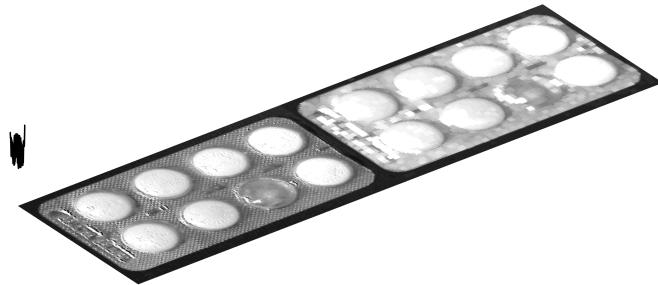


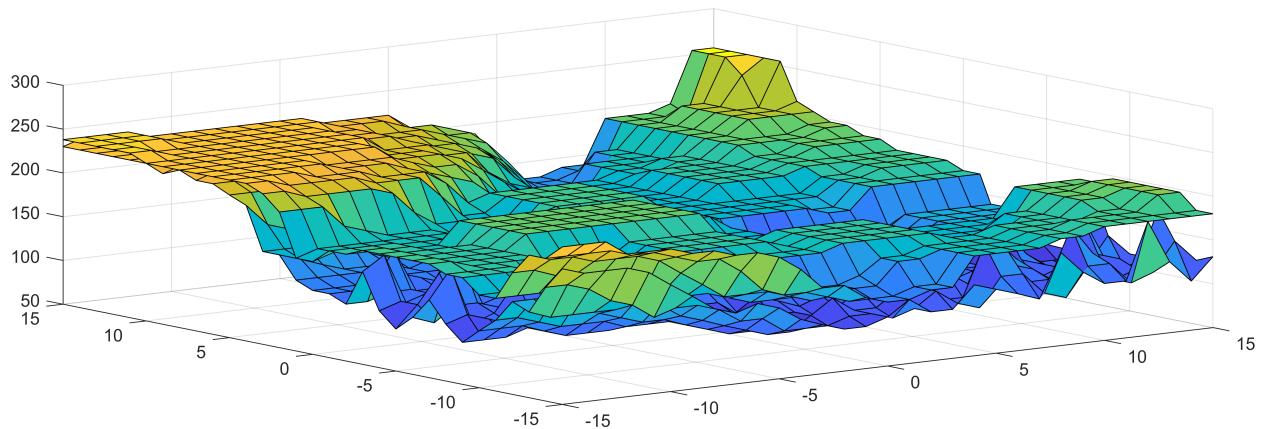
E6

Morfología multinivell

```
I = imread("astablet.tif");
ES = ones(5,5);
ID = imdilate(I, ES);
montage({I, ID});
```

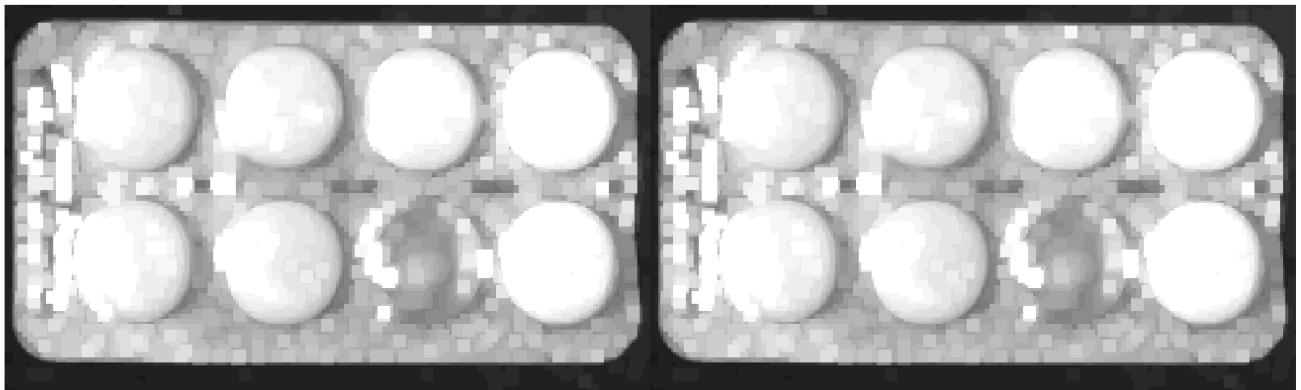


```
% Visualització en 3d
[f, c] = size(I);
f_2 = floor(f/2);
c_2 = floor(c/2);
Icrop = I(f_2 -15 : f_2 +15, c_2 -15 : c_2 +15);
IDcrop = ID(f_2 -15 : f_2 +15, c_2 -15 : c_2 +15);
[X, Y] = meshgrid(-15:15);
surf(X, Y, IDcrop);
% hold on
% surf(X, Y, Icrop)
```



