On Fri, 18 Sep 2009 02:53:29 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

> Hey!
>
> I need some help with amoeba (i'm a total IDL beginner...). For a
> start (get to understand how it works) I want to solve a pretty
> simple, 1-dim. problem. I'm having a parabola -x^2+4x+9 and I want to
> get the maximum with the help of AMOEBA. How do I do that? (Let's say
> starting point P0=5 and scale is 4).
> This is what it looks like now:
>
>
>
> FUNCTION FUNC, P
> x=P[0]
> y=-x^2.+4.*x+5.
> ydes=9.1
> RETURN, MIN(ydes^2-y^2)
> END
>
> R=AMOEBA(1.0e-1, SCALE=5, P0=0.05, FUNCTION_VALUE=fval)
>
> PRINT, 'x_Value:', r, $
> 'error:', fval[0]
>
> END
>
> As a result i get for the x_value -1 and for the error - Inf.... But
> why?! I mean the maximum of the function is at x=2 and this is within
> the scale...
> Maybe somebody can give me some help

It should be more like the code below. I never used this, but AMOEBA
seems to search for the minimum of a scalar field f(x,y,z,...).

In your example:
f(x) = -x^2.+4.*x+5.

If "FUNC" returns -f(x) it will search for the minimum of -f(x) which
is the same as finding the maximum of f(x).

```
FUNCTION FUNC, P
x=P[0]
y=-x^2.+4.*x+5.
RETURN, -y[0]
END

pro test
R=AMOEBA(1.0e-1,SCALE=10,P0=[0.01], FUNCTION_VALUE=fval)
xmax=r[0]
ymax=-fval[0]

PRINT, 'x_Value:', xmax
PRINT, 'maximum:', ymax

window
x=0.1*findgen(80)-2
y=-x^2.+4.*x+5.
plot,x,y
plots,xmax[[0,0]],[!y.crange[0],ymax],psym=-2
plots,[!x.crange[0],xmax],ymax[[0,0]],psym=-2
end
```

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Fri, 18 Sep 2009 11:52:50 GMT
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> R=AMOEBA(1.0e-1,SCALE=10,P0=[0.01], FUNCTION_VALUE=fval)

Lower the tolerance to get a better result.

Subject: Re: Optimization "AMOEBA"
Posted by Nicki on Fri, 18 Sep 2009 13:05:13 GMT
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O thanks so much for that... Just tried it also with my more
complicated function and it works... But now it's getting tricky:)
I have a 2nd varible...
this is set to 60 at the beginning and should vary plus/minus 30.
However my IDL cannot do it, it can only do scale 1, everything that
is more than one does not work out.....

That's the code:

FUNCTION FUNC, P

```
z=120.0
N_rows=3.0
d_fov=67
mu=438.689
R_tot=1.5
a_max=30
N=P[1]
R_i=P[0]
;a_max=P[2]

x=N*tan(a_max/2.0*!pi/180.0)*1.1/N_rows/!pi-1.0

a=2.0*asin((1.0/x+1.0)*d_fov/2/z)*180/!pi

 d=sqrt(R_tot^2-x^2*(R_i)^2)/(x+1)-alog(2)/mu*tan(a/2*!pi/180 )

 S=N*(1+x)^2/16/x^2/z^2*(d^2+2/mu*d*tan(a/2*!pi/180)+2/mu^2*( tan(a/2*!
pi/180))^2)*100

RETURN, -S

END



R=AMOEBA(1.e-1, SCALE=[0.50, 30.], P0=[0.55, 60.],
FUNCTION_VALUE=fval)

;Check for convergence:
;IF N_ELEMENTS(R) EQ 1 THEN MESSAGE, 'AMOEBA failed to converge'

; Print results:
PRINT, 'R_i, N:', r, $
    'function value: ', fval[0]

END
```

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Mon, 21 Sep 2009 07:38:51 GMT

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On Fri, 18 Sep 2009 06:05:13 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

> O thanks so much for that... Just tried it also with my more
> complicated function and it works... But now it's getting tricky:)
> I have a 2nd varible...

