Mathematical Morphology - Hit or Miss transforms

Assignment 4 - Part 2

```
Nom :
Prnom :
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Application 1

```
clear all;
close all;

I=imread('elipses.bmp');
figure(1);imshow(I)


sk=bwmorph(I,'skel',Inf);
figure(2), imshow(sk), title('Skeleton');

% pruning
skpr=bwmorph(sk,'spur',15);
figure(3), imshow(skpr), title('pruned Skeleton');
```

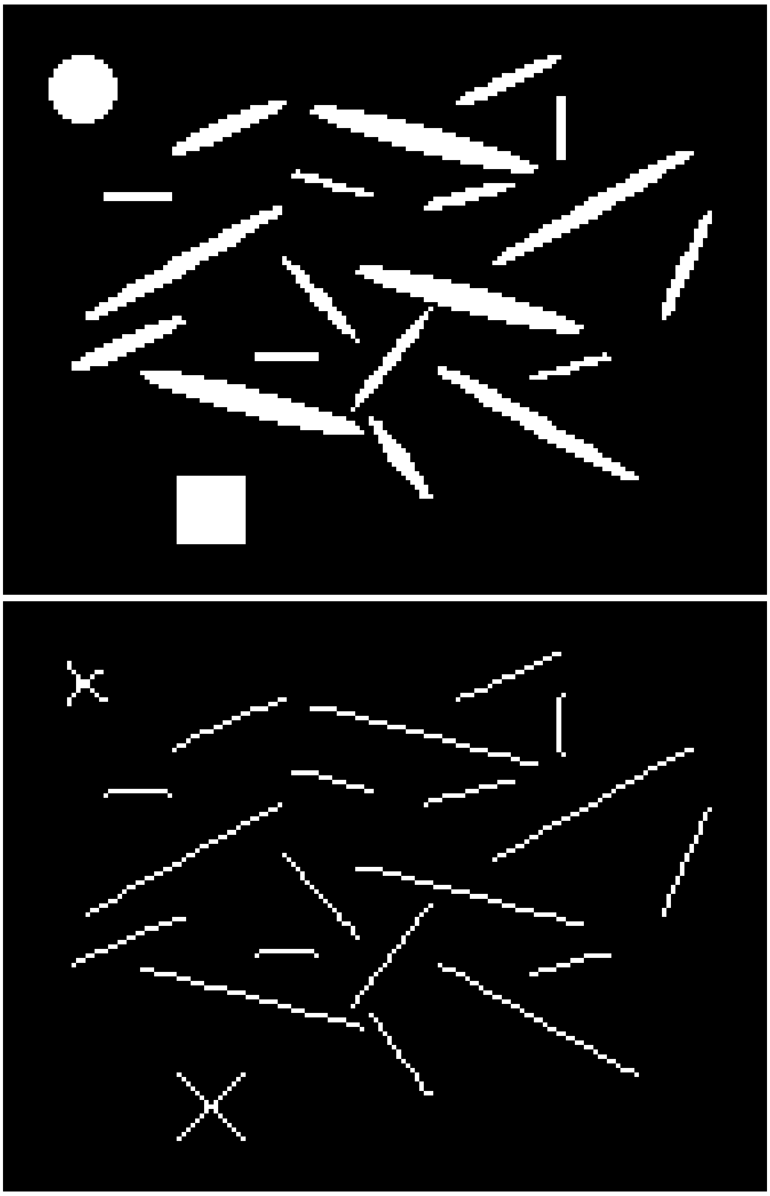
The operator will cut each object by their ending points the necessary to clear only the small ones. The parameter N is set accordingly to the length of the small objects. filtering of small isolated objects

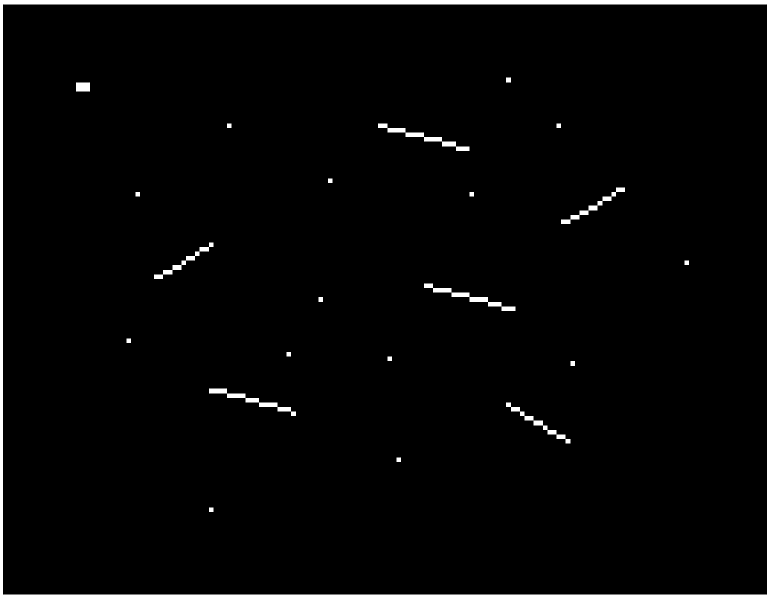
```
skprao=bwareaopen(skpr,10);
figure(4), imshow(skprao), title('pruned skeleton after filtering of small objects');

