Subject: How can one improve the derivative?
Posted by g.nacarts on Wed, 27 Nov 2013 12:25:06 GMT
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Hi

I had to differentiate noisy data - which is a problem. I was wondering, how can one improve the derivative?
I read on a blog that one way is to make a Fourier filtering afterwards and another way is to apply a "smoothed" or "filtered" gradient. But I had no idea how to do this in IDL. Can anyone help?

Thanks in advance

Subject: Re: How can one improve the derivative?
Posted by David Fanning on Wed, 27 Nov 2013 13:26:08 GMT
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g.nacarts@gmail.com writes:

> I had to differentiate noisy data - which is a problem. I was wondering, how can one improve the derivative?
> I read on a blog that one way is to make a Fourier filtering afterwards and another way is to apply a "smoothed" or "filtered" gradient. But I had no idea how to do this in IDL. Can anyone help?

I think I would just apply the SMOOTH function to your data before you
differentiate it.

Cheers,

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

Subject: Re: How can one improve the derivative?
Posted by wlandsman on Wed, 27 Nov 2013 14:46:28 GMT
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You might look at the SAVGOL function which gets rid of the high-frequency signal (noise) while preserving the lower-frequency signals. (Smooth() suppresses both high and low frequencies.) The documentation for SAVGOL() says

"Tip: You can use this function in conjunction with the CONVOL function for smoothing and optionally for numeric differentiation."

On Wednesday, November 27, 2013 8:26:08 AM UTC-5, David Fanning wrote:
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>
>
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> David
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> David Fanning, Ph.D.
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> Fanning Software Consulting, Inc.
>
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Subject: Re: How can one improve the derivative?
Posted by lecacheux.alain on Wed, 27 Nov 2013 14:50:02 GMT
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Le mercredi 27 novembre 2013 13:25:06 UTC+1, g.na...@gmail.com a écrit :
> Hi
>
>

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> I read on a blog that one way is to make a Fourier filtering afterwards and another way is to apply a "smoothed" or "filtered" gradient. But I had no idea how to do this in IDL. Can anyone help?
>
>
>
> Thanks in advance

Differentiating noisy data can often be obtained by convolution with a Savitzky-Golay filter. In IDL, look at SAVGOL and CONVOL functions.

alx.

Subject: Re: How can one improve the derivative?
Posted by g.nacarts on Thu, 28 Nov 2013 12:28:40 GMT
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Hi

I read the SAVGOL function but there is something I didn't understand very well. How can I choose the nL and nR?

Subject: Re: How can one improve the derivative?
Posted by lecacheux.alain on Thu, 28 Nov 2013 13:06:34 GMT
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Le jeudi 28 novembre 2013 13:28:40 UTC+1, g.na...@gmail.com a écrit :
> Hi
>
>
>
> I read the SAVGOL function but there is something I didn't understand very well. How can I choose the nL and nR?

Afaik, there is no definite rule. At order 0, the Savitzky-Golay filter is a smoothing filter of length nL+nR. The rule of thumb would be to keep the filter width not much larger than the narrowest feature you want to preserve. At higher order, it is a derivative filter. The filtering rule should be the same.
The best way is to try...
alx.

Subject: Re: How can one improve the derivative?
Posted by g.nacarts on Thu, 28 Nov 2013 13:27:41 GMT
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This is what I did, I was playing with different values for nL and nR. But I was wondering if there is any specific rule. Also, when I used order=1 to give me the first order derivative filter the answer was not converges at all.
At order 0, the Savitzky-Golay filter seems to make the things better but not much.

Subject: Re: How can one improve the derivative?
Posted by David Fanning on Thu, 28 Nov 2013 13:35:17 GMT
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g.nacarts@gmail.com writes:

> This is what I did, I was playing with different values for nL and nR. But I was wondering if there is any specific rule. Also, when I used order=1 to give me the first order derivative filter the answer was not converges at all.
> At order 0, the Savitzky-Golay filter seems to make the things better but not much.

There is a good example of high frequency filtering with the FFT function in the Image Processing chapter of Coyote's Guide to Traditional IDL Graphics.

I found three of these books in the back of the closet, in case you are interested. These are the last three. I'm providing free shipping in the US while they last.

http://www.idlcoyote.com/coyotestore/

Cheers,

David

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

Subject: Re: How can one improve the derivative?
Posted by g.nacarts on Thu, 28 Nov 2013 14:22:21 GMT
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I have already this book. I am doing simulations so how can I use the example of FFT function?

Subject: Re: How can one improve the derivative?
Posted by David Fanning on Thu, 28 Nov 2013 14:27:20 GMT
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g.nacarts@gmail.com writes:

> I have already this book. I am doing simulations so how can I use the example of FFT function?

Well, write code that applies a low-pass filter. It's on page 285 in my
book. ;-)

Cheers,

David

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

Subject: Re: How can one improve the derivative?
Posted by g.nacarts on Thu, 28 Nov 2013 14:42:10 GMT
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> Well, write code that applies a low-pass filter. It's on page 285 in my book. ;-)

You mean the smooth function right? I used the smooth function with the keyword
/Edge_Truncate as shown in your example but the results I got are not satisfactory. I was trying to perform image filtering with the Convol function but I didn't understand how to choose the kernel.

Subject: Re: How can one improve the derivative?
Posted by David Fanning on Thu, 28 Nov 2013 14:48:28 GMT
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g.nacarts@gmail.com writes:

> You mean the smooth function right? I used the smooth function with the keyword
/Edge_Truncate as shown in your example but the results I got are not satisfactory. I was trying to perform image filtering with the Convol function but I didn't understand how to choose the kernel.

No, I meant try a low-pass filter using frequency filtering with the FFT
function to filter out the high-frequency noise components.

Cheers,

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

Subject: Re: How can one improve the derivative?
Posted by g.nacarts on Thu, 28 Nov 2013 15:08:24 GMT
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> No, I meant try a low-pass filter using frequency filtering with the FFT function to filter out the high-frequency noise components.

I am completely confused. Can you please give an example what you mean?
The syntax of FFT : smoothresult=FFT(Array) is that what you mean?

Subject: Re: How can one improve the derivative?
Posted by David Fanning on Thu, 28 Nov 2013 15:12:00 GMT
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g.nacarts@gmail.com writes:

> I am completely confused. Can you please give an example what you mean?
> The syntax of FFT : smoothresult=FFT(Array) is that what you mean?

I've given an example. You have the book, right? I'm looking at page 296
in the section labeled Image Filtering in the Frequency Domain.

Cheers,

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

Subject: Re: How can one improve the derivative?
Posted by lecacheux.alain on Thu, 28 Nov 2013 16:53:56 GMT
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Le jeudi 28 novembre 2013 14:27:41 UTC+1, g.na...@gmail.com a écrit :
> This is what I did, I was playing with different values for nL and nR. But I was wondering if there is any specific rule. Also, when I used order=1 to give me the first order derivative filter the answer was not converges at all.
>
> At order 0, the Savitzky-Golay filter seems to make the things better but not much.

SG filtering assumes that your function can be locally fitted by a low order polynomial (of order 2 to 4, at most nL+nR). The (LS) fit is done for each point of the function. The output of the filter is the constant term of the best polynomial fit. This is similar to a moving average, except that the latter uses a constant (a polynomial of degree 0). Derivative is obtained in the same way, but the constant term of the corresponding derived polynomial is used in that case.
Everything will depend on the shape of your function. Derivatives noisier than
the function is a normal result: differenciating increases noise while integrating is a smoothing process.
alx.