> this is set to 60 at the beginning and should vary plus/minus 30.
> However my IDL cannot do it, it can only do scale 1, everything that
> is more than one does not work out.....

> a=2.0*asin((1.0/x+1.0)*d_fov/2/z)*180/!pi

Set a breakpoint in your FUNC and check for NaN's. For example:
"a=NaN" when P=[0.5,30].

Subject: Re: Optimization "AMOEBA"
Posted by Nicki on Tue, 22 Sep 2009 23:30:45 GMT

> Set a breakpoint in your FUNC and check for NaN's. For example:
> "a=NaN" when P=[0.5,30].

But still... If I set my scale to let's say [0.5, 0.5] for [0.55, 60.]
it should definitely work. however i get -0.2000 for P[0] which is not
even in the set range for P[0] (it goes from 0.05 to 1 (see above))
However I have no idea why... Somebody can help me out?

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Wed, 23 Sep 2009 07:54:52 GMT

On Tue, 22 Sep 2009 16:30:45 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

>
>
>> Set a breakpoint in your FUNC and check for NaN's. For example:
>> "a=NaN" when P=[0.5,30].
>
> But still... If I set my scale to let's say [0.5, 0.5] for [0.55, 60.]
> it should definitely work. however i get -0.2000 for P[0] which is not
> even in the set range for P[0] (it goes from 0.05 to 1 (see above))
> However I have no idea why... Somebody can help me out?

FUNC will still return NaN at some point! Add the following line to
FUNC to check it yourself:

FUNCTION FUNC, P
...
if ~finite(s) then stop
RETURN, -S

END

I see what your problem is now. The P0 and SCALE define an initial
simplex and by no means constraint the space in which the minimum
should lay. See: http://www.nrbook.com/a/bookcpdf/c10-4.pdf

Maybe you can do something like this when P gets out of its range:

```
FUNCTION FUNC, P
...
if ~finite(s) then return,!values.F_INFINITY
RETURN, -S
END
```

Does that work?

On Sep 23, 3:54 am, Wox <s...@nomail.com> wrote:
> On Tue, 22 Sep 2009 16:30:45 -0700 (PDT), Nicki
>
> <nickireite...@yahoo.de> wrote:
>
>>> Set a breakpoint in your FUNC and check for NaN's. For example:
>>> "a=NaN" when P=[0.5,30].
>
>> But still... If I set my scale to let's say [0.5, 0.5] for [0.55, 60.]
>> it should definitely work. however i get -0.2000 for P[0] which is not
>> even in the set range for P[0] (it goes from 0.05 to 1 (see above))
>> However I have no idea why... Somebody can help me out?
>
> FUNC will still return NaN at some point! Add the following line to
> FUNC to check it yourself:
>
> FUNCTION FUNC, P
> ...
> if ~finite(s) then stop
> RETURN, -S
> END
>
> I see what your problem is now. The P0 and SCALE define an initial
> simplex and by no means constraint the space in which the minimum
> should lay. See:http://www.nrbook.com/a/bookcpdf/c10-4.pdf
>
> Maybe you can do something like this when P gets out of its range:

```
>
> FUNCTION FUNC, P
> ...
> if ~finite(s) then return,!values.F_INFINITY
> RETURN, -S
> END
>
> Does that work?
```

I seem to remember Craig mentioning that implementing a constraint
using a brick wall like that can give you problems. I think he
advocated having a slightly smoother but still very steep transition
from the allowed values to the extremely high values in the forbidden
region. I'm sure it was in the context of his routines, but I wouldn't
be surprised if amoeba behaved similarly.

-Jeremy.

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Wed, 23 Sep 2009 13:41:48 GMT
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On Wed, 23 Sep 2009 04:49:42 -0700 (PDT), Jeremy Bailin
<astroconst@gmail.com> wrote:

> I seem to remember Craig mentioning that implementing a constraint
> using a brick wall like that can give you problems.