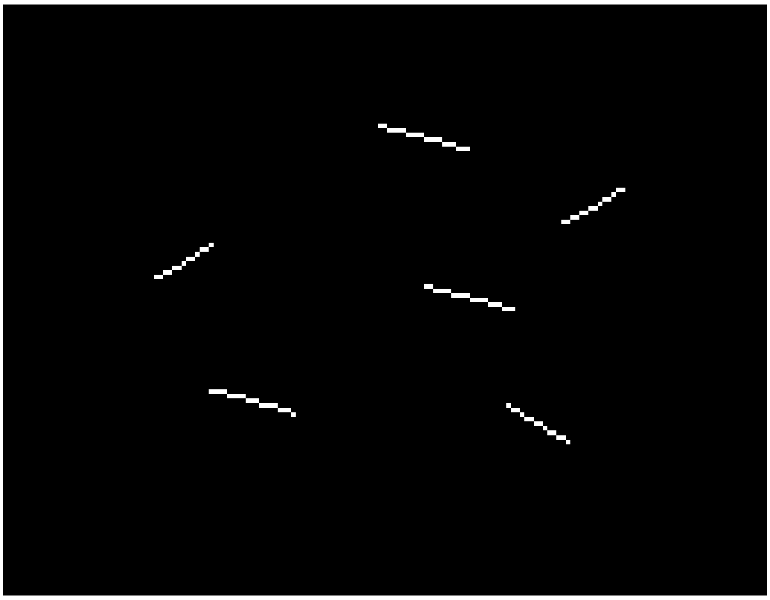
% reconstruction
res=imreconstruct(skprao,I);
figure(5), imshow(res), title('Elipse reconstruction');
```

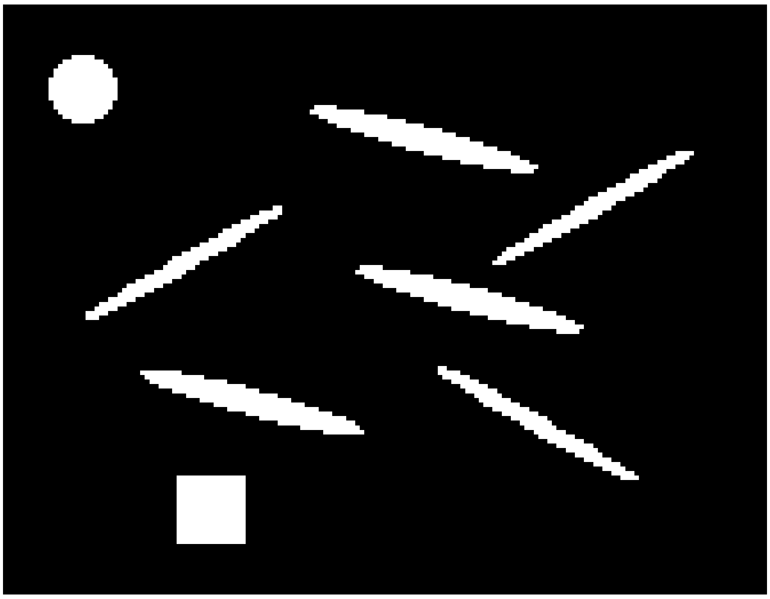
Remarque : les objets disque et carr ont t ajouts pour que l'opration filtrage par aire ne fonctionne pas directement sur les objets

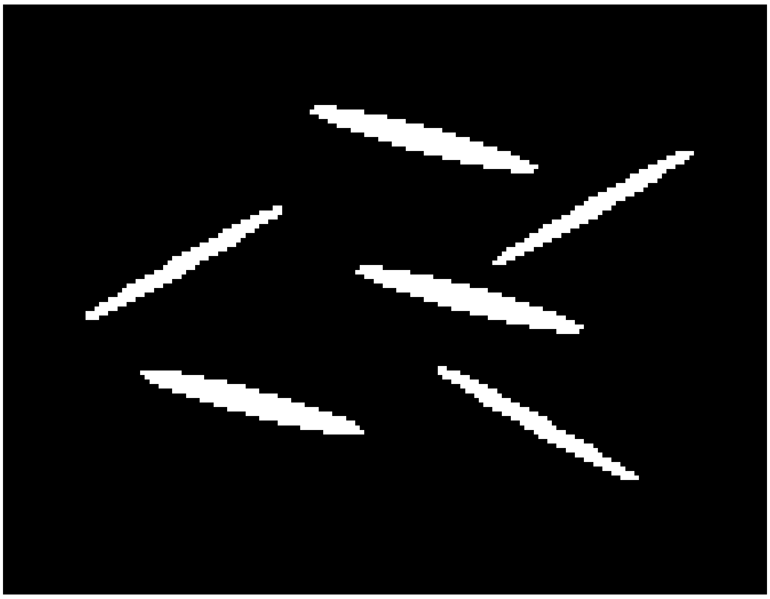
```
skprao2=bwareaopen(I,150);
figure(6), imshow(skprao2), title('Area openning on the original image');
```





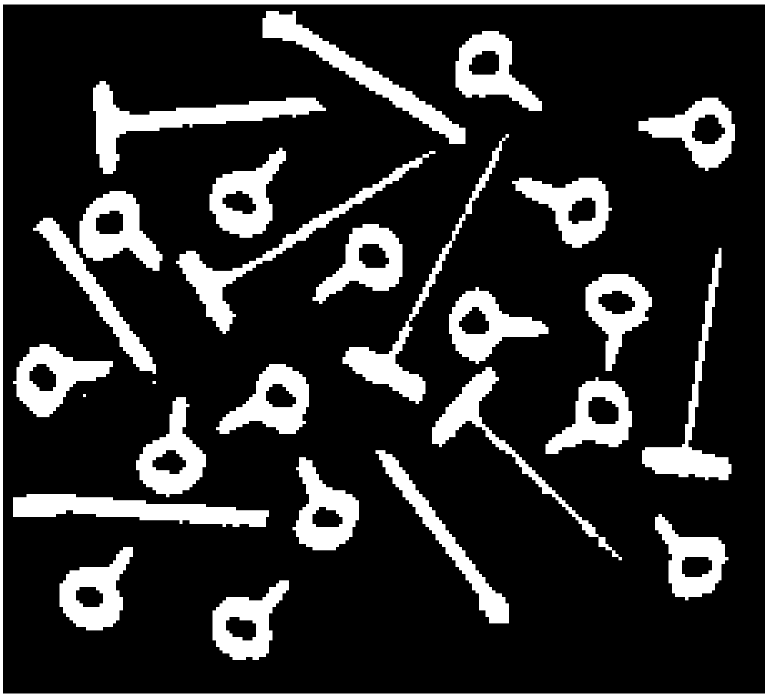






Application 2

