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Subject: Re: Calculating Error Estimates

Posted by [Karl Young](#) on Wed, 15 Jul 1998 07:00:00 GMT

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Hi David,

> It is so hot in Colorado today that I think my brain has  
> vapor locked. In any case, I can use some help. :-)

I was in Boulder last week for the World Shakuhachi Conference and I must admit it was a real joy to get back to foggy San Francisco

> Here is my problem. I have some experimental data. I  
> have used CURVEFIT and my roll-your-own function to  
> fit a curve through the data. What I want to do is  
> display the experimental data on the plot, along with  
> the curve. But I want to place error bars through  
> the experimental data points. My question is this:  
> how do I calculate the errors for the individual  
> points so that I can place them on the plot with  
> ERRPLOT?

>  
> CURVEFIT returns to me a parameter called SIGMA,  
> which contains the standard deviations of the returned  
> values of the four coefficients in my fitting  
> function. What I cannot seem to work out is how  
> to use these standard deviations to obtain an  
> error estimate for each individual experimental  
> point.

>  
> I realize this is basic error analysis, but even  
> an hour spent refreshing myself with Bevington  
> has not successfully stimulated this reptilian brain. :-(

>  
> Let's just say I had too much fun on vacation...  
>

Glad to hear you had a good vacation.

I recently had a similar problem, i.e. getting error estimates for constrained min (not curvefit, but the solution is similar in both cases).

Since I couldn't get information like derivative matrices out of constrained min (like you can out of curvefit, since the source is available) I checked with the folks at Windward Technology (the company that supplies constrained min). They pointed me towards a nice source, the book "Applied Regression Analysis" by Draper and Smith. In chapter 10 of that book they obtain a formula that is quite general for

nonlinear optimization problems, and should apply in your case. The formula for the "confidence ellipsoid", i.e. what you can use for error bounds is:

$$(P - Pfit)' Zfit' Zfit (P - Pfit) < p s^2 F(p,n-p,1-a)$$

where:

Pfit is the vector of parameters obtained from your fit

P is a vector of variables, which you can use to solve for the bounds

Zfit is the Hessian or second derivative matrix with the fitted values

of the parameters plugged in (I think you can snag that right out of

curvefit, i.e. you don't have to actually obtain the second derivatives)

p is the number of parameters

n is the number of points fit

F is the F-distribution

$$\text{and } s^2 = S(Pfit)/(n-p)$$

with S(Pfit) just the sum of the squared errors between the data and your function at Pfit.

If you need more details fell free to bug me.

-- KY

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