

INF 3300, INF4300

Week 40 exercise solution

The Hough transform

Lars Aurdal,
Norsk Regnesentral,
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The randomized Hough transform

1. Simple idea (line case): From the edge image, pick two points.
2. Find the ρ and θ corresponding to this set of points.
3. Increment the indicated (ρ, θ) cell.
4. Once a cell reaches a certain (low) count, assume that an edge is present in the image.
5. Verify this.
6. If truly present, erase this line from the image
7. Continue until no more points or until the number of iterations between two detections is too high.
8. Orders of magnitude faster than the ordinary transform

The randomized Hough transform

1. Simple idea (circle case): From the edge image, pick **three** points.
2. Find x_0 , y_0 and R corresponding to this set of three points.
3. Increment the indicated (x_0, y_0, R) cell.
4. We assume that we are looking for disks of roughly equal radius, thus the dimensionality of the accumulator matrix remains reasonable.
5. Once a cell reaches a certain (low) count, assume that a circle is present in the image.
6. Verify this (not implemented in the following code).
7. If truly present, erase this circle from the image (not implemented).
8. Continue until no more points or until the number of iterations between two detections is too high.
9. Orders of magnitude faster than the ordinary transform

Randomized Hough transform, Matlab implementation

```
% Clear everything
clear all
close all
% Get image and display
i=imread('coins2.jpg');
ig=double(rgb2gray(i));
figure
imshow(ig,[min(min(ig)) max(max(ig))])
% Make gradient image and display
h1=fspecial('sobel');
h2=h1';
igh=imfilter(ig,h1);
igv=imfilter(ig,h2);
igs=abs(igh)+abs(igv);
figure
imshow(igs,[min(min(igs)) max(max(igs))])
igsT=igs>170;
figure
imshow(igsT)
% Initialise the accumulator matrix
acc=zeros([size(ig) 21]);
% Get all indexes of points on contours
[r,c]=find(igsT);
```

```
% Iterate
iter=0;
while(iter<200000)
    iter=iter+1; % Count number of iterations
    N=length(r);
    ind=floor(N*rand(1,3))+1;
    while(length(unique(ind))<3)
        ind=floor(N*rand(1,3))+1;
    end
    [x0,y0,R]=threepoint([r(ind(1)) c(ind(1))],[r(ind(2))
c(ind(2))],[r(ind(3)) c(ind(3))]);
    x0=ceil(x0);
    y0=ceil(y0);
    R=ceil(R);
    if(isin(x0,[1 size(ig,1)])) % Test if values are in correct range
        if(isin(y0,[1 size(ig,2)]))
            if(isin(R,[15 25]))
                acc(x0,y0,R-14)=acc(x0,y0,R-14)+1; % Accumulate
                if(acc(x0,y0,R-14)>4) % If we have a sufficient
number of hits
                    s=sprintf('Found circle with [x0,y0,R]=[%d %d
%d], press any key to continue\n',x0,y0,R);
                    disp(s)
                    hold on
                    cc=circle([y0 x0],R,20,'-');
                    pause
                end
            end
        end
    end
end
end
end
```

Randomized Hough transform, original image and thresholded edges