```
clear all;close all;
I=imread('pieces.bmp');
figure(1);imshow(I)
```



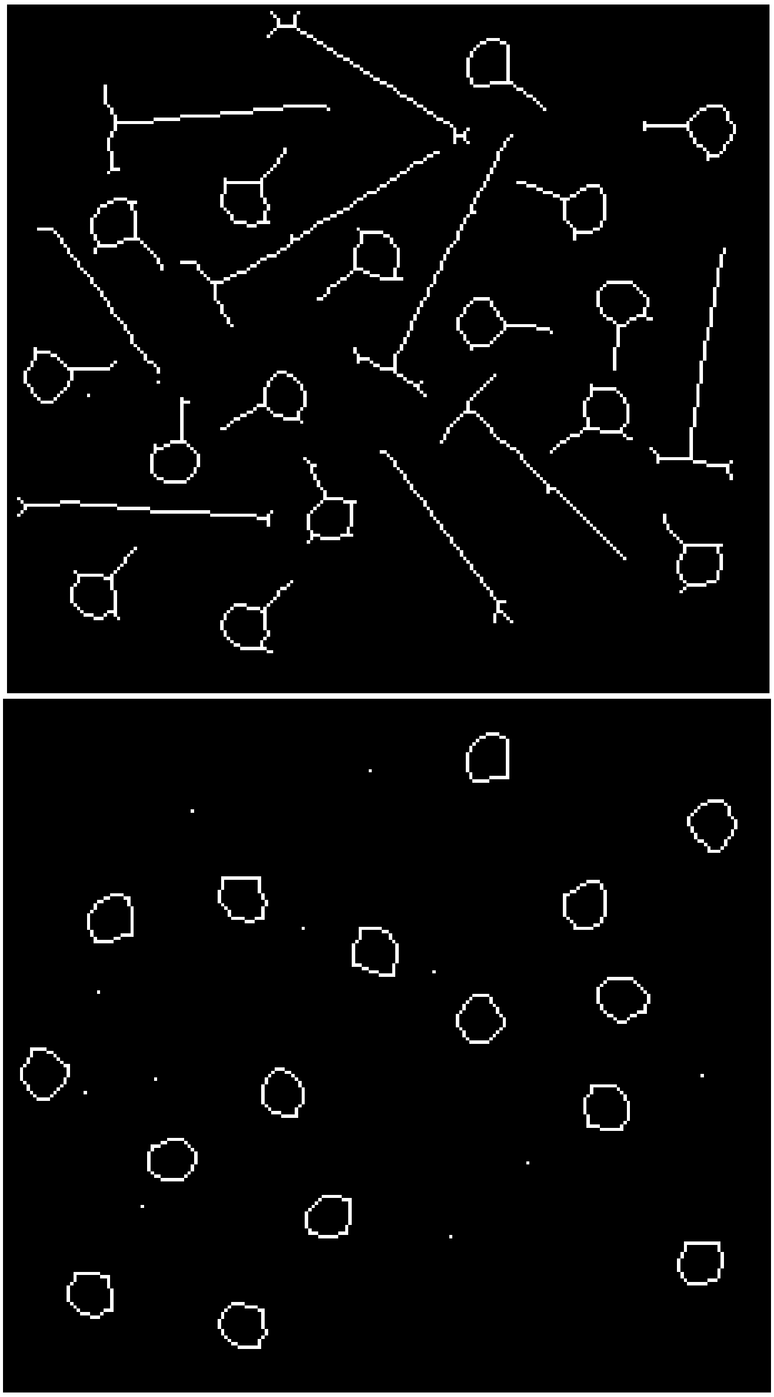
Ring pieces

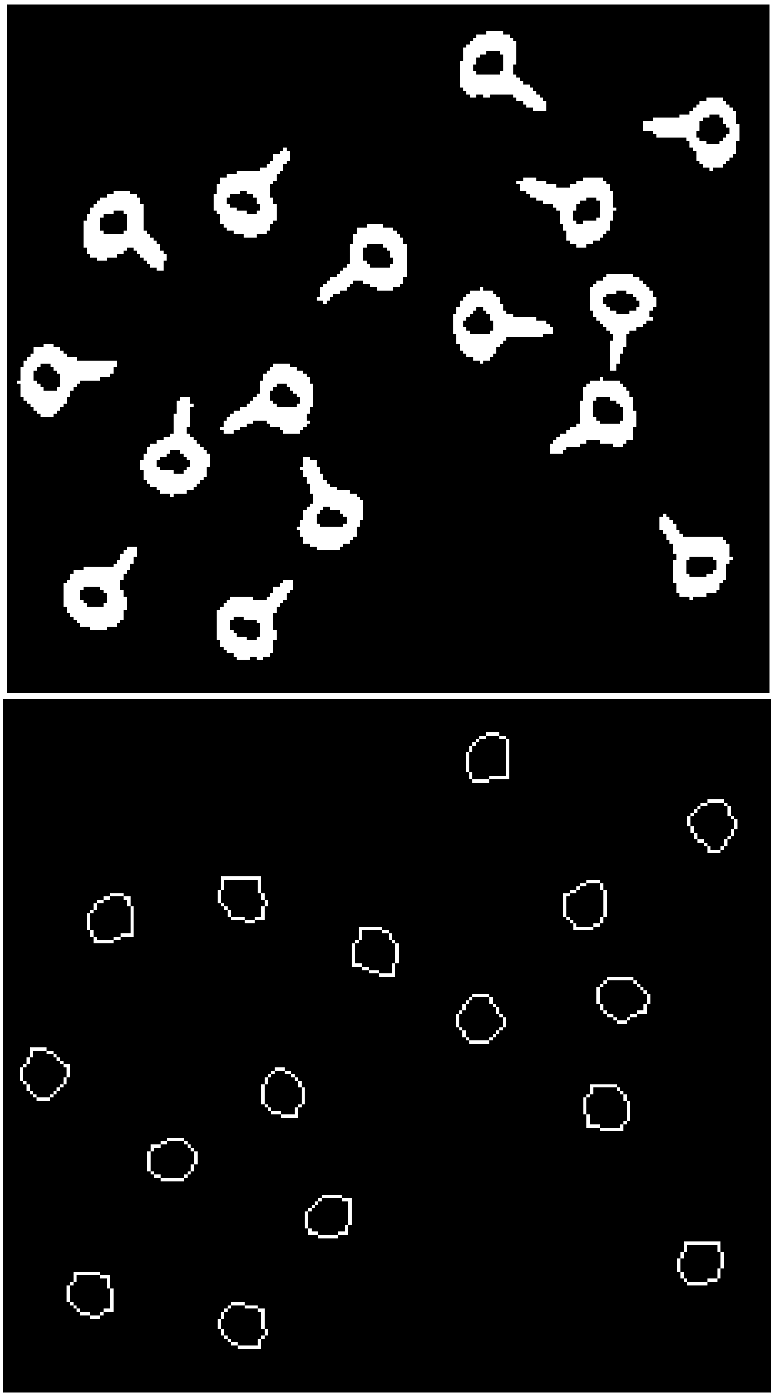
```
sk=bwmorph(I,'skel',Inf);
figure(2), imshow(sk), title('Skeleton');

% pruning
skpr=bwmorph(sk,'spur',Inf);
figure(3), imshow(skpr), title('pruned Skeleton');

% filtering of small isolated objects
skprao=bwareaopen(skpr,5);
figure(4), imshow(skprao), title('pruned skeleton after filtering of small objects');

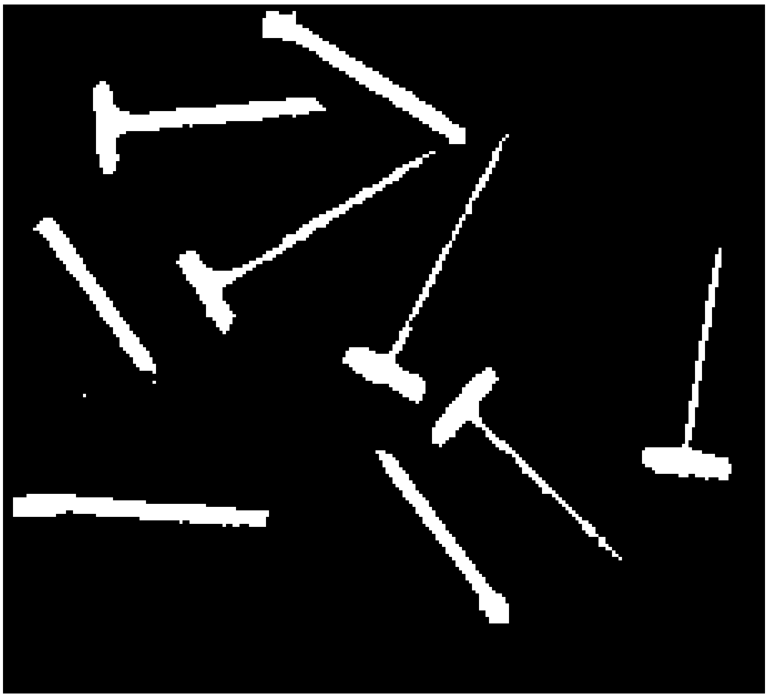
% reconstruction
res=imreconstruct(skprao,I);
figure(5), imshow(res), title('Rings reconstruction');
```

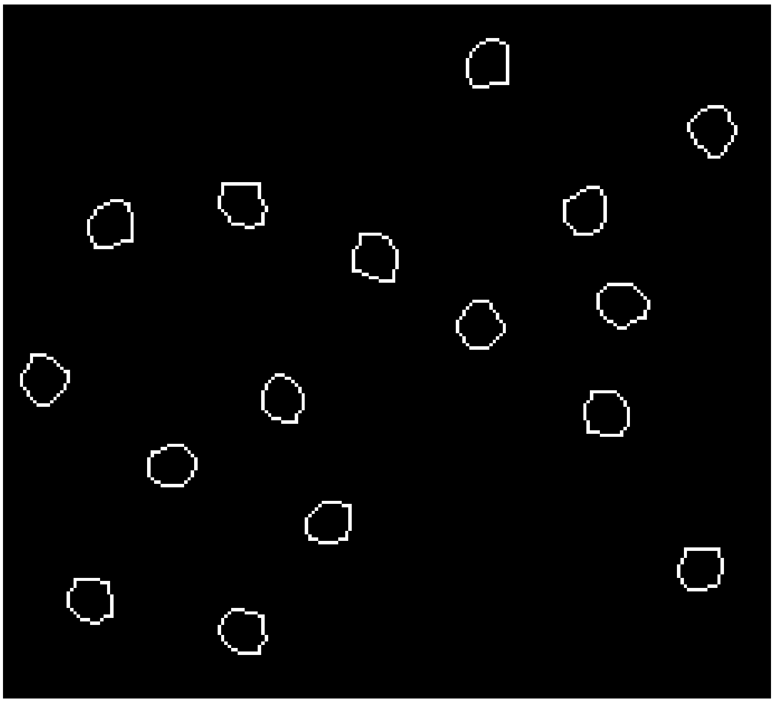




T pieces detection

```
I2=I-res;
BW = I2>0.1;
figure(6), imshow(BW), title('T pieces and nails');
```



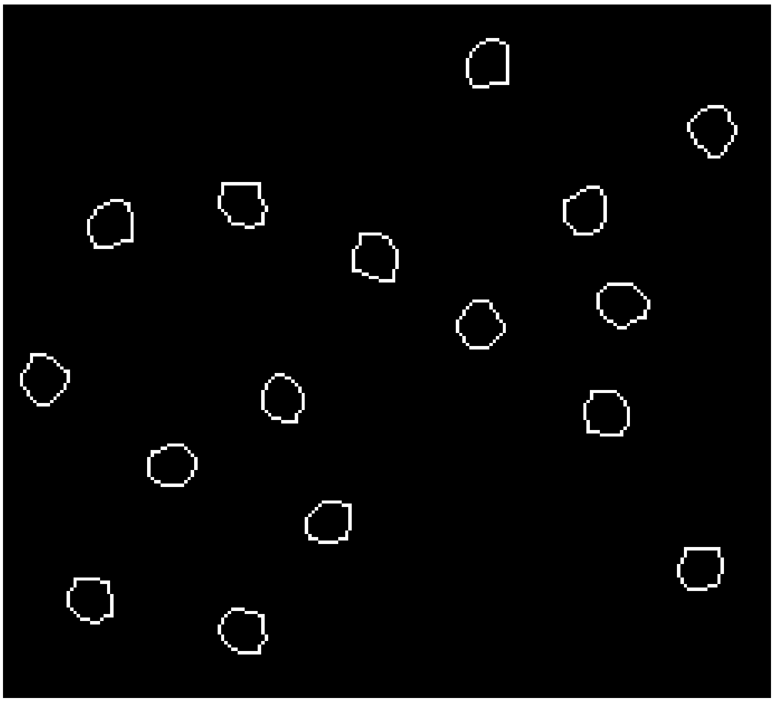


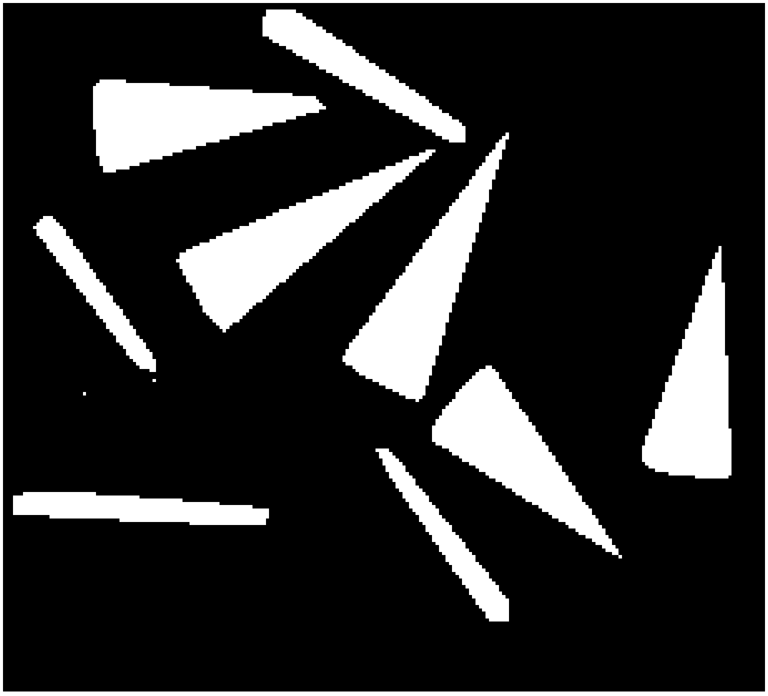
1re solution base sur l'enveloppe convexe

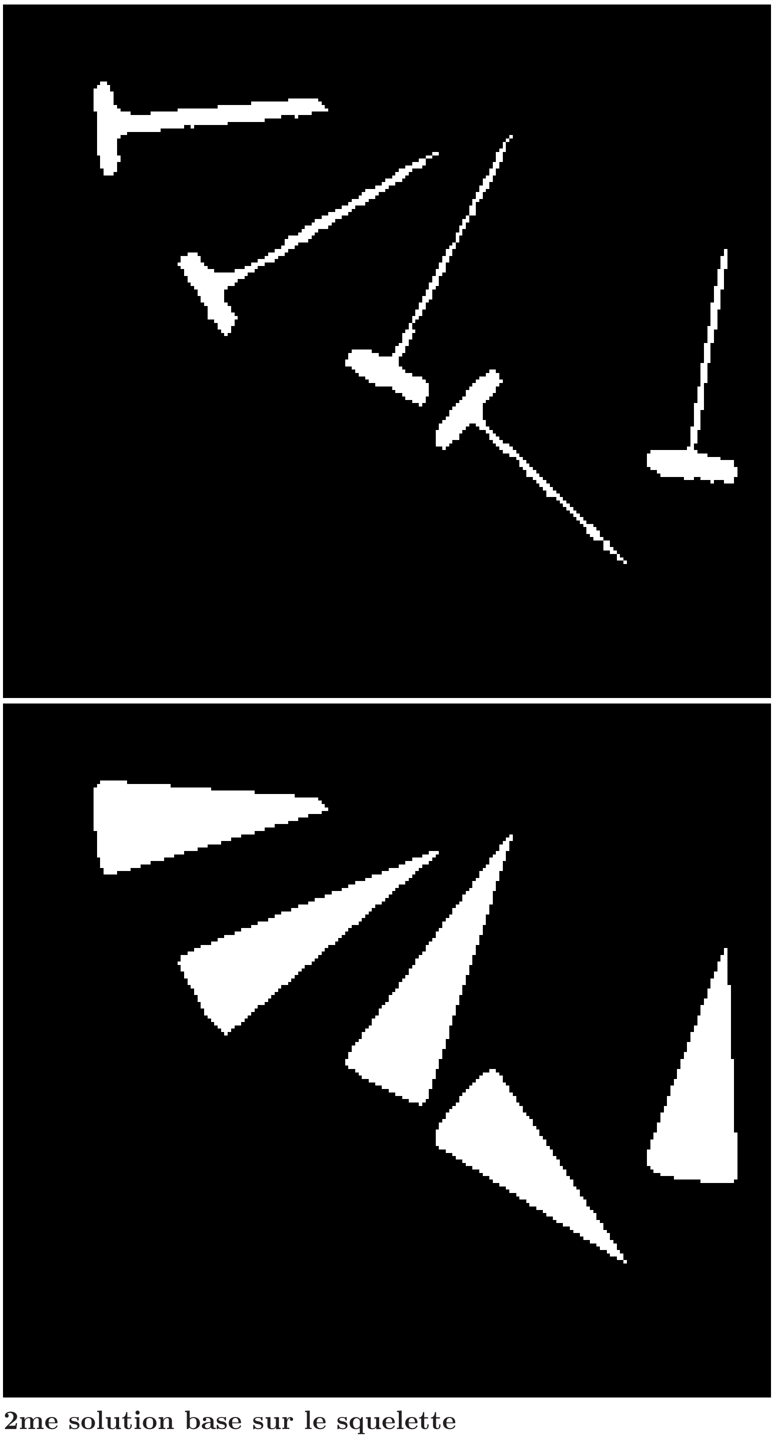
```
ch = bwconvhull(BW, 'objects');
figure(7), imshow(ch), title('convex hull');

skprao=bwareaopen(ch,850);
figure(8), imshow(skprao), title('CONVEX HULL filtered if area <850 pixels');

% reconstruction
ch2= skprao.*I2;
figure(9), imshow(ch2), title('identified T');
```





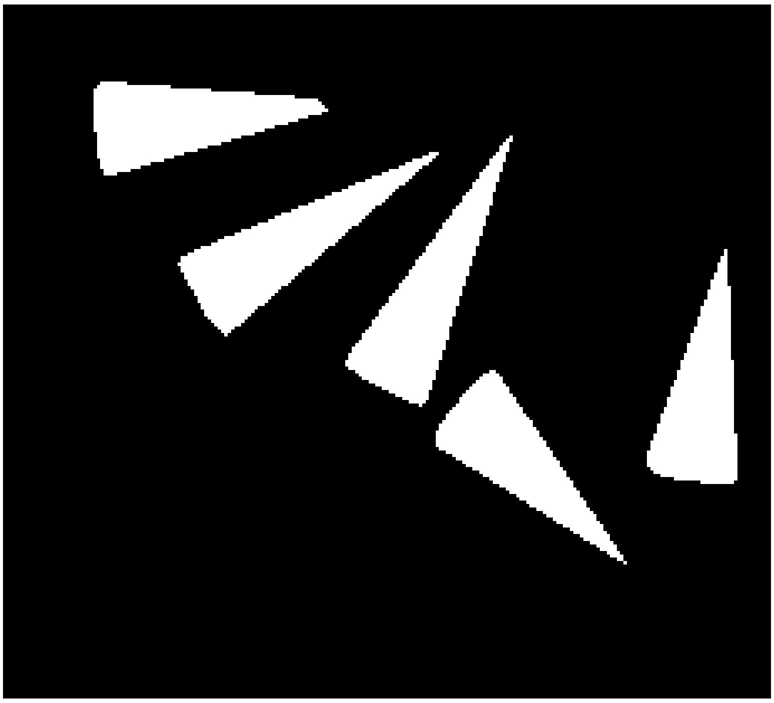


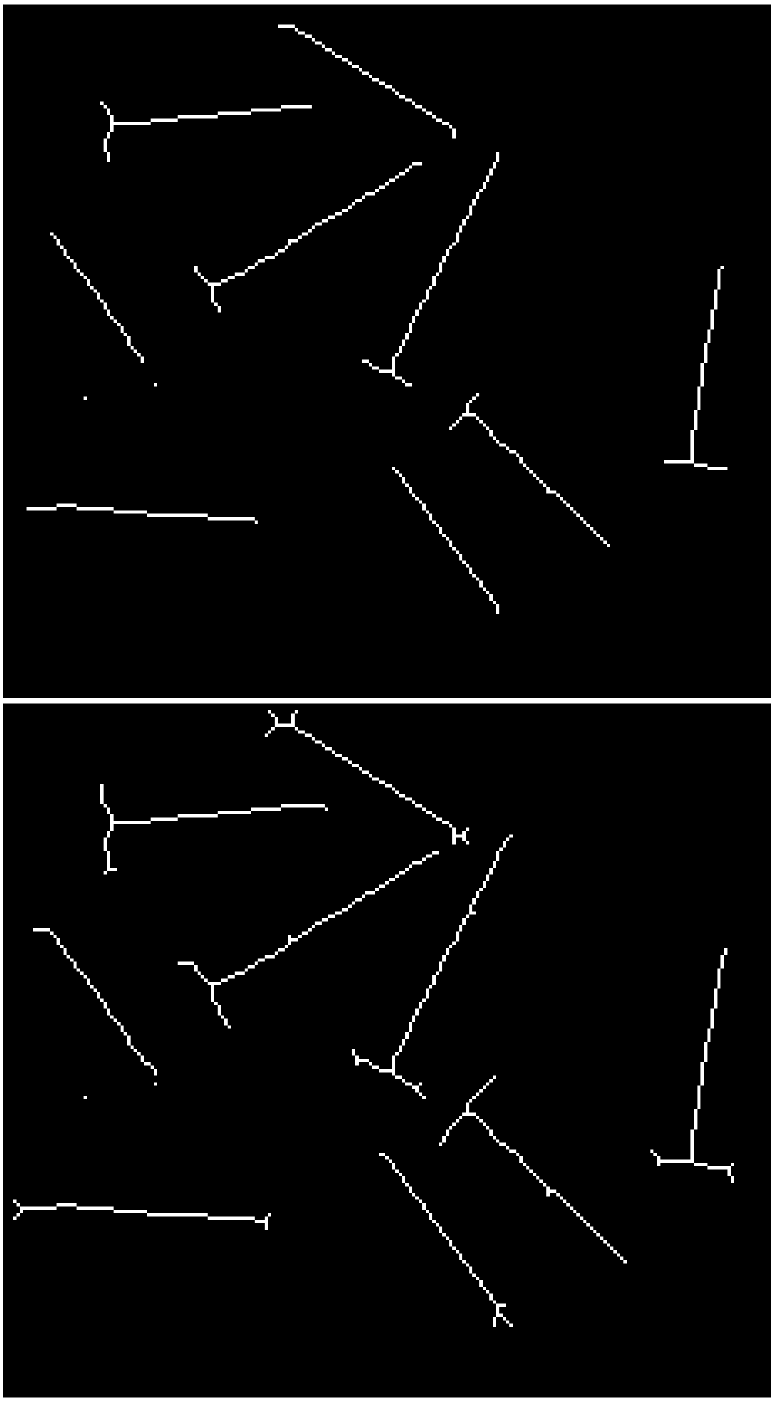
2me solution base sur le squelette

```
sk=bwmorph(I2,'skel',Inf);
figure(10), imshow(sk), title('Skeleton');

% pruning
skpr=bwmorph(sk,'spur',5);
figure(11), imshow(skpr), title('pruned Skeleton');
% on nettoie les petites branches artefacts pour n'avoir plus que des
% jonctions T correspondant aux objets recherchs.

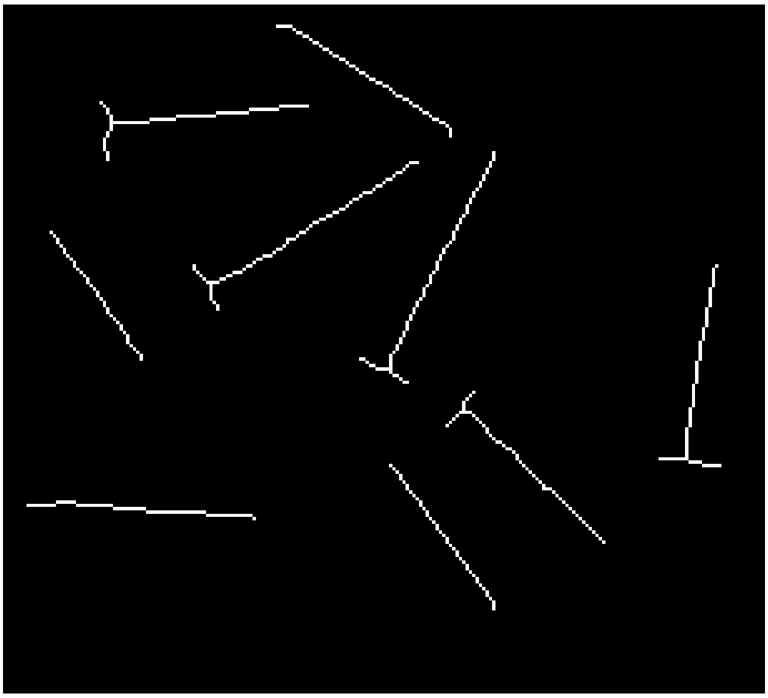
% test du filtrage par aire (celui ne doit pas permettre de sparer objet
% en T des clous)
% skpr2=bwareaopen(sk,80);
% figure, imshow(skpr2), title('pruned skeleton after filtering of small objects');
% OK bwereaopen ne permet plus de sparer objets en T des autres
```

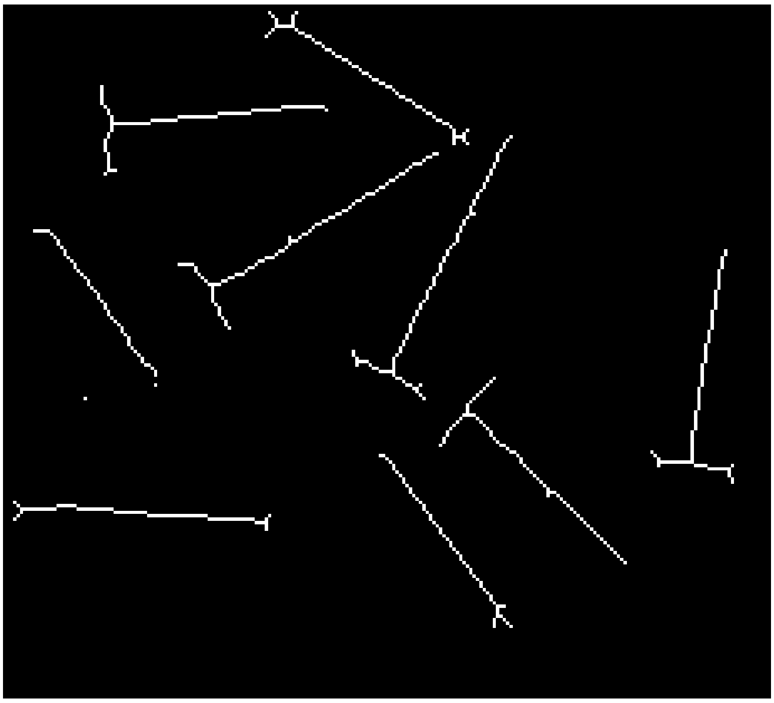




Filtering of small isolated objects

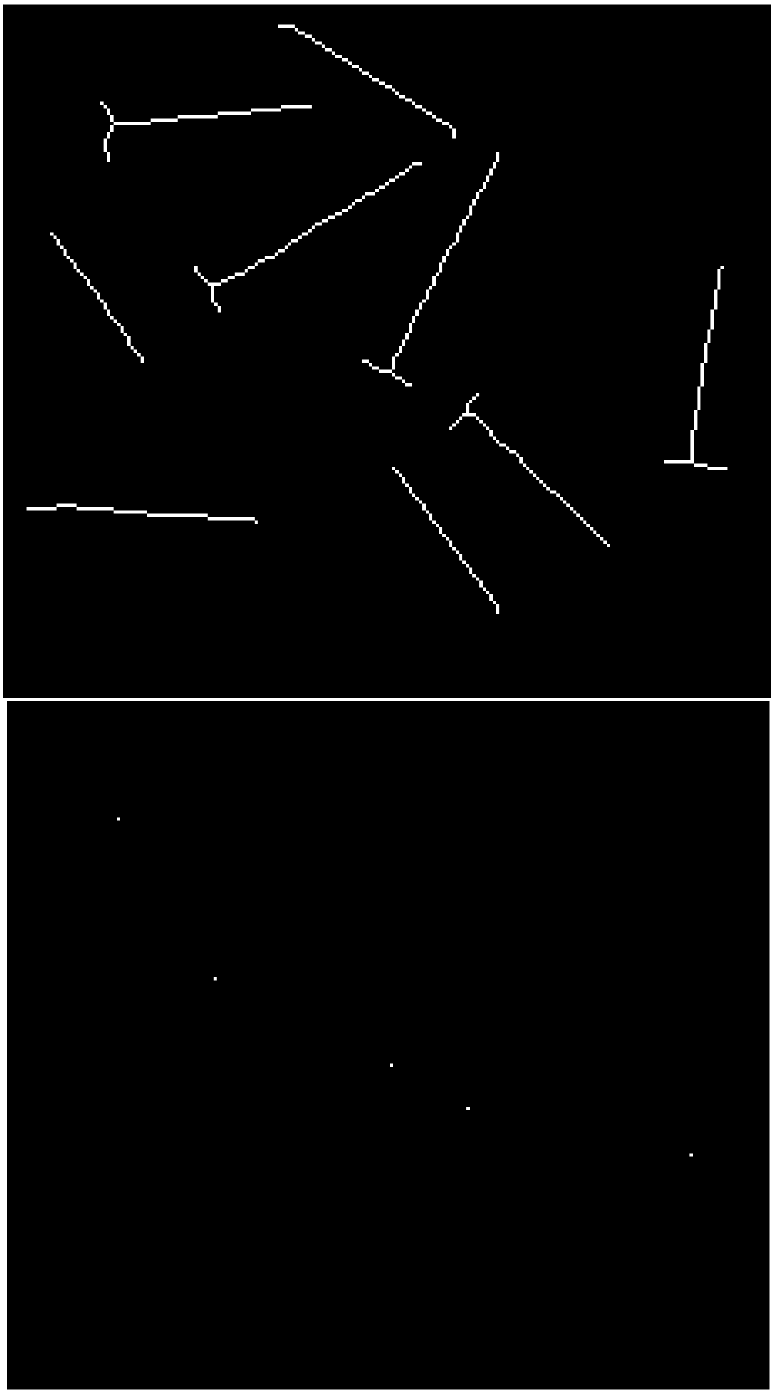
```
skprao=bwareaopen(skpr,5);
figure(12), imshow(skprao), title('pruned skeleton after filtering of small objects');
```





Using matlab detection of triple points

