Subject: Check numerical derivatives
Posted by geo85c on Tue, 27 Jun 2017 10:30:58 GMT
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Hi there,

I wanted to calculate numerical derivatives of a function. I would like to check if the following are correct.

Consider the function F in R^2.
F is a 2D image.
I did the following:
dims = size(F, /dimensions)
nx = dims[0]
ny = dims[1]
xc = findgen(nx)
yc = findgen(ny)

Derivative with respect to x:
F_x = F[xc[1:nx-1],*]-F[xc[0:nx-2],*] ;first order deriv
F_xx = F_x[xc[1:nx-1],*]-F[xc[0:nx-2],*] ;second order deriv
F_y = F[*,yc[1:ny-1]] - F[*,yc[0:ny-2]]
F_xy = F_x[*,yc[1:ny-1]] - F_x[*,yc[0:ny-2]]

Then I wanted to differentiate F_xy with respect to x. I did the following:
F_xxy = F_xy[xind[1:nx-1],*] - F_xy[xind[0:nx-2],*]

Are the above correct?

Thanks.

Subject: Re: Check numerical derivatives
Posted by wlandsman on Tue, 27 Jun 2017 14:52:26 GMT
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Yes, that looks correct to compute left-sided difference derivatives. But a few comments:

1. You don't need the xc,yc vectors, just use the function directly

F_x = F[1:nx-1,*]-F[0:nx-2,*]

2. You do not compute derivatives for the first column. Be careful because your derivative array has one less column than the original function.

3. Unless you need high compute speed, I would instead use the DERIV() function to obtain centered derivatives, with special treatment of the endpoints

```
F_x = fltarr(nx,ny)
for i=0,nx-1 do F_x[0,i] = $
  DERIV(F[*,i])
```

--Wayne

On Tuesday, June 27, 2017 at 6:30:59 AM UTC-4, geo...@gmail.com wrote:
> Hi there,
>
> I wanted to calculate numerical derivatives of a function. I would like to check if the following are correct.
>
> Consider the function F in R^2.
> F is a 2D image.
> I did the following:
> dims = size(F, /dimensions)
> nx = dims[0]
> ny = dims[1]
> xc = findgen(nx)
> yc = findgen(ny)
>
> Derivative with respect to x:
> F_x = F[xc[1:nx-1],*]-F[xc[0:nx-2],*] ;first order deriv
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> F_y = F[*,yc[1:ny-1]] - F[*,yc[0:ny-2]]
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> Then I wanted to differentiate F_xy with respect to x. I did the following:
> F_xxy = F_xy[xind[1:nx-1],*] - F_xy[xind[0:nx-2],*]
>
> Are the above correct?
>
> Thanks.

Subject: Re: Check numerical derivatives
Posted by geo85c on Wed, 28 Jun 2017 08:23:42 GMT
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Speed matters that's why I implemented it this way.
Thank you for your comments.

Your comment 2 was interesting. Is any other way to make it calculate the derivatives of all columns tho?

Subject: Re: Check numerical derivatives

Posted by wlandsman on Wed, 28 Jun 2017 14:46:50 GMT
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On Wednesday, June 28, 2017 at 4:23:45 AM UTC-4, geo...@gmail.com wrote:

> Your comment 2 was interesting. Is any other way to make it calculate the derivatives of all columns tho?

Well, you can't take the left-sided derivative of the first column because there is no column to the left. But it might be useful to keep the derivative array the same size as the original array. One could use the right-sided derivative for the first column, which would be the same as the left-sided derivative of the second column. --Wayne

```
F_x = F[1:nx-1,*]-F[0:nx-2,*]
F_x = [F_x[0,*],F_x]
```

(Of course the three point Lagrangian interpolation of the DERIV() function would be preferable.)