Subject: MORPH_XYZ and values keyword Posted by btt on Tue, 24 Jun 2003 21:00:40 GMT

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Hello,

I completely mystified by the VALUES keyword to the MORPH_XYZ (like MORPH_TOPHAT) routines. I think I understand the meaning of VALUES for DILATE and ERODE-like routines - but I can't make sense of the MORPH XYZ routines.

Here's the description of the so-called structuring element that these rotuine accept...it gives the shape and 'on-off'-ness of each pixel.

A one-, two-, or three-dimensional array to be used as the structuring element. The elements are interpreted as binary values 121/2 either zero or nonzero. The structuring element must have the same number of dimensions as the Image argument.

Now here's the decription of the VALUES keyword...

An array of the same dimensions as the Structure argument providing the values of the structuring element. If the VALUES keyword is not present, all elements of the structuring element are 0.

What the heck does that mean?

I thought providing the VALUES was like providing a weighting to the structuring element.

Here's an example using the MORPH_TOPHAT routine... if here's a structure with a narrow brim - any peaks detected that fit within the 1s is a keeper.

0 0 0 0 0 0 0 1 1 1 1 1 0 0 1 1 1 1 1 1 1 0 1 1 1 1 1 0 0 0 0 1 0 0 0

Now if I am working with a grayscale image... I want to make sure the peak is tall (bright) enough so, I weight the structuring element with

some kind of a height - like I want the peak to be at least 5 whatevers above the brim values. So I set VALUES equal to...

I can't see any difference between the results when I do and do not provide the VALUES. Which, of course, means I don't understand it at all.

Stumped and grateful for any help,

Ben

Subject: Re: MORPH_XYZ and values keyword Posted by Karsten Rodenacker on Thu, 26 Jun 2003 06:24:13 GMT View Forum Message <> Reply to Message

Hi, I have slightly changed your Morphtest example into Morphtest1 with two parameters, extension and type. You should play around with extension and gen_sphere type. You will see, that the flat value structuring element (STE) does not show considerable differences to the simple STE. However the last example shows some influences of value STE.

Flat STE controls local extension, value STE controls value extension (and function shape).

To learn to understand morphological operations morph_tophat is IMHO not the best routine. Since it is simply the differenc between original and opened array, I have replaced it by open and close, the ingredients for bright and dark tophat.

Simply run Morphtest1 will open 4 windows with different parameters showing opening and closing.

Regards Karsten

Ben Tupper schrieb:

> Karsten Rodenacker wrote:

>

>> Hallo, maybe some information concerning VALUE keywords. Let ste the

```
>> structuring element and val the values array.
>> 1. Only val*(ste ne 0) is of importance!
>> 2. As far as I know are the val values subtracted or added from the
>> input data befor the max or min according erode or dilate is
>> performed. Hence, flat value arrays do not make sense.
>> 3. I attach two routines (for 1-d morphological filtering) for
>> illustration, gen_sphere to generate the value array and mm filter to
>> apply a sequence of increasing filter steps. Unluckily the routines
>> are not documented. Maybe they are comprehensible without further words.
>>
>
 Thanks Karsten,
>
>
  This helps very much. I'm still not clear on why a flat-topped VALUES
  do not make sense. Here's what I get from the online docs for ERODE
> and DILATE. They don't look symmetric to me - so it seems like a
> flat-topped kernal would have a meaningful effect. But, I'm new at this
> and feeling like I'm on pretty thin ice.
>
>
> Erode... result = min(Image) - VALUE
> "Each pixel of the result is the minimum of Image less the corresponding
  elements of VALUE."
>
> Dilate... result = max(Image + VALUE)
> "Each pixel of the result is the maximum of the sum of the corresponding
> elements of VALUE and the Image pixel value. "
>
  The Tophat filter is supposed to be...
    result = (Erosion followed by Dilation) - OriginalImage
>
> I have mocked up an 1-d example (below) using your gen_sphere routine.
  It looks to me like I might be better off *not* using the VALUES anyway.
>
> Just type morphtest from the command line. The top plot is the tophat
> without values specified. The second is with the fat-topped (the VALUES
> structure is shown hovering over the plot on the right.) And the last
  is using a non-flat-topped structure (also shown at hovering at right.)
>
> Thanks,
> Ben
>
  ******begin code
  function gen_sphere, rad, TYPE=typ
>
    if not keyword set(typ) then typ=0
```

```
case typ of
>
      1:v = \operatorname{sqrt}(\operatorname{rad}^2-(\operatorname{rad-findgen}(\operatorname{rad}^2+1))^2)
>
      2:v = rad^2-(rad-findgen(rad^2+1))^2
>
      3:v = 0.05/(1.+sqrt(rad^2-(rad-findgen(rad^2+1))^2))
>
      4:v = 0.05/(1.+rad^2-(rad-findgen(rad^2+1))^2)
>
      5:v = rad-sqrt(rad^2-(rad-findgen(rad^2+1))^2)
>
      6:v = rad^2-(rad-findgen(rad^2+1))^2
>
     -1:v = replicate(1.0, rad*2+1)
>
      else: v = rad-abs(-findgen(rad*2+1)+rad)
>
    ENDCASE
>
    mv = max(v)
>
    IF mv GT (rad+1) THEN v = v/mv*(rad+1)
>
    return, v
>
> end
>
>
>
>
> Pro MorphTest
>
> x = [19,19,21,23,24,23,22,21,20,19,20,20,19,17,15,$
> 13,11,11,12,14,17,21,24,25,24,23,21,21,23,26,29,30,27,$
> 22,17,12,10,10,12,14,16,19,20,21,20,17,12,8,$
> 4,3,3,6,10,14,19,23,26,27,28,29,29,29,29,27,$
> 23,19,16,14,14,16,18,19,19,18,15,13,11,7,$
> 4,1,0,0,3,6,10,12,12,11,8,5,2,1,1,4,7,11,14,17,20,23,27]
>
>
> n = 10
>
> old p = !P
> !P.CharSize = 2
> !P.Multi = [0,1,3]
> Dim = get_Screen_Size()
> Window, /Free, ys = dim[1]*0.9
> plot, x, title = 'orig with simple tophat'
> oplot, thick = 2, $
     morph_tophat(x, [0, replicate(1,n-1), 0])
>
>
> plot, x, title = 'orig with tophat values set with flat top'
> values = [0, replicate(9,n-1),0]
> oplot, thick = 2, $
     morph_tophat(x, [0, replicate(1, n-1), 0], values = values)
>
  oplot, Indgen(n+1) + 80, values + 10, thick = 2
>
> plot, x, title = 'orig with tophat values set with rounded top'
```

```
> values = gen sphere(n/2)
> oplot, thick =2, $
     morph_tophat(x, [0, replicate(1,n-1), 0], values = values)
> oplot, Indgen(n+1) + 80, values + 10, thick = 2
> !P = old_p
> End
  ******end code
Pro MorphTest1, n, t
x = [19,19,21,23,24,23,22,21,20,19,20,20,19,17,15,
13,11,11,12,14,17,21,24,25,24,23,21,21,23,26,29,30,27,$
22,17,12,10,10,12,14,16,19,20,21,20,17,12,8,$
4,3,3,6,10,14,19,23,26,27,28,29,29,29,29,27,$
23,19,16,14,14,16,18,19,19,18,15,13,11,7,$
4,1,0,0,3,6,10,12,12,11,8,5,2,1,1,4,7,11,14,17,20,23,27]
if n params() eq 0 then n = 10
if n params() le 1 then t = 1
old p = !P
!P.CharSize = 2
!P.Multi = [0,1,3]
Dim = get Screen Size()
Window, /Free, ys = dim[1]*0.9
plot, x, title = 'orig with simple open/close'
oplot, thick = 2, $
  morph_open(x, [0b,replicate(1b,n-1),0b],/gray)
oplot, thick = 1, linest=1, $
  morph_close(x, [0b,replicate(1b,n-1),0b],/gray)
plot, x, title = 'orig with open/close values set flat top'
values = [0b, replicate(byte(n-1),n-1),0b]
oplot, thick = 2, $
  morph_open(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, thick = 1,linest=1, $
  morph close(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, Indgen(n+1) + 80, values + 10, thick = 2
plot, x, title = 'orig with open/close values set with gen_sphere'
values = gen_sphere(n/2, typ=t)
oplot, thick =2, $
  morph open(x, [0b, replicate(1b,n-1), 0b], values = values)
```

```
oplot, thick =1, linest=1, $
    morph_close(x, [0b, replicate(1b,n-1), 0b],values =values)
oplot, Indgen(n+1) + 80, values + 10, thick = 2

!P = old_p
End
for i=6,12,2 do morphtest1,i,1
end

File Attachments
1) MorphTest1.pro, downloaded 68 times
```

Subject: Re: MORPH_XYZ and values keyword Posted by btt on Thu, 26 Jun 2003 17:13:05 GMT

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In article <3EFA918D.2010108@gsf.de>,
Karsten Rodenacker <Karsten.Rodenacker@gsf.de> wrote:

- > Hi, I have slightly changed your Morphtest example into Morphtest1 with
- > two parameters, extension and type. You should play around with
- > extension and gen sphere type. You will see, that the flat value
- > structuring element (STE) does not show considerable differences to the
- > simple STE. However the last example shows some influences of value STE.
- > Flat STE controls local extension, value STE controls value extension
- > (and function shape).
- > To learn to understand morphological operations morph_tophat is IMHO not
- > the best routine. Since it is simply the differenc between original and
- > opened array, I have replaced it by open and close, the ingredients for
- > bright and dark tophat.
- > Simply run Morphtest1 will open 4 windows with different parameters
- > showing opening and closing.

Hi,

>

>

I posted a message earlier today - but the pesky server is having a bad hair day. Thanks so much - the fog is a bit less dense now. The lower level routines do give a heck of a lot more control, as you show it.

I modified the code, yet again, to show how the various TOPHAT filter work. On each plot is shown the data (thin line), the opening (thick

line) and the tophat (dashed.) On each plot, RSI's MORPH_TOPHAT is shown in the top plot, in the subsequent ones show

tophatResult = original - openedOriginal

using the various VALUES provided by your GEN_SPHERE routine.

Thanks again, Ben

*****begin code
Pro MorphTest, n, t

x = [19,19,21,23,24,23,22,21,20,19,20,20,19,17,15,\$

13,11,11,12,14,17,21,24,25,24,23,21,21,23,26,29,30,27,\$

22,17,12,10,10,12,14,16,19,20,21,20,17,12,8,\$

4,3,3,6,10,14,19,23,26,27,28,29,29,29,29,27,\$

23,19,16,14,14,16,18,19,19,18,15,13,11,7,\$

4,1,0,0,3,6,10,12,12,11,8,5,2,1,1,4,7,11,14,17,20,23,27]

if $n_params()$ eq 0 then n = 10

if n_params() le 1 then t = 1

 $old_p = !P$

!P.CharSize = 2

!P.Multi = [0,1,3]

Dim = get_Screen_Size()

Window, /Free, ys = dim[1]*0.9

```
plot, x, title = "orig with simple open/close"
oplot, thick = 2, $
  morph_open(x, [0b,replicate(1b,n-1),0b],/gray)
; oplot, thick = 1, linest=1, \$
   morph_close(x, [0b,replicate(1b,n-1),0b],/gray)
oplot, thick = 2, linest = 2, $
  morph_Tophat(x,[0b,replicate(1b,n-1),0b])
plot, x, title = 'orig with open/close values set flat top'
values = [0b, replicate(byte(n-1),n-1),0b]
op = morph_open(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, thick = 2, op
;oplot, thick = 1,linest=1, $
   morph_close(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, thick = 2, linestyle = 2, x-op
oplot, Indgen(n+1) + 80, values + 10, thick = 2
plot, x, title = 'orig with open/close values set with gen_sphere'
```

```
values = gen_sphere(n/2, typ=t)
op = morph_open(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, thick =2, $
  morph_open(x, [0b, replicate(1b,n-1), 0b], values = values)
;oplot, thick =1, linest=1, $
   morph_close(x, [0b, replicate(1b,n-1), 0b], values = values)
oplot, thick = 2, linestyle = 2, x-op
oplot, Indgen(n+1) + 80, values + 10, thick = 2
!P = old_p
End
PRO morphtest1
for i=6,12,2 do morphtest,i,1
end
*****end code
Ben Tupper
Bigelow Laboratory for Ocean Sciences
btupper@bigelow.org
```