Segmentación

Proceso Digital de Imágenes

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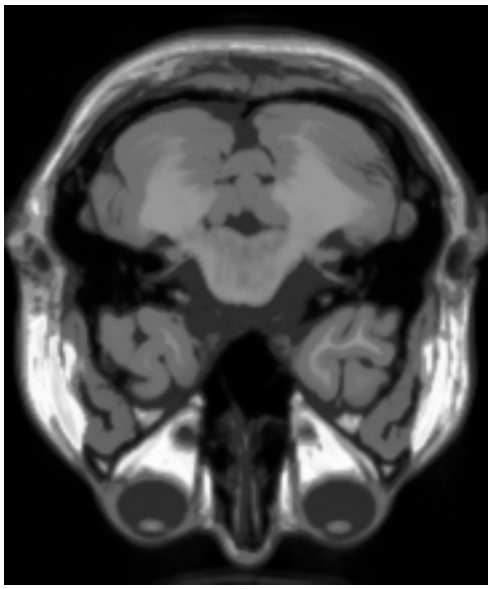
Gradientes

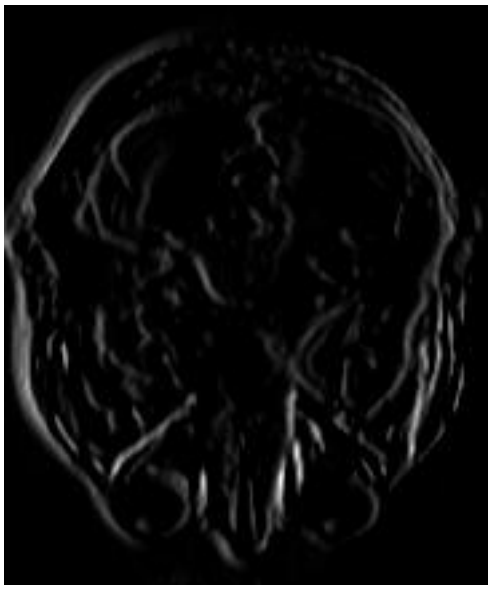
Gradiente de Prewitt

Para realizar el gradiente de Prewitt sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = GradientePrewitt( img )
    [x,y] = size(img);
    img2 = zeros(x+2,y+2);
    img2(2:x+1,2:y+1) = img;
    H = ([-1,0,1;
          -1,0,1;
          -1,0,1]./ 3);
    for i=1:x
        for j=1:y
            salida(i,j) = sum(sum(img2(i:1:i+2,j:1:j+2).*H));
        end
    end
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:



