Everything You Need to Know to Run The Most Recent Program

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Contents

Introduction

If you read this document, you will understand what the commands/outputs are for the most recent sun centering program. That's it.

1 Main Program

The main program is called `alpha.pro` and spits out images in X11 windows and center positions in the terminal window.

Content of `alpha.pro` with coded in comments defined by lines starting with ';' and my comments within the LaTeX document starting with '**':

```
; docformat = 'rst'
PRO alpha
;+
;    :Description:
;       Finds the center of N whole suns and M partial suns using limb-fitting for the whole suns and simple centroiding for the
      partial suns
;
;    :Params:
;
;    :TODO:
;        NONE, BRAH
;
; idldoc,root='../suncentering', output='rbdoc',format_style='rst',/user,/quiet,markup_style='rst'
;-
**
** The command above produces html documentation on all the .pro files starting from the main directory and branching into all
     sub-directories with the IDLdoc program. The document markup syntax is reStructuredText, otherwise known as rst.
**

COMPILE_OPT idl2

; Our list of images to take centers of
wholeimage = MRDFITS('../fits_files/dottedimage.fits',/sil)
w1_w2_p3 = MRDFITS('../fits_files/partial3rd.fits',/sil)
w1_p2_p3 = MRDFITS('../fits_files/2partials.fits',/sil)
reg12 = MRDFITS('../fits_files/1_2.fits',/sil)
reg13 = MRDFITS('../fits_files/1_3.fits',/sil)
reg23 = MRDFITS('../fits_files/2_3.fits',/sil)
w2_p3 = MRDFITS('../fits_files/w2_p3.fits',/sil)
p1_w2_w3 = MRDFITS('../fits_files/p1_w2_w3.fits',/sil)
p1_w2_p3 = MRDFITS('../fits_files/p1_w2_p3.fits',/sil)
p1_p2_w3 = MRDFITS('../fits_files/p1_p2_w3.fits',/sil)
w1_p2_w3 = MRDFITS('../fits_files/w1_p2_w3.fits',/sil)
p1_w3 = MRDFITS('../fits_files/p1_w3.fits',/sil)
p1_w2 = MRDFITS('../fits_files/p1_w2.fits',/sil)
w1_p3 = MRDFITS('../fits_files/w1_p3.fits',/sil)
brightsun = MRDFITS('../fits_files/albsun.fits',/sil)
corner = MRDFITS('../fits_files/corner.fits',/sil)
corner2 = MRDFITS('../fits_files/corner2.fits',/sil)
corner3 = MRDFITS('../fits_files/corner3.fits',/sil)
dimsun = MRDFITS('../fits_files/sun2.fits',/sil)
tritest = MRDFITS('../fits_files/tritest.fits',/sil)

**
** Each of these fits files is a byte image of a sun or multiple suns
**

; Toggling which image is going to be analyzed

startimage=wholeimage
; startimage=w1_w2_p3
; startimage=w1_p2_p3
; startimage=reg12
; startimage=reg23
; startimage=reg13
; startimage=w2_p3
; startimage=p1_w2_w3
```

```
; startimage=p1_w2_p3
; startimage=p1_p2_w3
; startimage=w1_p2_w3
; startimage=p1_w3
; startimage=p1_w2
; startimage=w1_p3
; startimage=brightsun    ;no param list for this one
startimage = dimsun
startimage = tritest

;  profiler
;  profiler ,/system
**
** We only used this when we were benchmarking the program for speed. As it is now, it should be fast enough.
**
; takes ~.07 s to run albert's triple sun image


tic
defparams, 'pblock_albtritest.txt'
; defparams, 'pblock_albdimsun.txt'
; defparams, 'pblock_orig_small.txt'
** Here we load the parameter *.txt file and store all the variables into a global variable, !param **
toc
