

of images.

I have a masking image (dimX, dimY), from wich I extract some points I am interested in (a ROI) with the command WHERE.

I could then change the one dimensional subscripts returned by WHERE into two vectors, that give me the X and Y coordinates of the points.

What I want to do is:

index= INDGEN(n_images)
result= ARRAY[X, Y, index],

but I get an error:

% All array subscripts must be same size. Var = ARRAY.

I have read in the documentation I can't do

result= ARRAY[X,Y, 0:n_images-1]

because I get an (n,n,n_images); where n is the number of X (or Y) coordinates array, instead of the expected (n,n_images) array. Acording to IDL's help this combines each element in the first vector with all elements in the second vector, so it would work for me if my points where in a regular grid, but this is not the case!

With a FOR statement the solution would be easy:

n_points= N_ELEMENTS(X); number of points I am interested on. result= FLTARR(n_points, n_images)
FOR i=0, n_points-1 DO \$
result[i,*]= ARRAY[X[i], Y[i], 0:n_images-1]

Is there a way to solve it with array subscripts, or should I go ahead with the FOR statement?.

Subject: Re: Problem array subscripting
Posted by Craig Markwardt on Mon, 16 Aug 1999 07:00:00 GMT
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```
GRI <dibeas@etsit.upm.es> writes:
```

```
> ...
```

- > I have a little problem I want to solve using array subscripting (if
- > possible), but I haven't been able to do it without using a FOR
- > statement:

>

- > I have a 3D array (dimX, dimY, n_images), which represents a time-series
- > of images.

>

- > I have a masking image (dimX, dimY), from wich I extract some points I
- > am interested in (a ROI) with the command WHERE.

>

- > I could then change the one dimensional subscripts returned by WHERE
- > into two vectors, that give me the X and Y coordinates of the points.

>

- > What I want to do is:
- > index= INDGEN(n_images)
- > result= ARRAY[X, Y, index],

First of all, I would argue that using a FOR loop in this situation is acceptable. Why? Because you are still vectorizing the majority of the computation at the image level. The extra computational overhead of the FOR loop for a few images will be small.

That said, if you *really* want to vectorize, then I think you need to take a different approach. Array subscripting with index lists can get tricky if you mix with other forms of subscripting at the same time. The WHERE command, operated on a two dimensional array, gives a *one* dimensional list of array indices. Therefore, it's usually best to refer to your data the same way, ala REFORM.

If MASK is (NX x NY) and ARRAY is (NX x NY x N_IMAGES) then this should work.

```
wh = where(MASK EQ 1, n_pix) ;; One-dimensional array array = reform(array, nx*ny, n_images, /overwrite) result = array(wh, *) array = reform(array, nx, ny, n_images, /overwrite) ;; Revert to old dims.
```

Subject: Re: Problem array subscripting Posted by m218003 on Mon, 16 Aug 1999 07:00:00 GMT

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In article <37B7FF76.F5062466@etsit.upm.es>,
 GRI <dibeas@etsit.upm.es> writes:
 Hello everybody.
 Hello everybody.
 I have a 3D array (dimX, dimY, n_images), which represents a time-series
 result= ARRAY[X,Y, 0:n_images-1]
 how about result = (ARRAY[X,Y,*]) [*,*,0:n_images-1]

You could also try my little arrex function which was developed from a request on this newsgroup and can be found at http://www-as.harvard.edu/people/staff/mgs/idl/ (hopefully still there)

(download the tools library)

Regards,
Martin.

Subject: Re: Problem array subscripting
Posted by davidf on Tue, 17 Aug 1999 07:00:00 GMT
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Henry Chapman (chapman9@llnl.gov) writes:

```
> This can be solved with a little trick I posted awhile back (some time after a long thread about indices). The trick is to index an extra dimension.
> Example:
> IDL> array = bindgen(16,16,5)
> IDL> index = indgen(5)
> IDL> x = [0,1,2]
> IDL> y = [8,9,10,11]
> IDL> result = array[x, y, index, 0]
```

The trouble with this trick is that I don't understand how it works. It's fine for production code, don't get me wrong, where a little smoke and mirrors can even be elegant. I just don't want to get up in front of an IDL programming class and have to explain it. Do you have any theories?

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting

Phone: 970-221-0438 E-Mail: davidf@dfanning.com

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

Toll-Free IDL Book Orders: 1-888-461-0155

Subject: Re: Problem array subscripting
Posted by Henry Chapman on Tue, 17 Aug 1999 07:00:00 GMT
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This can be solved with a little trick I posted awhile back (some time after a long thread about indices). The trick is to index an extra dimension.

Example:

```
IDL> array = bindgen(16,16,5)
IDL> index = indgen(5)
IDL> x = [0,1,2]
IDL> y = [8,9,10,11]
```

IDL> result = array[x, y, index, 0]

IDL> help,result

RESULT BYTE = Array[3, 4, 5]

IDL> print,result[*,*,0]

128 129 130

144 145 146

160 161 162

176 177 178

You could also do IDL> result = array[x, y, *, 0]

Henry.

--

Henry Chapman mailto:chapman9@llnl.gov Information Science & Technology Program Lawrence Livermore National Lab L-395, 7000 East Ave., Livermore CA 94550

Subject: Re: Problem array subscripting Posted by GRI on Wed, 18 Aug 1999 07:00:00 GMT View Forum Message <> Reply to Message

I think I did not explain myself very well the first time... I'll try again

What I want to do is to be able to get the evolution along time of some pixels of a given image series. For instance, I want to see what values pixel at the origin (x=0, y=0) takes as time goes by.

Suppose I define:

array= INDGEN(2,2,5); dimensions (x,y,t)

I want to extract vectors along the time dimensions, i.e. of length 5, at any given combination of x and y.

For instance, I may need the vector at x=0, y=0 (from t=0 to t=4), and also another vector at x=1, y=1 (I obtain the x and y coordinates from a masking image)

This vectors would be, in this case [0,4,8,12,16] and [3,7,11,15,19].

When using a combination of two vectors to index ARRAY like

array[[0,1],[0,1],*]

what IDL does is combine each value in the first vector with all elements in the second vector ([0,0], [0,1], [1,0], [1,1]), and all values in the third dimension, as indicated by the asterisk, and so I get (in this case) the original array.

In a general case this would be ok if I wanted to profile the array along the time dimension at a regular grid ([0,0], [10,0], [20,0], [0,10], [10,10], [20,10] ...)

The only method I haved proved it works like I want is the 'ugly' one proposed by Craig Markwardt. I have also seen it is really faster than using a for loop when the number of vectors to extract is hight. Looks like the use of the /OVERWRITE keyword makes it work very fast, since as IDL's help says it only changes the data descriptor, not the data itself.

The other two methods give me the same results as indexing the time series directly with $[[0,1],[0,1],^*]$.

I haven't been able to download Martin Schultz's arrex function (might be a problem with my browser, the tools library is there, but instead of downloading

it my Netscape opens it like if it were text, which is not).

Thanks everybody for your help.

P.S.: I hope I have explained this time, but as I read this again it looks a lot like my original post... well, at least this time I have included the little example!

Subject: Re: Problem array subscripting
Posted by davidf on Wed, 18 Aug 1999 07:00:00 GMT
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Henry Chapman (chapman9@llnl.gov) writes a lengthy explanation for his array subscripting trick:

Well, as I say, I'm not anxious to get up in front of an IDL programming class and explain it. :-(

Cheers.

David

P.S. But I *would* consider giving them your e-mail address so *you* can explain it. :-)

--

David Fanning, Ph.D.

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Subject: Re: Problem array subscripting

Posted by Henry Chapman on Wed, 18 Aug 1999 07:00:00 GMT

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David Fanning wrote:

>> IDL> result = array[x, y, index, 0]

>

- > The trouble with this trick is that I don't understand
- > how it works. It's fine for production code, don't get
- > me wrong, where a little smoke and mirrors can even be
- > elegant. I just don't want to get up in front of an IDL
- > programming class and have to explain it. Do you have
- > any theories?

Well, here's what's written in "Building IDL applications" on pp 62,63:

---- [begin quote from building.pdf] ---

"Extra" Dimensions

When creating arrays, IDL eliminates all size 1, or "degenerate", trailing

dimensions. Thus, the statements

A = INTARR(10, 1) HELP, A

print the following:

A INT = Array(10)