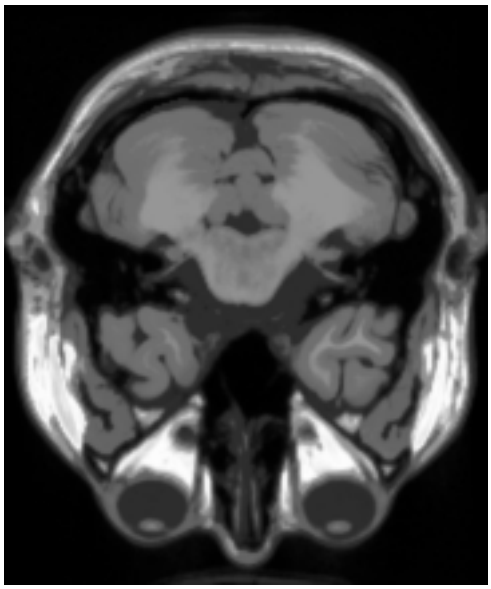


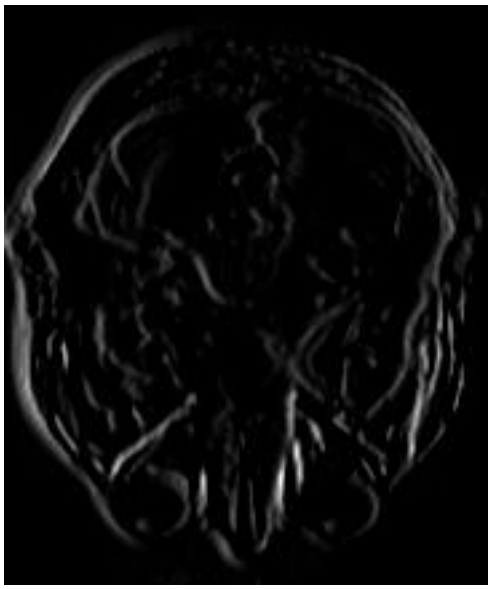
Gradiente de Sobel

Para realizar el gradiente de Sobel sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = GradienteSobel( img )
    [x,y] = size(img);
    img2 = zeros(x+2,y+2);
    img2(2:x+1,2:y+1) = img;
    H = ([-1,0,1;
          -2,0,2;
          -1,0,1]./ 4);
    for i=1:x
        for j=1:y
            salida(i,j) = sum(sum(img2(i:1:i+2,j:1:j+2).*H));
        end
    end
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:



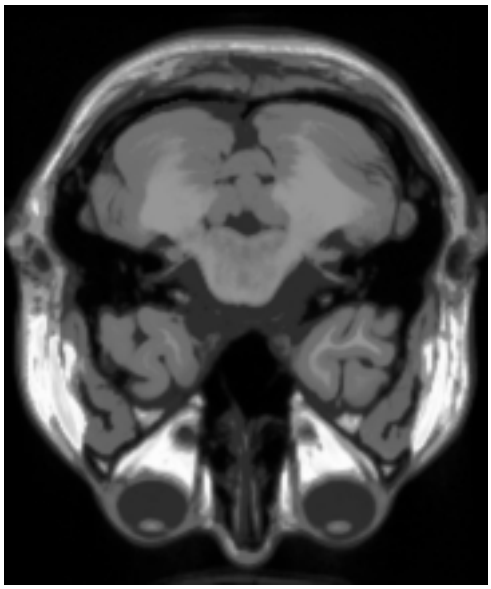


Gradiente de Frei-Chen

Para realizar el gradiente de Frei-Chen sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = GradienteFrei_Chen( img )
    [x,y] = size(img);
    img2 = zeros(x+2,y+2);
    img2(2:x+1,2:y+1) = img;
    raiz2=sqrt(2);
    H = ([         1,0,    -1;
          raiz2,0,-raiz2;
              1,0,    -1]./(2+raiz2));
    for i=1:x
        for j=1:y
            salida(i,j) = sum(sum(img2(i:1:i+2,j:1:j+2).*H));
        end
    end
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:

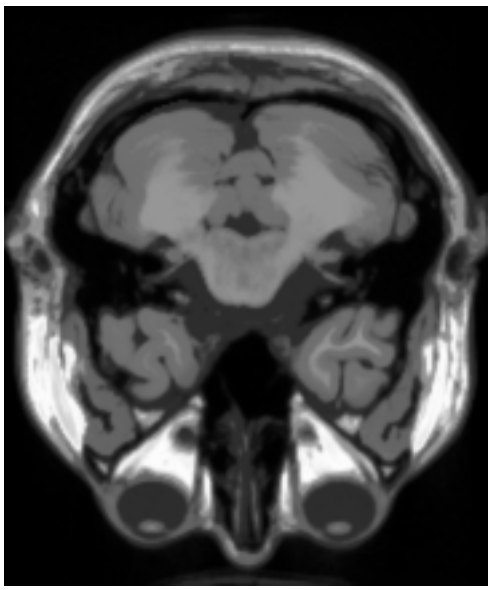


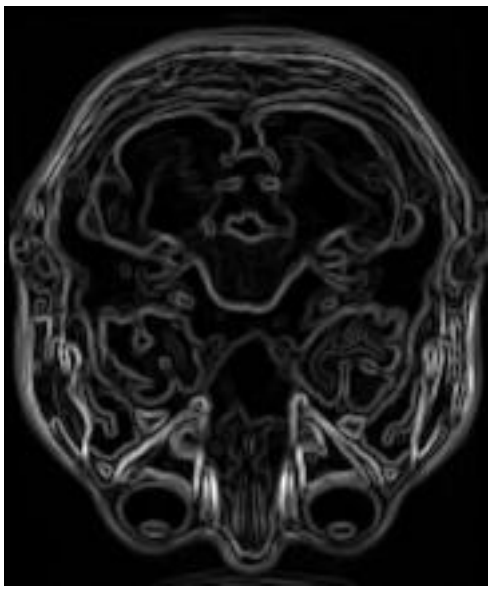
Gradiente de Kirsh

Para realizar el gradiente de Kirsh sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = GradienteKirsh( img )
    N=8;
    k = zeros (3,3,N);
    k(:,:,1) = [-3,-3,5;
                -3, 0,5;
                -3,-3,5];
    k(:,:,2) = [-3, 5, 5;
                -3, 0, 5;
                -3,-3,-3];
    for i=3:1:N
        k(:,:,i)=rot90(k(:,:,i-2));
    end
    G = zeros(size(img,1),size(img,2),N);
    [x,y] = size(img);
    img2 = zeros(x+4,y+4);
    img2(3:x+2,3:y+2) = img;
    for i=1:1:N
        for j=3:x
            for l=3:y
                salida(j,l,i) = sum(sum(img2(j:1:j+2,l:1:l+2).*k(:,:,i)));
            end
        end
    end
    % Se selecciona el maximo de cada filtro
    salida = max (abs(salida),[],3);
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:





Gradiente de Nevatia-Barbu

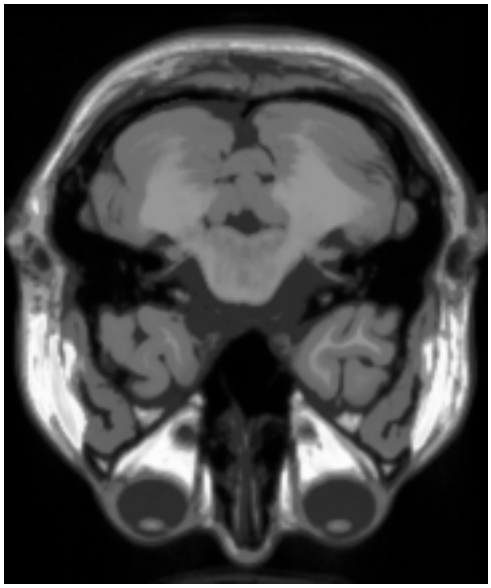
Para realizar el gradiente de Nevatia-Barbu sobre una imagen se ha utilizado la siguiente función en Matlab:

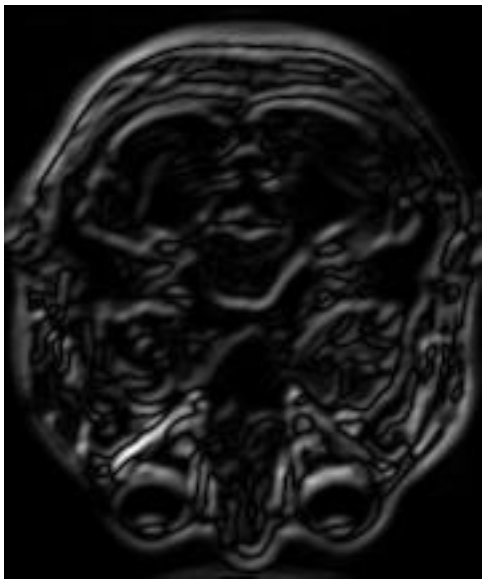
```
function [ salida ] = GradienteNevatia_Barbu( img )
     N = 12;

    k(:,:,1) = [  100/1000, 100/1000,         0,-100/1000,-100/1000;
                  100/1000, 100/1000,         0,-100/1000,-100/1000;
                  100/1000, 100/1000,         0,-100/1000,-100/1000;
                  100/1000, 100/1000,         0,-100/1000,-100/1000;
                  100/1000, 100/1000,         0,-100/1000,-100/1000];
    k(:,:,2) = [  100/1102, -32/1102,-100/1102,-100/1102,-100/1102;
                  100/1102,  78/1102, -92/1102,-100/1102,-100/1102;
                  100/1102, 100/1102,         0,-100/1102,-100/1102;
                  100/1102, 100/1102,  92/1102, -78/1102,-100/1102;
                  100/1102, 100/1102, 100/1102,  32/1102,-100/1102];
    k(:,:,3) = [ -100/1102,-100/1102,-100/1102,-100/1102,-100/1102;
                   32/1102, -78/1102,-100/1102,-100/1102,-100/1102;
                  100/1102,  92/1102,         0, -92/1102,-100/1102;
                  100/1102, 100/1102, 100/1102,  78/1102, -32/1102;
                  100/1102, 100/1102, 100/1102, 100/1102, 100/1102];
    k(:,:,4) = [ -100/1000,-100/1000,-100/1000,-100/1000,-100/1000;
                 -100/1000,-100/1000,-100/1000,-100/1000,-100/1000;
                         0,         0,         0,         0,         0;
                  100/1000, 100/1000, 100/1000, 100/1000, 100/1000;
                  100/1000, 100/1000, 100/1000, 100/1000, 100/1000];
    k(:,:,5) = [ -100/1102,-100/1102,-100/1102,-100/1102,-100/1102;
                 -100/1102,-100/1102,-100/1102, -78/1102,  32/1102;
                 -100/1102, -92/1102,         0,  92/1102, 100/1102;
                  -32/1102,  78/1102, 100/1102, 100/1102, 100/1102;
                  100/1102, 100/1102, 100/1102, 100/1102, 100/1102];
    k(:,:,6) = [ -100/1102,-100/1102,-100/1102, -32/1102, 100/1102;
                 -100/1102,-100/1102, -92/1102,  78/1102, 100/1102;