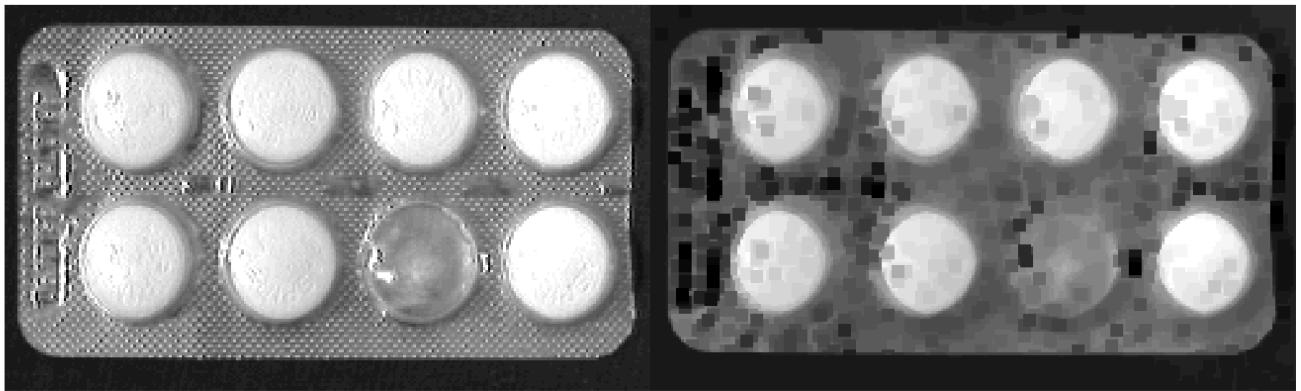
```
% hold off
```

```
% Dilatacio = max dels veins
ID2 = colfilt(I, [5,5], 'sliding', @max);
montage({ID, ID2});
```



```
% Erode
```

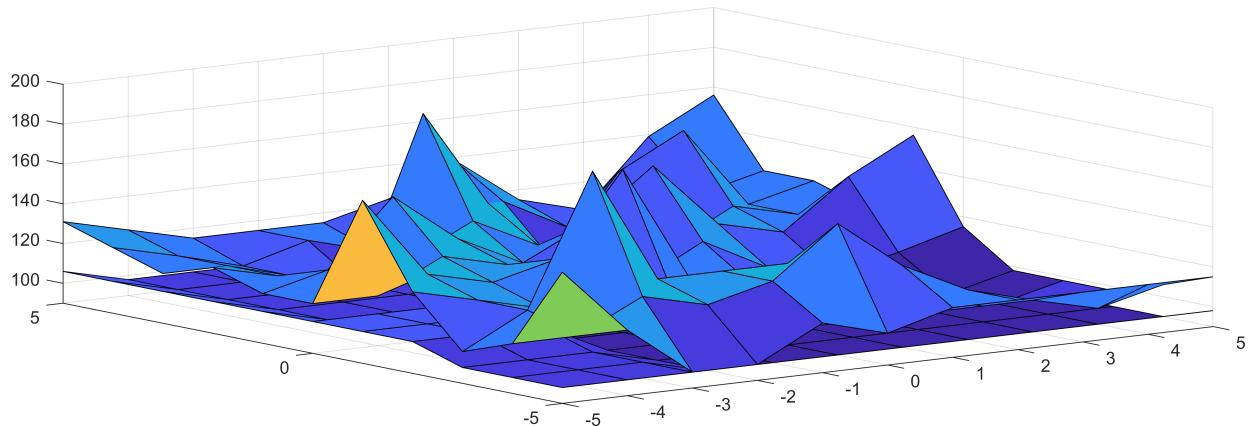
```
IE = imerode(I, ES);
montage({I, IE});
```



