
Subject: Re: Radon Transform

Posted by [R.G. Stockwell](#) on Thu, 02 Mar 2000 08:00:00 GMT

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re: radon

I wrote my own radon transform, can't remember why I didn't use Reimann.

Radon.pro is below

The function is followed by a mainlevel example of the function,
so you can compile and run radon.pro to see how it works.
(the example calls wheremax() also included:

Cheers,
bob

--

R.G. Stockwell
Colorado Research Associates
3380 Mitchell Lane
Boulder, CO

```
; radon transform
;
;
; Copyright (c) 1999-5000, R.G. Stockwell
;   Unauthorized modification prohibited.
;
;
; DISCLAIMER: this is from RGS's collection of hackware. It
;   is not documented or optimized for speed. Use at your own risk.
;
;
;
; NAME:
;   RADON
;
; PURPOSE:
;   this incorporates the linear interpolation scheme
;   takes an image h(x,y) and returns the radon transform
;   r(p, tau), where p is the slope from -1 to 1
;   and tau is the y offset along a y axis at x= slength/2
;   ie that is halfway horizontally across the image.
;   if you want to find slopes > 1 or < -1 then rotate the
;   image 90 degrees.
;
;
; CATEGORY:
```

```

; image pro.
;
; CALLING SEQUENCE:
;   g_radon = radon(image,p,tau,all_rays=all_rays,raylen=raylen)
;
; INPUTS:
;   image:   An 2D image
;
; OUTPUTS:
;   p:      1 D vector of the sampled slopes
;   tau:    1 D vector of the sampled y offsets
;
; KEYWORD PARAMETERS:
;   RETURNS EXTENDED INFORMATION, does not affect program execution.
;   all_rays: a 3 dimensional array (p,tau,ray) holding the ray for
each slope and y offset
;   raylen:  the length of the ray for each ray in the above 3D
array.
;   NOTE these parameters are not needed in normal use of the radon
transform.
;   They return the individual rays used in
the radon calculation in
;   you (or I) want to perform a different
operation than averaging.
;
; EXAMPLE: follows the function
;
; REFERENCE:
;   The Analysis of Time Series (Fourth Edition)
;   C. Chatfield
;   ISBN 0-412-31820-2
;
; MODIFICATION HISTORY:
;   Written by: R.G. Stockwell
;   Research Scientist
;   Colorado Research Associates
;   3380 Mitchell Lane
;   Boulder, Colorado, 80301
;   stockwell@co-ra.com
;   early 1999
;-

```

```
function radon,image,p,tau,all_rays=all_rays,raylen = raylen
```

```
if n_params() lt 1 then return,-1
```

```

sz = size(image)
if sz(0) ne 2 then return,-1
xl = sz(1)
yl = sz(2)
x = findgen(xl)-xl/2
y = findgen(yl)
; max size of inray is max of indexes

```

```

kl=xl
hl=yl
ml=xl
nl=yl
delta_x =(delta_y=1)
p = (findgen(kl)/(kl-1)*kl-(kl)/2)*delta_y/max(abs(x))
tau = findgen(hl)*delta_y
x_min = min(x)
y_min = min(y)
alpha = p * delta_x/delta_y

```

```

g_radon = fltarr(kl,hl)
raylen = fltarr(kl,hl)
all_rays = fltarr(kl,hl,xl > yl)

```

```

for k = 0,kl-1 do begin
  for h = 0,hl-1 do begin
    beta = (p(k)*x_min+tau(h) - y_min)/delta_y
    if alpha(k) gt 0 then begin
      m_min = 0 > ceil((-beta)/alpha(k))
      m_max = ml - 1 <
floor((nl-1-beta)/alpha(k))
    endif else begin
      m_min = 0 > ceil((nl-1-beta)/alpha(k))
      m_max = ml - 1 < floor((-beta)/alpha(k))
    endelse
    sum=0
    mv = findgen(m_max-m_min+1)+m_min
    nfloatv = (alpha(k)*mv+beta)
    wneg = where(nfloatv lt 0.0,wnegcount)
    wre = where(abs(nfloatv) lt 0.01,wrecount)
    if wrecount gt 0 then nfloatv(wre) = 0
    nv = floor(nfloatv)
    wv = nfloatv-nv
    sum = 0
    if max(nfloatv) gt nl-1 then stop ;this is an error in
indexing
    wno = where(wv eq 0,wnocount)

```

```

inray = fltarr(n_elements(mv))
if wnocount gt 0 then begin
  inray(wno) = image(mv(wno),nv(wno))
  wint = where(wv ne 0,wintcount)
  if wintcount gt 0 then begin

inray(wint)=image(mv(wint),nv(wint))*(1-wv)+image(mv(wint),n v(wint)+1)*w
v
    endif
  endif else inray = image(mv,nv)*(1-wv)+image(mv,nv)*wv
  g_radon(k,h) = delta_x*(mean(inray))
  raylen(k,h) =n_elements(inray)
  all_rays(k,h,0:raylen(k,h)-1) = inray
endfor
endfor

return,g_radon

end

;
;_____
;
;_____
; test code here

xl=(yl=100)
image = fltarr(xl,yl)

;slope=-0.8
;offset = 0
slope= (randomu(seed,1))(0)*2-1
offset = (randomu(seed,1))(0)*xl

line = 10
for i = 0,yl-1 do begin
  yind = slope*(i-xl/2)+offset
  if yind ge 0 and yind lt yl then $
    image(i,yind) = image(i,yind) + line
endfor

image=smooth(image,5)
image = image+randomn(seed,xl,yl)

g_radon = radon(image,p,tau,all_rays=all_rays,raylen=raylen)

wm = wheremax(g_radon)
print

```

```

print,'Actual Values for slope and y offset:..... P=',slope,
'   Tau = : ',offset
print,'Measured slope and offset from radon transform: P=',p(wm(0)),
Tau = : ',tau(wm(1))
print,'value at peak of radon transform= ',g_radon(wm(0),wm(1))

```

```

!P.multi=[0,1,2]
!P.charsize=2
fill=1
contour,image,fill=fill,tit='Image (line + noise)',xtit='X',ytit='Y'
axis,xl/2,/data,yaxis=1
contour,g_radon,p,tau,tit='Radon
Transform',fill=fill,nlevels=21,xtit='Slope',ytit='Y Offset'

end

```

```

;;;;;;;;;;;;; wheremax.pro below, place in file called wheremax
;;;;;;;;;;;;; this is kinda sloppy

```

```

function wheremax, array

```

```

; finds the position of the maximum in an array
s = size(array)

```

```

w = where(array eq max(array),count)
if count < 0 then begin
  message,'No maximum found!'
  return,-1
endif
if n_elements(w) gt 1 then begin
  ;print,'WARNING! Maximum not unique in wheremax().'
  ;return,w
  w = round(w(0))
endif
if s(0) eq 0 then return,w ; scalar, return w=0
if s(0) eq 1 then return,w ; vector

```

```

pos = fltarr(s(0))
if s(0) eq 2 then begin

```

```

    pos(1) = round(w/s(1)) ; the y position, ie what row it is in
    pos(0) = round((float(w)/s(1)-(w)/s(1) )*s(1))

```

```
return,pos  
endif
```

```
return,-1 ; if higher than 2, ill worry about this later
```

```
end
```

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