                 -100/1102,-100/1102,         0, 100/1102, 100/1102;
                 -100/1102, -78/1102,  92/1102, 100/1102, 100/1102;
                 -100/1102,  32/1102, 100/1102, 100/1102, 100/1102];
    k(:,:,7) = [ -100/1000,-100/1000,         0, 100/1000, 100/1000;
                 -100/1000,-100/1000,         0, 100/1000, 100/1000;
                 -100/1000,-100/1000,         0, 100/1000, 100/1000;
                 -100/1000,-100/1000,         0, 100/1000, 100/1000;
                 -100/1000,-100/1000,         0, 100/1000, 100/1000];
    k(:,:,8) = [ -100/1102,  32/1102, 100/1102, 100/1102, 100/1102;
                 -100/1102, -78/1102,  92/1102, 100/1102, 100/1102;
                 -100/1102,-100/1102,         0, 100/1102, 100/1102;
                 -100/1102,-100/1102, -92/1102,  78/1102, 100/1102;
                 -100/1102,-100/1102,-100/1102, -32/1102, 100/1102];
    k(:,:,9) = [  100/1102, 100/1102, 100/1102,100/1102 , 100/1102;
                  -32/1102,  78/1102, 100/1102,100/1102 , 100/1102;
                 -100/1102, -92/1102,         0,92/1102  , 100/1102;
                 -100/1102,-100/1102,-100/1102,-78/1102 ,  32/1102;
                 -100/1102,-100/1102,-100/1102,-100/1102,-100/1102];
    k(:,:,10) = [ 100/1000, 100/1000, 100/1000, 100/1000, 100/1000;
                  100/1000, 100/1000, 100/1000, 100/1000, 100/1000;
                          0,         0,         0,         0,         0;
                 -100/1000,-100/1000,-100/1000,-100/1000,-100/1000;
                 -100/1000,-100/1000,-100/1000,-100/1000,-100/1000];
    k(:,:,11) = [ 100/1102, 100/1102, 100/1102, 100/1102, 100/1102;
                  100/1102, 100/1102, 100/1102,  78/1102, -32/1102;
                  100/1102,  92/1102,         0, -92/1102,-100/1102;
                   32/1102, -78/1102,-100/1102,-100/1102,-100/1102;
                 -100/1102,-100/1102,-100/1102,-100/1102,-100/1102];