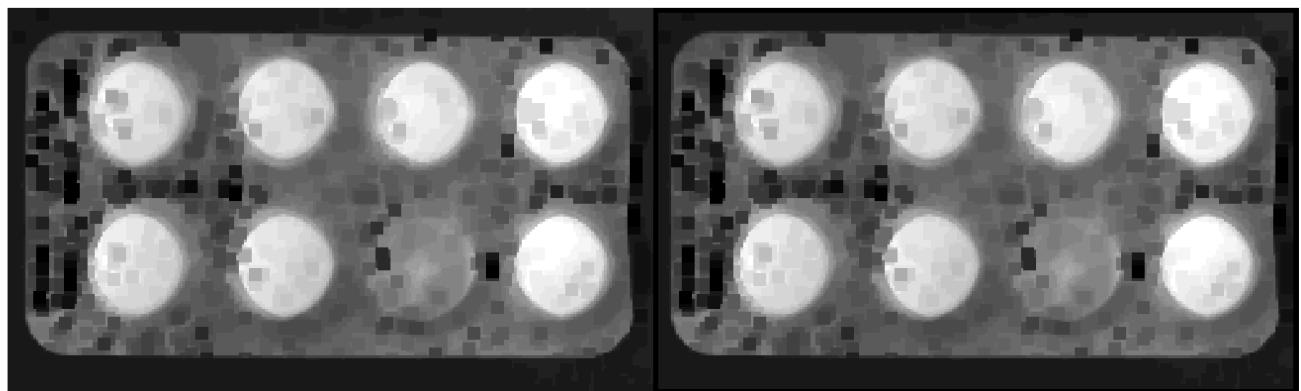
```
% Visualització en 3d
```

```
[f, c] = size(I);
f_2 = floor(f/2);
c_2 = floor(c/2);
Icrop = I(f_2 - 5 : f_2 +5, c_2 -5 : c_2 +5);
IEcrop = IE(f_2 - 5 : f_2 +5, c_2 -5 : c_2 +5);
[X, Y] = meshgrid(-5:5);
surf(X, Y, IEcrop);
hold on
surf(X, Y, Icrop)
```

```
hold off
```



```
% Erosio = min dels veins  
IE2 = colfilt(I, [5,5], 'sliding', @min);  
montage({IE, IE2})
```

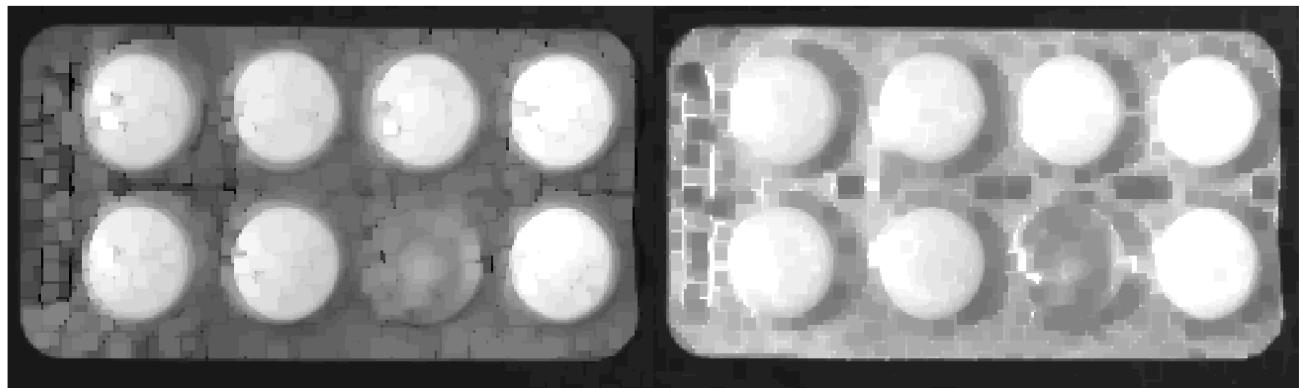


```
% Open  
IO = imopen(I, ES);  
montage({I, IO});
```