; .0005 to here
defsysvarthresh, startimage
**
** With the variables just defined, we load the starting image, sort the 2D image into a 1D arary, chop off the top .1% pixels, then take the 2nd derivative and calculate thresholds. defsysvarthresh calls idsuns and setbetterpeak
**
toc
; .03 to here
grannysmith = everysun(startimage)
**
** With the thresholds defined from defsysvarthresh, we centroid whatever suns are in the image, regardless if they are in a bad position in the image.
**
toc
; .065 to here
fuji = picksun_rot(startimage, grannysmith)
**
** Now we look at each solar center and make sure it's not too close to the edge of the image or the bottom corners.
**
toc
; .065 to here
limbfittedcentroids =centroidwholesuns(fuji,startimage)
**
** With a list of ''good'' suns, we crop a box around the centers, making sure not to cut off any part of the sun. Then, we take 5 slices in each direction centered around the solar center. The locations of these chords that cross the limbs of the sun are fitted with a polynomial. Then, we take the midpoint of each chord bounded by where the polynomail crosses the threshold. We average the midpoints and get a limb-fitted center position.
**
toc
; .068 to here
bbb = para_fid(startimage, limbfittedcentroids)
**
** Now, with the limb-fitted center, we look analyze the sun for fiducials.
**
; .07 to here
toc
tmpimage = startimage

if N_ELEMENTS(limbfittedcentroids) gt 1 then begin
    for i =0,N_ELEMENTS(limbfittedcentroids)-1 do begin
        tmpimage[limbfittedcentroids[i].limbxpos-1:limbfittedcentroids[i].limbxpos+1,*] = 255
        tmpimage[*,limbfittedcentroids[i].limbypos-1:limbfittedcentroids[i].limbypos+1] = 255
    endfor
endif else begin
    tmpimage[limbfittedcentroids[0].limbxpos-1:limbfittedcentroids[0].limbxpos+1,*] = 255
    tmpimage[*,limbfittedcentroids[0].limbypos-1:limbfittedcentroids[0].limbypos+1] = 255
endelse
```

```
122
123 **
124 ** Here, we draw lines in the starting image corresponding to the X and Y positions of each sun.
125 **
126
127 ; so the rough center is a bit off. Gasp! Why though?
128
129 ;  profiler,/report,data=data
130 ;  profiler,/reset,/clear
131 ; print,data[sort(-data.time)],format='(A-20, I7, F12.5, F10.5, I9)'
132
133 **
134 ** The format above is just so that we can see which use/IDL functions are taking up the most time so we can optimize our code
135 **
136
137 atmp = startimage
138
139 ; So I have to highlight fiducials
140
141 for i = 0,N_ELEMENTS(bbb)-1 do begin
142     for j = 0,N_ELEMENTS((*(bbb[i])).fidarr)-1 do begin
143
144         if ((*(bbb[i])).fidarr)[j].subx ne 0 or ((*(bbb[i])).fidarr)[j].suby ne 0 then begin
145         atmp[((*(bbb[i])).fidarr)[j].subx + limbfittedcentroids[i].limbxpos - !param.crop_box -1:((*(bbb[i])).fidarr)[j].subx +
                limbfittedcentroids[i].limbxpos - !param.crop_box+1,((*(bbb[i])).fidarr)[j].suby + limbfittedcentroids[i].limbypos -
               !param.crop_box-1:((*(bbb[i])).fidarr)[j].suby + limbfittedcentroids[i].limbypos - !param.crop_box+1]=255
146         endif
147     endfor
148 endfor
149