```
skprao1=bwmorph(skprao,’thin’,5);   % First a little thinning
figure(12), imshow(skprao1), title(’pruned skeleton after filtering of small objects’);s
figure(13), imshow(skpraobp), title(’branch points detection’);
```



Using tailored structuring element pairs

```
B{1} =      [   -1  1 -1   ;...
                 1  1  1   ;...
                -1 -1 -1   ];

B{2} =      [    1 -1  1   ;...
                -1  1 -1   ;...
                -1 -1  1   ];

B{3} =      [   -1  1 -1   ;...
                -1  1  1   ;...
                -1  1 -1   ];

B{4} =      [   -1 -1  1   ;...
                -1  1 -1   ;...
                 1 -1  1   ];

B{5} =      [   -1 -1 -1   ;...
                 1  1  1   ;...
                -1  1 -1   ];

B{6} =      [    1 -1 -1   ;...
                -1  1 -1   ;...
                 1 -1  1   ];

B{7}    = [   -1  1 -1   ;...
                 1  1 -1   ;...
                -1  1 -1   ];

B{8}    = [    1 -1  1   ;...
                -1  1 -1   ;...
                 1 -1 -1   ];

B{9}    =  [   -1  1 -1   ;...
                -1  1  1   ;...
                 1 -1 -1   ];

B{10}    =   [   -1 -1  1   ;...
                 1  1 -1   ;...
                -1 -1  1   ];

B{11}    =   [    1 -1 -1   ;...
                -1  1  1   ;...
                -1  1 -1   ];

B{12}    =   [   -1  1 -1   ;...
                -1  1 -1   ;...
```

```
                 1 -1  1   ];

B{13}    =   [   -1 -1  1   ;...
                 1  1 -1   ;...
                -1  1 -1   ];

B{14}    =  [    1 -1 -1   ;...
                -1  1  1   ;...
                 1 -1 -1   ];

B{15}    =  [   -1  1 -1   ;...
                 1  1 -1   ;...
                -1 -1  1   ];

B{16}    = [  1 -1  1   ;...
             -1  1 -1   ;...
             -1  1 -1   ];


ptstriples=zeros(size(skprao));
figure(14)

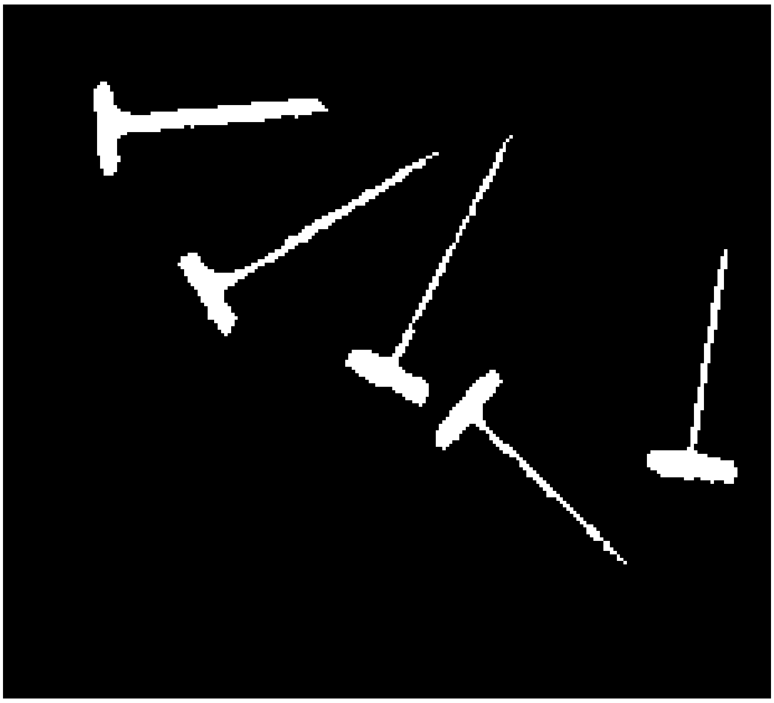
   for i=1:16,
      ptstriples=ptstriples+bwhitmiss(skprao,B{i});
      imshow(ptstriples)
      disp(['B' int2str(i) ' applied, press any key to continue ... '])
      %pause
   end
   disp(['********  # of passes = ' int2str(i)]);
```

```
B1 applied, press any key to continue ...
B2 applied, press any key to continue ...
B3 applied, press any key to continue ...
B4 applied, press any key to continue ...
B5 applied, press any key to continue ...
B6 applied, press any key to continue ...
B7 applied, press any key to continue ...
B8 applied, press any key to continue ...
B9 applied, press any key to continue ...
B10 applied, press any key to continue ...
B11 applied, press any key to continue ...
B12 applied, press any key to continue ...
B13 applied, press any key to continue ...
B14 applied, press any key to continue ...
B15 applied, press any key to continue ...
B16 applied, press any key to continue ...
```

```
********  # of passes = 16
```

reconstruction partir des points triples

```
res2=imreconstruct(double(ptstriples),double(I));
figure(15), imshow(res2), title('T reconstruction');
```



Detection des derniers objets

```
res3=I - res - res2;
figure(16), imshow(res3), title('Nail objects');
```