% Close

```
IC = imclose(I, ES);
montage({I, IC});
```



% Open + Close Filtre = elimina soroll

```
IOC = imclose(IO, ES);
montage({I, IOC});
```



```
% Filtre
```

```
I0CF = uint8((double(I0) + double(IC)) / 2);  
montage({I, I0CF});
```

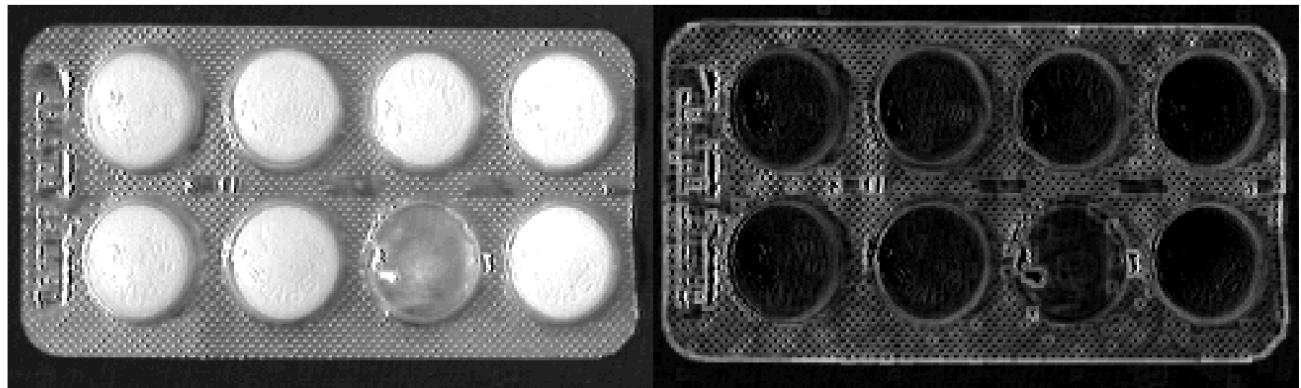


```
% Residus
```

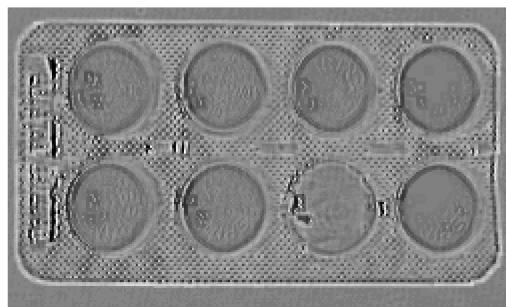
```
I = imread('astablet.tif');  
ES = ones(5,5);  
IE = imerode(I, ES);  
RI = I - IE; % enaltir contorn morfologic intern  
montage({I, RI});
```