150 **
151 ** This for loop goes through each fiducial position and marks them white on the starting image
152 **
153
154 ; print,'Main sun x pos:', limbfittedcentroids[0].limbxpos
155 ; print,'Main sun y pos:', limbfittedcentroids[0].limbypos
156 ; print,'50% sun x pos: ', limbfittedcentroids[1].limbxpos
157 ; print,'50% sun y pos: ', limbfittedcentroids[1].limbypos
158 ; print,'25% sun x pos: ', limbfittedcentroids[2].limbxpos
159 ; print,'25% sun y pos: ', limbfittedcentroids[2].limbypos
160
161 window,0
162 cgimage,tmpimage,/k
163 window,1
164 cgimage,atmp,/k
165
166 ztmp = startimage
167 tic
168 best4 = best4( limbfittedcentroids,bbb)
169 **
170 ** With the fiducial positions we calculated, we only care about the 4 closest to the solar center.
171 **
172 toc
173
174 for i = 0,n_elements(best4)-1 do begin
175     for j = 0,n_elements(best4[i].fidarr)-1 do begin
176         ztmp[best4[i].fidarr[j].subx + limbfittedcentroids[i].limbxpos - !param.crop_box -1:best4[i].fidarr[j].subx +
                limbfittedcentroids[i].limbxpos - !param.crop_box+1,$
177             best4[i].fidarr[j].suby + limbfittedcentroids[i].limbypos - !param.crop_box-1:$
178             best4[i].fidarr[j].suby + limbfittedcentroids[i].limbypos - !param.crop_box+1]=255
179     endfor
180 endfor
181
182 **
183 ** Now, we highlight the best 4 fiducials for each sun
184 **
185 window,2
186 cgimage,ztmp,/k
187
188
189 print,'Brightest sun center position: ', limbfittedcentroids[0].limbxpos, limbfittedcentroids[0].limbypos
```

```
print,'50% sun center position: ', limbfittedcentroids [1].limbxpos, limbfittedcentroids [1].limbypos
print,'25% sun center position: ', limbfittedcentroids [2].limbxpos, limbfittedcentroids [2].limbypos


stop
idedfids = idfids(best4)



; What's going on here?

; cgimage,startimage[ limbfittedcentroids [0].limbxpos- !param.crop_box:limbfittedcentroids [0].limbxpos+
    !param.crop_box,limbfittedcentroids [0].limbypos- !param.crop_box:limbfittedcentroids [0].limbypos+
    !param.crop_box],output='tritest_reg1.eps',/k,/display
; cgimage,startimage[ limbfittedcentroids [1].limbxpos- !param.crop_box:limbfittedcentroids [1].limbxpos+
    !param.crop_box,limbfittedcentroids [1].limbypos- !param.crop_box:limbfittedcentroids [1].limbypos+
    !param.crop_box],output='tritest_reg2.eps',/k,/display
; cgimage,startimage[ limbfittedcentroids [2].limbxpos- !param.crop_box:limbfittedcentroids [2].limbxpos+
    !param.crop_box,limbfittedcentroids [2].limbypos- !param.crop_box:limbfittedcentroids [2].limbypos+
    !param.crop_box],output='tritest_reg3.eps',/k,/display

; aa = startimage

; aa[*, limbfittedcentroids [0].limbypos -20]=255
; aa[*, limbfittedcentroids [0].limbypos -10]=255
; aa[*, limbfittedcentroids [0].limbypos]=255
; aa[*, limbfittedcentroids [0].limbypos +10]=255
; aa[*, limbfittedcentroids [0].limbypos +20]=255

; aa = aa[ limbfittedcentroids [0].limbxpos- !param.crop_box:limbfittedcentroids [0].limbxpos+
    !param.crop_box,limbfittedcentroids [0].limbypos- !param.crop_box:limbfittedcentroids [0].limbypos+ !param.crop_box]
; cgimage,aa,/k,/display ,output='5chords.eps'

stop

end
```