This removal of superfluous dimensions is usually convenient, but it can cause problems when attempting to write fully general procedures and functions. Therefore, IDL allows you to specify "extra" dimensions for

an array as long as the extra dimensions are all zero. For example, consider a vector defined as follows:

ARR = INDGEN(10)

The following are all valid references to the sixth element of ARR:

X = ARR[5] X = ARR[5, 0] X = ARR[5, 0, 0, *, 0]

Thus, the automatic removal of degenerate trailing dimensions does not cause problems for routines that attempt to access the resulting array.

---- [end quote] ---

So, IDL says that it's all Kosher to put in the extra dimension.

But, I guess, that doesn't quite answer all of it, since the above doesn't address the behaviour of subscripting. Let me quote some more from building.pdf (p 68):

---- [start quote]

When combining two subscript arrays, each element of the first array is combined with the corresponding element of the other subscript array. The two

subscript arrays must have the same number of elements. The resulting subscript

array has the same number of elements as its constituents. For example, the

expression A[[1, 3], [5, 9]] yields the elements A[1,5] and A[3,9].

---- [end quote]

That is, when you try and do

result = array[x, y]

IDL wants to return result[0] = array[x[0], y[0]],result[i] = array[x[i], y[i]], ...

And this may well be what you want. So how does one switch between these behaviours? There is a hint on p. 67 of the same good book:

-- [start quote]

When combining an array subscript with a subscript range, the result is

an array of subscripts constructed by combining each element of the subscript array with each member of the subscript range. Combining an n-element array with an m-element subscript range yields an nm-element subscript. Each dimension of the result is equal to the number of elements in the corresponding subscript array or range.

For example, the expression A[[1, 3, 5], 7:9] is a nine-element, $3 i \frac{1}{2} x 3$ array composed of the following elements:

-- [end quote]

So, I think my trick is consistant with IDL's documentation, although it might not have been what IDL had in mind. Here is my summary of array subscripting:

There are two behaviours you may want when you try result = array[x, y,..., z], and x, y, ..., z are 1-d arrays:

- return a 1-d array with result[i] = array[x[i], y[i],..., z[i]]
 return a 2-d array with result[i, j,..., k] = array[x[i], y[i],...,z[k]]
- IDL does (1), which requires x, y,...,z all have the same length. However, IDL does (2) if one of the dimensions is a subscript range. Since a single number is a subscript range, it will do (2) in that case. And since 0, written in as an extra dimension is also a subscript range, IDL will use behaviour (2)

Henry.

--

Henry Chapman mailto:chapman9@llnl.gov Information Science & Technology Program phone:(925)423-1580 Lawrence Livermore National Lab fax:(925)423-1488 L-395, 7000 East Ave., Livermore CA 94550

Subject: Re: Problem array subscripting
Posted by Liam Gumley on Thu, 19 Aug 1999 07:00:00 GMT
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GRI wrote:

>

- > I think I did not explain myself very well the first time... I'll try again
- > What I want to do is to be able to get the evolution along time of some
- > pixels of a given image series. For instance, I want to see what values
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```
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 Suppose I define:
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>
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  at any given combination of x and y.
>
> For instance, I may need the vector at x=0, y=0 (from t=0 to t=4), and also
> another vector at x=1, y=1 (I obtain the x and y coordinates from a masking
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> problem with my browser, the tools library is there, but instead of
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> it my Netscape opens it like if it were text, which is not).
I've been scratching my head over this one for a while, and I don't see
```

I've been scratching my head over this one for a while, and I don't see how this particular problem can be solved using traditional IDL array indexing syntax, even with added degenerate dimensions. I don't think arrex will solve it either (I'll be happy to be proven wrong).

Say you have the following arrays defined:

```
a = indgen(2, 2, 5)
x = [0, 1]
y = [0, 1]
z = [0, 1, 2, 3, 4]
```

When you tell IDL to extract a[x, y, z], it extracts the following elements:

- 0, 0, 0
- 1, 0, 0
- 0, 1, 0
- 1, 1, 0
- 0, 0, 1
- 1, 0, 1
- 0, 1, 1
- 1, 1, 1
- 0, 0, 2
- 1, 0, 2
- 0, 1, 2
- 1, 1, 2 0, 0, 3
- 1, 0, 3
- 0, 1, 3
- 1, 1, 3
- 0, 0, 4 1, 0, 4
- 0, 1, 4
- 1, 1, 4

You can see that it loops through the supplied index arrays an element at a time, with the leftmost index array in the innermost loop. The elements you really wanted were

- 0, 0, 0
- 1, 1, 0
- 0, 0, 1
- 1, 1, 1
- 0, 0, 2
- 1, 1, 2
- 0, 0, 3
- 1, 1, 3
- 0, 0, 4
- 1, 1, 4

I don't believe you can extract this sub-array using normal array indexing. It requires creative array re-arrangement, as Craig demonstrated rather elegantly IMHO.

Array indexing is always good for a long thread in this newsgroup.....

Cheers, Liam.

--

Liam E. Gumley
Space Science and Engineering Center, UW-Madison
http://cimss.ssec.wisc.edu/~gumley

Subject: Re: Problem array subscripting Posted by davidf on Thu, 19 Aug 1999 07:00:00 GMT View Forum Message <> Reply to Message

Henry Chapman (chapman9@llnl.gov) writes:

- >> P.S. But I *would* consider giving them your e-mail address
- >> so *you* can explain it. :-)

>

> Is that your definition of being famous?

Uh, no. My definition of being famous is to throw one of Stein Vidar's no-loop constructions up on the board and say to the class, "Like that, of course!" :-)

Someone pointed out to me the other day that I... uh, *overused* the phrase "of course" in my book. They said nothing is "of course" to a beginning IDL user. So I want you to know that I went through the whole damn book and eliminated all 5,438 instances (or whatever it was) of them. I'm calling this the 2nd (Less Pedantic) Edition. :-)

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting

Phone: 970-221-0438 E-Mail: davidf@dfanning.com

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Subject: Re: Problem array subscripting

Posted by Henry Chapman on Thu, 19 Aug 1999 07:00:00 GMT

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David Fanning wrote:

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Henry.

--

Henry Chapman mailto:chapman9@llnl.gov Information Science & Technology Program Lawrence Livermore National Lab L-395, 7000 East Ave., Livermore CA 94550

Subject: Re: Problem array subscripting Posted by Mirko Vukovic on Thu, 19 Aug 1999 07:00:00 GMT View Forum Message <> Reply to Message

In article <37BB1623.DEC726F8@etsit.upm.es>, GRI <dibeas@etsit.upm.es> wrote:

- ... stuff deleted
- > I haven't been able to download Martin Schultz's arrex function (might be a
- > problem with my browser, the tools library is there, but instead of
- > downloading
- > it my Netscape opens it like if it were text, which is not).

>

In that case you can use Save As (under file menu) to save the file. If I remember correctly (I cannot test this now, as I am typing this in Netscape), as long as you select the file type as something else other than html, you should get a usefull text file, which after some editing on your part becomes you .pro file.

good luck

Mirko

Sent via Deja.com http://www.deja.com/ Share what you know. Learn what you don't.

Subject: Re: Problem array subscripting Posted by davidf on Fri, 20 Aug 1999 07:00:00 GMT

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Martin.Schultz@dkrz.de (m218003@modell3.dkrz.de) writes:

- >> [...]. So I want you to know that I went through the
- >> whole damn book and eliminated all 5,438 instances
- >> (or whatever it was) of them [of course]. I'm calling this the
- >> 2nd (Less Pedantic) Edition. :-)

>

- > Wow! That's 48942 characters! Enough space for a whole new chapter I should
- > think ;-)

Gee, I hadn't thought of that! I did notice, however, that the cost of shipping the book to Germany went down by a third. :-)

Cheers,

David

--

David Fanning, Ph.D.

Fanning Software Consulting

Phone: 970-221-0438 E-Mail: davidf@dfanning.com

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Subject: Re: Problem array subscripting Posted by m218003 on Fri, 20 Aug 1999 07:00:00 GMT

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In article <MPG.12261704372f4d149898ab@news.frii.com>, davidf@dfanning.com (David Fanning) writes:

> Henry Chapman (chapman9@llnl.gov) writes:

>

- > . So I want you to know that I went through the
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- > (or whatever it was) of them . I'm calling this the
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Martin

>