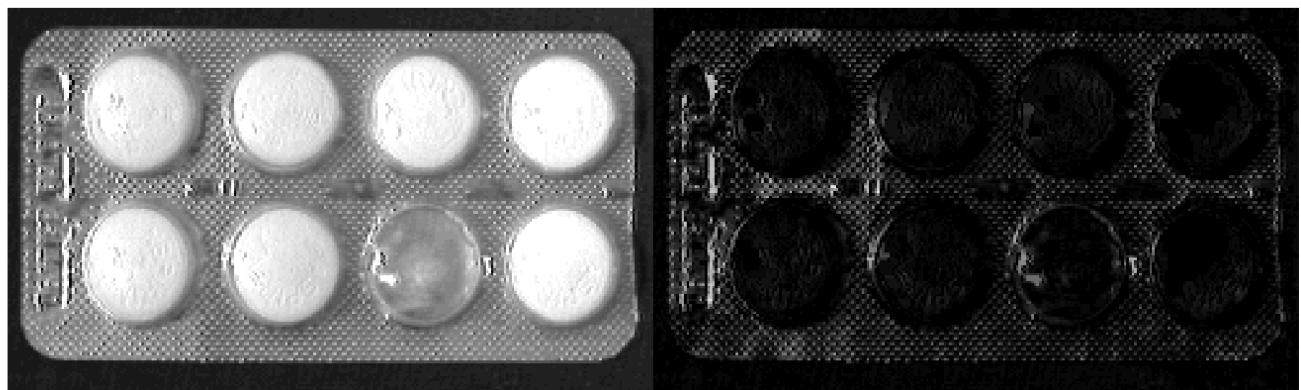
```
ID = imdilate(I, ES);  
RE = ID - I; % enaltir contorn morfologic extern  
montage({I, RE});
```



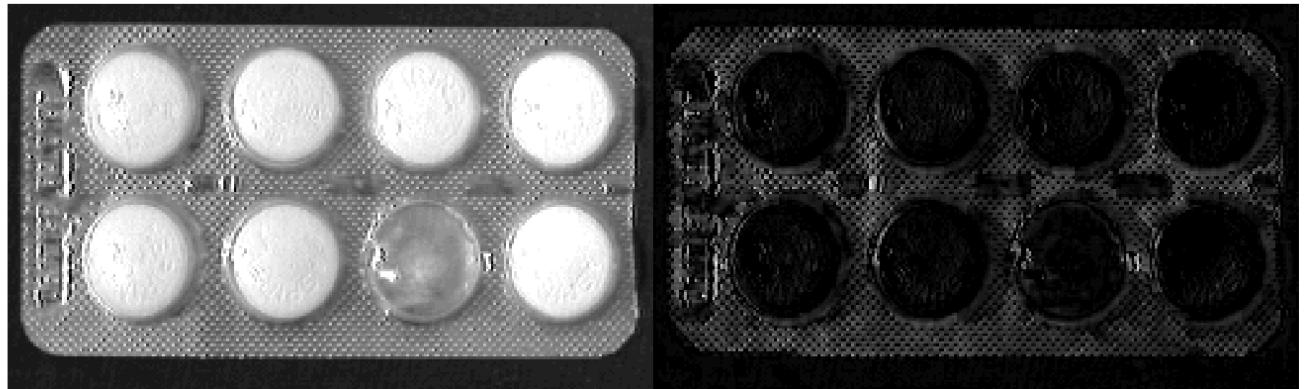
```
% Laplacia  
L = double(RE) - double(RI);  
imshow(L, [])
```



```
ES = ones(5,5);  
  
IO = imopen(I, ES);  
TH = I - IO;  
montage({I, TH})
```



```
IC = imclose(I, ES);  
BH = IC - I;  
montage({I, BH})
```



```
% Aplicació del top hat
```

```
I = imread("nshadow.tif");
imshow(I);
```

ived by erosion
at filter:
 $(f) = \Psi(\Psi(f))$
 $\leq g \Rightarrow \Psi(f) \leq$

```
ES = ones(25, 25);
IO = imopen(I, ES);
TH = I - IO;
imshow(TH, []);
```

```
wed by erosion  
cal filter:  
 $(f) = \Psi(\Psi(f))$   
 $\leq g \Rightarrow \Psi(f) \leq$ 
```

```
t = otsuthresh(imhist(TH));  
imshow(TH > t * 255, []);
```

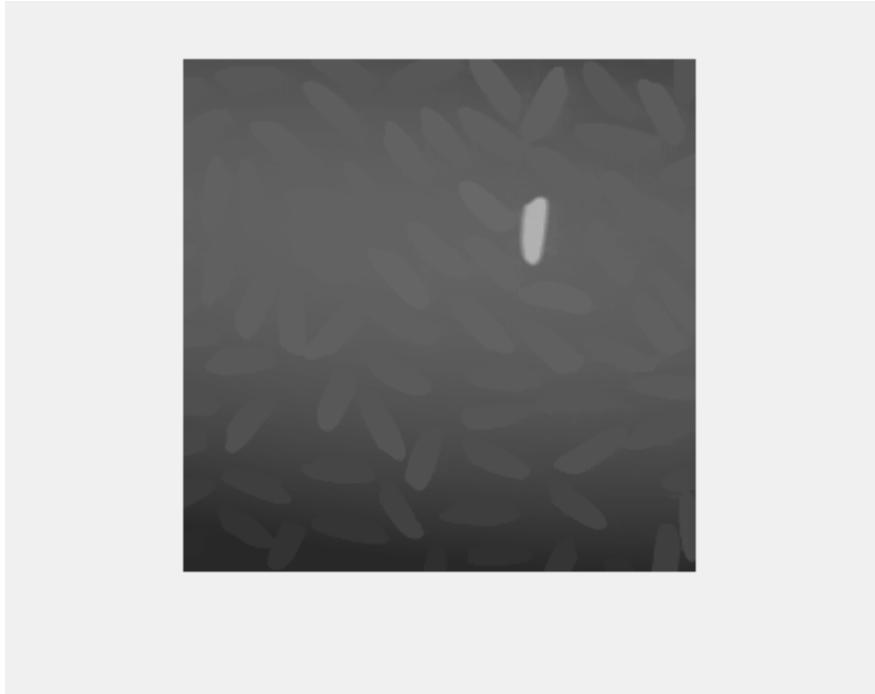
```
wed by erosion  
cal filter:  
 $(f) = \Psi(\Psi(f))$   
 $\leq g \Rightarrow \Psi(f) \leq$ 
```

```
% Reconstruccio
```

```
I = imread("arros.tif");  
imshow(I);  
[y,x] = getpts;
```



```
MARK = uint8(zeros(size(I)));
MARK(uint16(x),uint16(y)) = 255;
REC = imreconstruct(MARK, I);
imshow(REC);
```



```
% Maximis regionals
I = imread("astablet.tif");
```

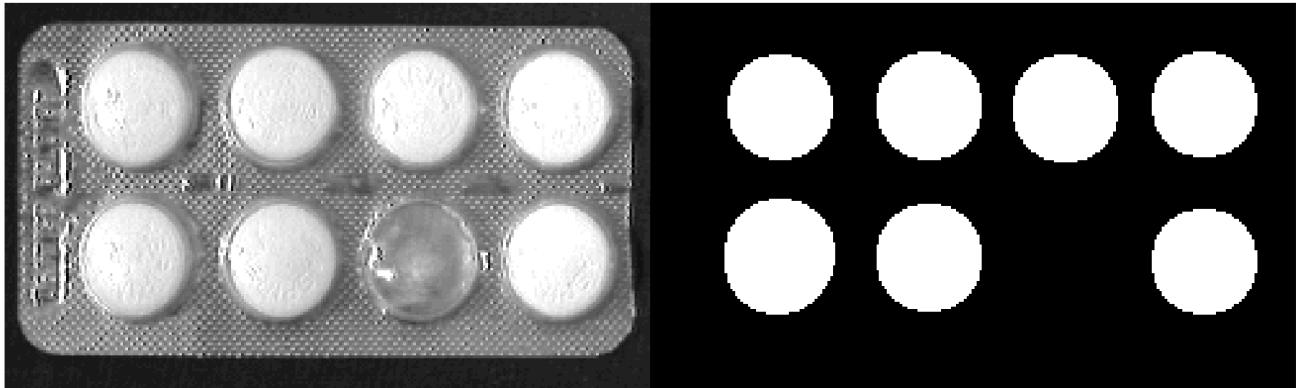
```

IRM = imregionalmax(I); % Masses maxims regionals per detectar les pastilles

% Filtrat
ES = fspecial("disk", 20) > 0; % ES = strel()
IO = imopen(I, ES);
IMR_filtered = imregionalmax(IO);

montage({I, IMR_filtered});