2 Output Images

After running `alpha.pro`, 3 images should be outputted:

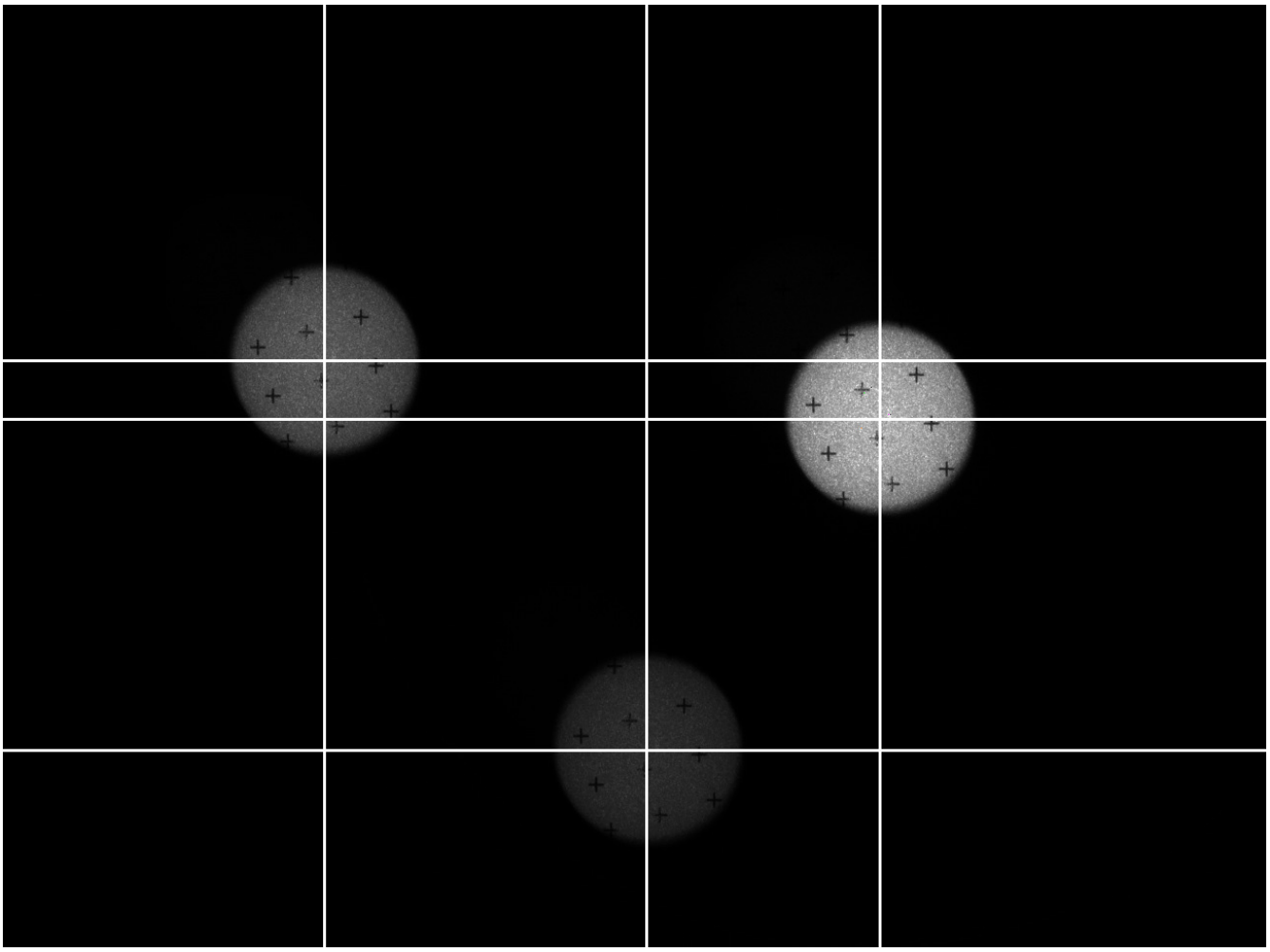
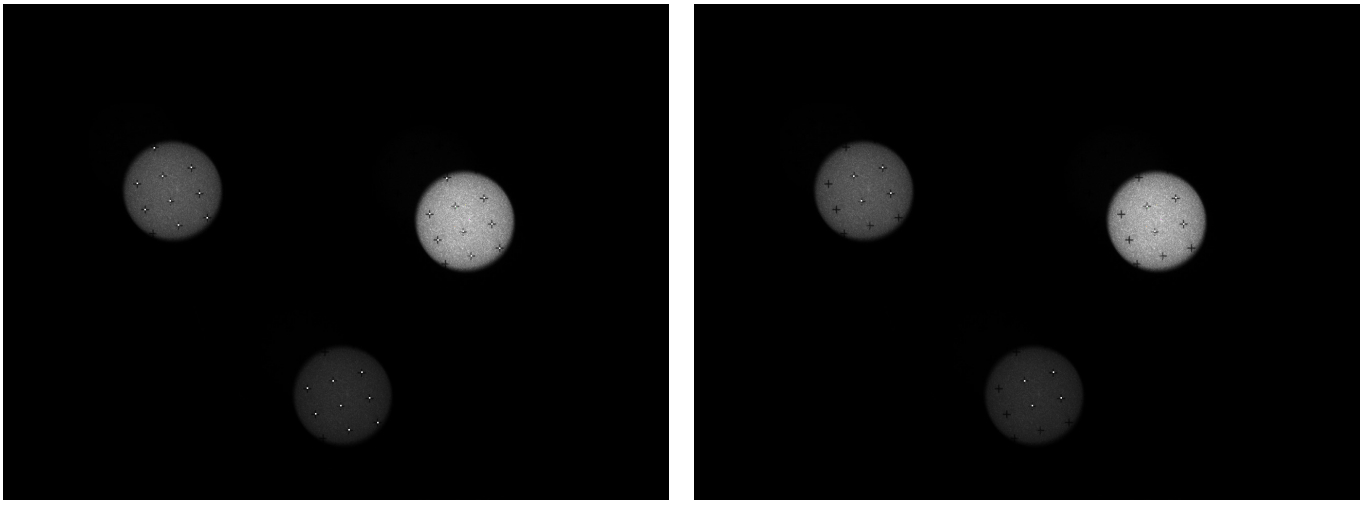


Figure 1: Starting image with center positions marked as white lines



(a) All good fiducials are marked in white

(b) Only the best 4 fiducials per sun have been marked

Figure 2