Yes, for non-linear least squares refinement. See CONSTRAINT in code
below.

```
FUNCTION CONSTRAINT,Pin
; P must be with ]P0-dP,P0+dP[
COMMON FUNC_XY, P0, dP
return,P0+2*dP/!pi*atan(Pin)
END

FUNCTION FUNC, Pin, NOCONSTR=NOCONSTR

; NOCONSTR is just for plotting
if keyword_set(NOCONSTR) then P=Pin $
else P=CONSTRAINT(Pin)

z=120.0
```

```
N_rows=3.0
d_fov=67
mu=438.689
R_tot=1.5
a_max=30
N=P[1]
R_i=P[0]
;a_max=P[2]

x=N*tan(a_max/2.0*!pi/180.0)*1.1/N_rows/!pi-1.0

a=2.0*asin((1.0/x+1.0)*d_fov/2/z)*180/!pi

 d=sqrt(R_tot^2-x^2*(R_i)^2)/(x+1)-alog(2)/mu*tan(a/2*!pi/180 )

 S=N*(1+x)^2/16/x^2/z^2*(d^2+2/mu*d*tan(a/2*!pi/180)+2/mu^2*( tan(a/2*!pi/180))^2)*100

if ~finite(s) then stop
RETURN, -S

END

pro test34

COMMON FUNC_XY, P0, dP
P0=[0.3, 60]
dP=[0.5,15]

R=AMOEBA(1.0e-5,SCALE=dP, P0=P0, FUNCTION_VALUE=fval)
if r[0] eq -1 then begin
 print,'No minimum found.'
 return
endif
xmax=CONSTRAINT(r[0:1])
ymax=-fval[0]
PRINT, 'x_Value:', xmax
PRINT, 'maximum:', ymax

; Plot
n=200
L=P0-dP
H=P0+dP
inc1=(2*dP[0])/n
inc2=(2*dP[1])/n
b1=L[0]
b2=L[1]

x=b1+inc1*indgen(n)
```

```
y=b2+inc2*indgen(n)
z=fltarr(n,n)
for i=0,n-1 do $
 for j=0,n-1 do $
  z[i,j]=-func([x[i],y[j]],/NOCONSTR)

isurface,z,x,y
end
```

Subject: Re: Optimization "AMOEBA"
Posted by Nicki on Thu, 24 Sep 2009 01:04:46 GMT
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Wuhuu, thank you. The last part does not work though (plot), i just
commented it out and try to fix it later since the plot is right now
not that important.
so now, just that i understand everything...What do I need to change
and take care of when i also have a 3rd, 4th and maybe even a 5th
variable?? I don't have to change the function constraint, do i? (the
next thing will be letting a_max go from 20 to 80. If there is for a
specific N, a_max and R_i a "NaN" it won't stop the approximation,
will it?!(i hope you know what i mean))

Subject: Re: Optimization "AMOEBA"
Posted by Nicki on Thu, 24 Sep 2009 02:13:13 GMT
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On 24 Sep., 11:04, Nicki <nickireite...@yahoo.de> wrote:
> Wuhuu, thank you. The last part does not work though (plot), i just
> commented it out and try to fix it later since the plot is right now
> not that important.
> so now, just that i understand everything...What do I need to change
> and take care of when i also have a 3rd, 4th and maybe even a 5th
> variable?? I don't have to change the function constraint, do i? (the
> next thing will be letting a_max go from 20 to 80. If there is for a
> specific N, a_max and R_i a "NaN" it won't stop the approximation,
> will it?!(i hope you know what i mean))

Okay, I added the other variables now and it works... and also the 3D
plot works...
If I have 3 Variables now, what do i need to add to the ploting
section? And is it possible to get the results for a second minimum as
well (if there is another local minimum?)

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Thu, 24 Sep 2009 07:37:31 GMT

On Wed, 23 Sep 2009 18:04:46 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

> Wuhuu, thank you. The last part does not work though (plot), i just
> commented it out and try to fix it later since the plot is right now
> not that important.
> so now, just that i understand everything...What do I need to change
> and take care of when i also have a 3rd, 4th and maybe even a 5th
> variable?? I don't have to change the function constraint, do i? (the
> next thing will be letting a_max go from 20 to 80.

Constraint will work with any number of variables. To understand what
this function does, try this:

```
x=indgen(100)-50
P0=50.
dP=10.
plot,x,P0+2.*dP/!pi*atan(x),/ys
```

The parameter x is always projected between 40 and 60.

Thinking about it, you should probably start AMOEBA with P0=[0,0.]
R=AMOEBA(1.0e-5,SCALE=dP, P0=[0,0.], FUNCTION_VALUE=fval)

> If there is for a
> specific N, a_max and R_i a "NaN" it won't stop the approximation,
> will it?!(i hope you know what i mean))

The constraint function puts box-constraints around each parameter. If
you don't have a box (i.e. the boundaries depend on the value of other
parameters) you need a more complicated constraint function.

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Thu, 24 Sep 2009 07:56:44 GMT

On Wed, 23 Sep 2009 19:13:13 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

> Okay, I added the other variables now and it works... and also the 3D
> plot works...
> If I have 3 Variables now, what do i need to add to the ploting
> section? And is it possible to get the results for a second minimum as

> well (if there is another local minimum?)

I just included the surface plot to see whether the maximum found by
amoeba (within the box constraints) made any sense.

If you want to check this for more than 2 parameters, you can do
something like changing one of the parameters at a time while keeping
the others fixed at their optimized position (i.e. where the function
is maximal):

```
; Plot
n=200
b=P0-dP
inc=(2*dP)/n
y=fltarr(n)
for j=0,n_elements(P0)-1 do begin
 x=b[j]+inc[j]*indgen(n)

 P=xmax
 for i=0,n-1 do begin
  P[j]=x[i]
  y[i]=-func(P,/NOCONSTR)
 endfor

 window,j
 plot,x,y
 plots,xmax[[j,j]],[!y.crange[0],ymax],psym=-2
endfor
```

As for the second local minimum: I guess you need to play with your
box-constraints to get one or the other.

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Thu, 24 Sep 2009 08:13:48 GMT
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>> If there is for a
>> specific N, a_max and R_i a "NaN" it won't stop the approximation,
>> will it?!(i hope you know what i mean))
>
> Okay, I added the other variables now and it works... and also the 3D
> plot works...
> If I have 3 Variables now, what do i need to add to the ploting
> section? And is it possible to get the results for a second minimum as
> well (if there is another local minimum?)

I'm just wondering what you want to achieve here. Why do you want to use AMOEBA and not POWELL for example? Do you need to do this for 1 function only or are there more? Do you always know the box constraints and is it always a box?

Subject: Re: Optimization "AMOEBA"
Posted by Nicki on Thu, 24 Sep 2009 13:23:05 GMT
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On 24 Sep., 10:13, Wox <s...@nomail.com> wrote:
>>> If there is for a
>>> specific N, a_max and R_i a "NaN" it won't stop the approximation,
>>> will it?!(i hope you know what i mean))
>
>> Okay, I added the other variables now and it works... and also the 3D
>> plot works...
>> If I have 3 Variables now, what do i need to add to the ploting
>> section? And is it possible to get the results for a second minimum as
>> well (if there is another local minimum?)
>
> I'm just wondering what you want to achieve here. Why do you want to
> use AMOEBA and not POWELL for example? Do you need to do this for 1
> function only or are there more? Do you always know the box
> constraints and is it always a box?

I thought about trying powell as well...maybe i should do this...what
would be the advantages of powell?
 i actually have more equations, but kind of put them into each other,
eliminated a few parameters and got one superlong equation with five
variables...
i'm having box constraints for every parameter...

Subject: Re: Optimization "AMOEBA"
Posted by Wout De Nolf on Thu, 24 Sep 2009 14:13:54 GMT
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On Thu, 24 Sep 2009 06:23:05 -0700 (PDT), Nicki
<nickireiter87@yahoo.de> wrote:

> I thought about trying powell as well...maybe i should do this...what
> would be the advantages of powell?

Well, downhill simplex is not an efficient method, but if speed is not
an issue than you can use it just as well I suppose...

Alright, so far everything is working--thanks!

BUT another thing... what if I want one variable to vary and it needs
to be an integer, so let's say it should be either 3, 4 or 5 ? What do
i have to write for dP ?