    k(:,:,12) = [ 100/1102, 100/1102, 100/1102,  32/1102,-100/1102;
                  100/1102, 100/1102,  92/1102, -78/1102,-100/1102;
                  100/1102, 100/1102,         0,-100/1102,-100/1102;
                  100/1102,  78/1102, -92/1102,-100/1102,-100/1102;
                  100/1102, -32/1102,-100/1102,-100/1102,-100/1102];
    for i=3:1:N
        k(:,:,i)=rot90(k(:,:,i-2));
    end
    G = zeros(size(img,1),size(img,2),N);
```

```
    [x,y] = size(img);
    img2 = zeros(x+4,y+4);
    img2(3:x+2,3:y+2) = img;
    for i=1:1:N
        for j=3:x
            for l=3:y
                salida(j-2,l-2) = sum(sum(img2(j-2:1:j+2,l-2:1:l+2).*k(:,:,i)));
            end
        end
    end
    % Se selecciona el maximo de cada filtro
    salida = max (abs(salida),[],3);
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:



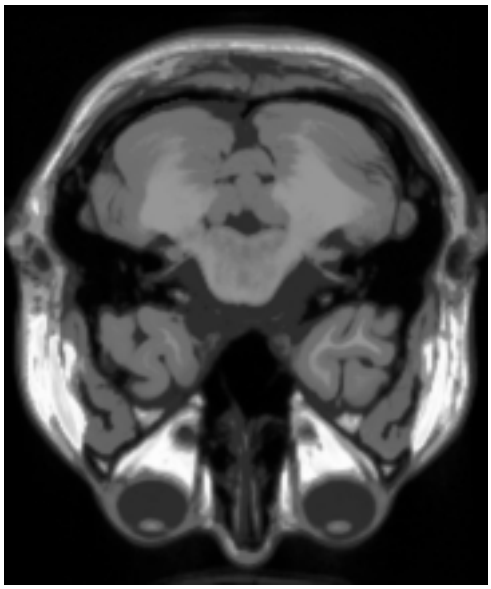


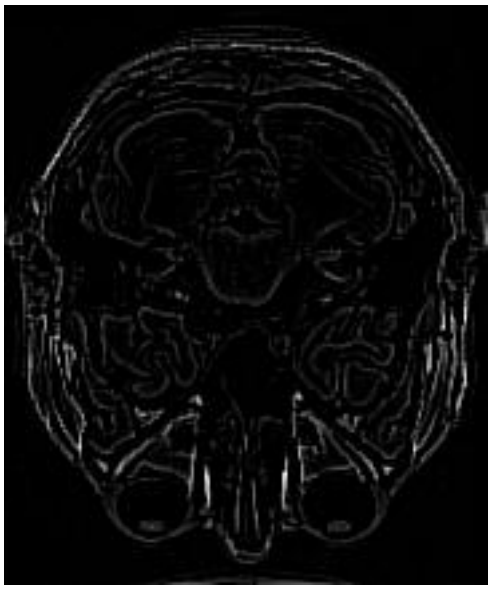
Gradiente Laplaciano-8

Para realizar el gradiente Laplaciano-8 sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = Laplaciana8( img )
    [x,y] = size(img);
    img2 = zeros(x+2,y+2);
    img2(2:x+1,2:y+1) = img;
    H = [-2  1 -2;
          1  4  1;
         -2  1 -2]./8;
    for i=1:x
        for j=1:y
            salida(i,j) = sum(sum(img2(i:1:i+2,j:1:j+2).*H));
        end
    end
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:



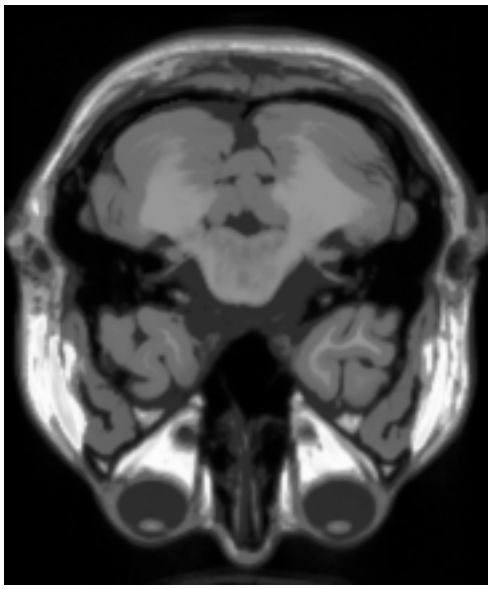


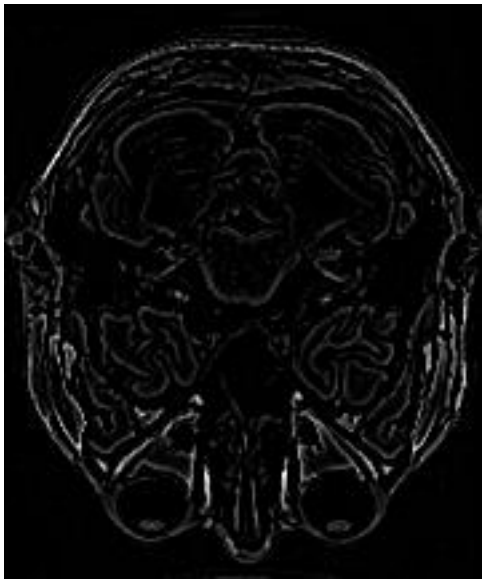
Gradiente LoG

Para realizar el gradiente LoG sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = LoG( img )
    [x,y] = size(img);
    img2 = zeros(x+4,y+4);
    img2(3:x+2,3:y+2) = img;
    H =[ 0  0 -1  0  0;
         0 -1 -2 -1  0;
        -1 -2 16 -2 -1;
         0 -1 -2 -1  0;
         0  0 -1  0  0];
    for i=3:x
        for j=3:y
            salida(i-2,j-2) = sum(sum(img2(i-2:1:i+2,j-2:1:j+2).*H));
        end
    end
    salida = uint8(salida.*255./max(max(salida)));
end
```