```



```

IM = I;
IM(not(IMR_filtered)) = 0;

REC = imreconstruct(uint8(IM), I);
imshow(REC)

```



Exercici: Realitzar un plot de granulometria

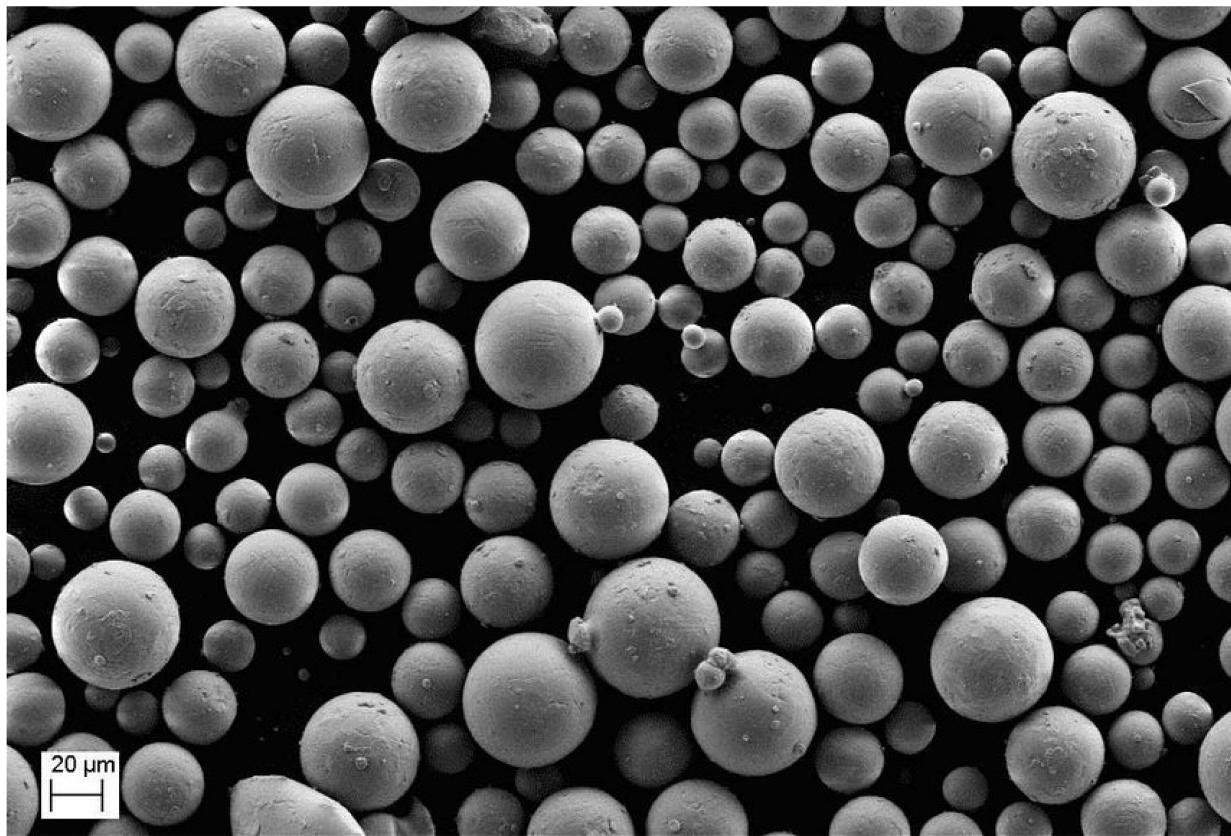
```

% Plot mostra mida vs nombre

I = imread("granulometria2.png");

```

```
imshow(I);
```



```
% 1
results = zeros(50, 1);
for i = 1:50
    ES = fspecial("disk", i) > 0;
    I0 = imopen(I, ES);
    t = otsuthresh(imhist(I0));
    t = max(32, t*255);
    BW = I0 > t;
    imshow(BW);
    drawnow;
    results(i) = bwconncomp(BW).NumObjects;
end
```



```
plot(results)
```