obteniendo el siguiente resultado:





Umbralizado Adaptable

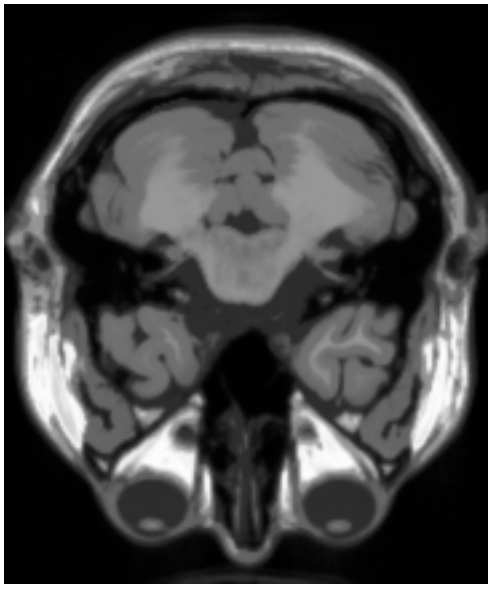
Para realizar el Umbralizado Adaptable sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = Umbralizado( img )
    [r c]=size(img);
    L = 256;
    k = 80;
    p=zeros(1,L);
    for level=1:1:L
        for i=1:1:r
            for j=1:1:c
                if(img(i,j)==level)
                    p(level)=p(level)+1;
                end
            end
            p(level) = p(level);
        end
    end
    p1 = zeros(1,L);
    p2 = zeros(1,L);
    m1 = zeros(1,L);
    m2 = zeros(1,L);
    var = zeros(1,L);
    temp=0;
    temp2 = 0;
    temp3 = 0;
    temp4 = 0;
    for thresh=1:k
        for ite= 1:thresh
            temp=temp+p(ite);
        end
        p1(thresh)=temp;
        temp=0;
    end
    for thresh2 = k+1: L
        for i = thresh2:L

            temp2 = temp2 + p(i);
        end
        p2(thresh2)=temp2;
        temp2=0;
    end
    for thresh3 =1:k
        for i =1:thresh3
            temp3 = temp3 + i* p(i);
        end
        m1(thresh3) = temp3/p1(thresh3);
    end
    for thresh4 =k+1:L
        for i =thresh4:L
            temp4 = temp4 + i* p(i);
        end
        m2(thresh4) = temp4/p2(thresh4);
    end
    mg = p1(k)*m1(k)+p2(k)*m2(k);
    for v =1:L
        var(v) = ( p1(v)*(m1(v)-mg)^2 )+( p2(v)*(m2(v)-mg)^2 );
    end
    [maxNum IndexofMaxNum] = max(var);
    output=img;
    for i=1:r
        for j=1:c
            if output(i,j) >IndexofMaxNum
                output(i,j)=255;
            else
                output(i,j)=0;
            end
        end
    end
```

```
        salida = output;
    end
```

obteniendo el siguiente resultado:



Crecimiento de Regiones

Para realizar el Crecimiento de Regiones sobre una imagen se ha utilizado la siguiente función en Matlab:

```
function [ salida ] = CrecimientoRegiones( img, x, y )
    Isizes = size(img);
    J = zeros(Isizes);
    reg_mean = img(x,y);
    reg_size = 1;
    neg_free = 10000;
    neg_pos=0;
    neg_list = zeros(neg_free,3);
    pixdist=0;
    reg_maxdist = 0.2;
    neigb=[-1  0;
            1  0;
            0 -1;
            0  1];
    while(pixdist<reg_maxdist&&reg_size<numel(img))
        for j=1:4,
            xn = x +neigb(j,1);
            yn = y +neigb(j,2);
 if((xn>=1)&&(yn>=1)&&(xn<=Isizes(1))&&(yn<=Isizes(2))&&(J(xn,yn)==0))
                    neg_pos = neg_pos+1;
                    neg_list(neg_pos,:) = [xn yn img(xn,yn)];
                    J(xn,yn)=1;
            end
        end
        if(neg_pos+10>neg_free)
            neg_free=neg_free+10000;
            neg_list((neg_pos+1):neg_free,:)=0;
        end
        a = neg_list(1:neg_pos,3);
        dist = abs(uint8(a)-reg_mean);
        [pixdist, index] = min(dist);
        J(x,y)=2;
        reg_size=reg_size+1;
        reg_mean= (reg_mean*reg_size + neg_list(index,3))/(reg_size+1);
        x = neg_list(index,1);
        y = neg_list(index,2);
        neg_list(index,:)=neg_list(neg_pos,:);
        neg_pos=neg_pos-1;
    end

    salida=J>1;
end
```

obteniendo el siguiente resultado: