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# Detecció de Caràcters

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## CODI

### Imatges Inicials

```
close all; clc
w = warning ('off','all');

f=dir(['cars' '/*.jpg']);
files={f.name};
numcotxes = numel(files);
names = convertCharsToStrings(files);
for k=1:numcotxes
    names(k) = erase(names(k), ".jpg");
    names(k) = erase(names(k), ".JPG");
    names(k) = erase(names(k), "_");
end

im_ors=cell(1,numcotxes);
for k=1:numcotxes
    im_ors{k}=imread(files{k});
end

im_mat=cell(1,numcotxes);
for k=1:numcotxes
    im_mat{k}=F_PotencialsMatricules(im_ors{k});
end

im_mat2=cell(1,numcotxes);
for k=1:numcotxes
    im_mat2{k}=F_EliminarNoMatricules(im_ors{k},im_mat{k});
end
```

### Selecció de Caràcters

```
% Seleccioem els números dels components connexos de les matrícules
```

```
function imnums = F_SeleccionarNumeros(imor,immat)
[n, m] = size(immat);
imnums = logical(zeros(n,m));

Iprops=regionprops(immat, 'BoundingBox', 'Area', 'Image');
count = numel(Iprops);

for i=1:count
    if Iprops(i).Area < 1000
        continue
    end
    boundingBox=Iprops(i).BoundingBox;
    regionCol = imcrop(imor,boundingBox);
    region = rgb2gray(regionCol);

    ridncalv = @ridncalv;
    regbin = ~imbinarize(region,ridncalv(region));

    regionmat = imcrop(immat,boundingBox);
    regbin = regionmat.*regbin;

    % Eliminem els elements molt grans
    reggran = imopen(regbin,strel("rectangle",[9,9]));
    reglletres = logical(regbin - reggran);

    % Eliminem els elements molt llargs
    reggran = imopen(reglletres,strel("rectangle",[1,30]));
    reglletres = logical(reglletres - reggran);

    %Eliminem les zones de colors(marcadors de pais)
    imhsv = rgb2HSV(regionCol);
    imcol = imhsv(:,:,2) .* imhsv(:,:,3);
    imcol = imbinarize(imcol,0.3);
    reglletres = reglletres .* (~imcol);
    reglletres = logical(reglletres);

    %Filtrem els components connexos molt estrets
    imer = imeroide(reglletres, strel("rectangle",[5,1]));
    reglletres = imreconstruct(imer,reglletres);

    % Unim lletres separades
    reglletres = imclose(reglletres,strel("rectangle",[4,1]));

    % Eliminem els components connexos molt petits
    reglletres = bwareafilt(reglletres,[15,100000]);

    % Treballem amb les regions
    [n2,m2] = size(reglletres);

props=regionprops(bwconncomp(reglletres), 'BoundingBox', 'PixelList', 'Solidity', 'Circularity'
for j=1:numel(props)
    prop = props(j);
    pl = prop.PixelList;
    X = ceil(prop.BoundingBox(1)); Y = ceil(prop.BoundingBox(2));
```

```
W = prop.BoundingBox(3); H = prop.BoundingBox(4);

% Eliminem elements poc sòlids
if prop.Solidity < 0.3
    reglletres = F_PintaPixels(reglletres,pl,0);
    continue;
end

% Eliminem els elements massa llargs
if W > m2*0.4
    reglletres = F_PintaPixels(reglletres,pl,0);
    continue;
end

% Eliminem els elements massa circulars
if prop.Circularity > 0.5 && W/H > 0.9
    reglletres = F_PintaPixels(reglletres,pl,0);
    continue;
end

% Eliminem els elements massa poc llargs
if H < n2/6 || H < 10 || W < 2
    reglletres = F_PintaPixels(reglletres,pl,0);
    continue;
end

% Dividim els elements que no encaixen la proporció
ratio = 0.9;
if W/H > ratio && numel(props) < 8
    reglletres(Y:Y+H,X+ceil(W/2)) = 0;
end

X = boundingBox(1); Y = boundingBox(2);
W = boundingBox(3); H = boundingBox(4);
imnums(Y:Y+H, X:X+W) = reglletres;
end
end

% Eliminem els components connexos aïllats
regunits = imclose(imnums, strel("rectangle",[1,30]));
regnoaillats =imerode(regunits,strel("rectangle",[1,50]));
regnoaillats = imreconstruct(regnoaillats,regunits);
imnums = regnoaillats .* imnums;

Iprops=regionprops(bwconncomp(imnums), 'BoundingBox', 'PixelList');
count = numel(Iprops);
nums_data = zeros(0,3);
for i=1:count
    prop = Iprops(i);
    pl = prop.PixelList;
    X = ceil(prop.BoundingBox(1)); Y = ceil(prop.BoundingBox(2));
    W = prop.BoundingBox(3); H = prop.BoundingBox(4);

    % Eliminem els elements massa llargs
```

```
if W > 50
    imnums = F_PintaPixels(imnums,pl,0);
    continue;
end

nums_data(end+1,:) = [H+Y/2,X,i];
end

% Escollim els 7 possibles números amb menor diferència d'altura.
nums_data = sortrows(nums_data);

if (numel(nums_data(:,1)) > 7)
    min_dist = intmax;
    min_idx = intmax;

    for i=1: numel(nums_data(:,1))-6
        dist = 0;
        for j=1:6
            dist = dist + (nums_data(i+j,1) - nums_data(i,1));
        end
        if dist < min_dist
            min_idx = i;
            min_dist = dist;
        end
    end

    for i=1: numel(nums_data(:,1))
        if i < min_idx || i > min_idx+6
            pl = Iprops(nums_data(i,3)).PixelList;
            imnums = F_PintaPixels(imnums,pl,0);
        end
    end
    nums_data = nums_data(min_idx:min_idx+6);
end
end
```

## Pintat de Píxels

```
function res = F_PintaPixels(imor,pixelList,val)
    res = imor;
    for row = 1 : size(pixelList(:, 2))
        thisRow = pixelList(row, 2);
        thisColumn = pixelList(row, 1);
        res(thisRow, thisColumn) = val;
    end
end
```

## RESULTATS

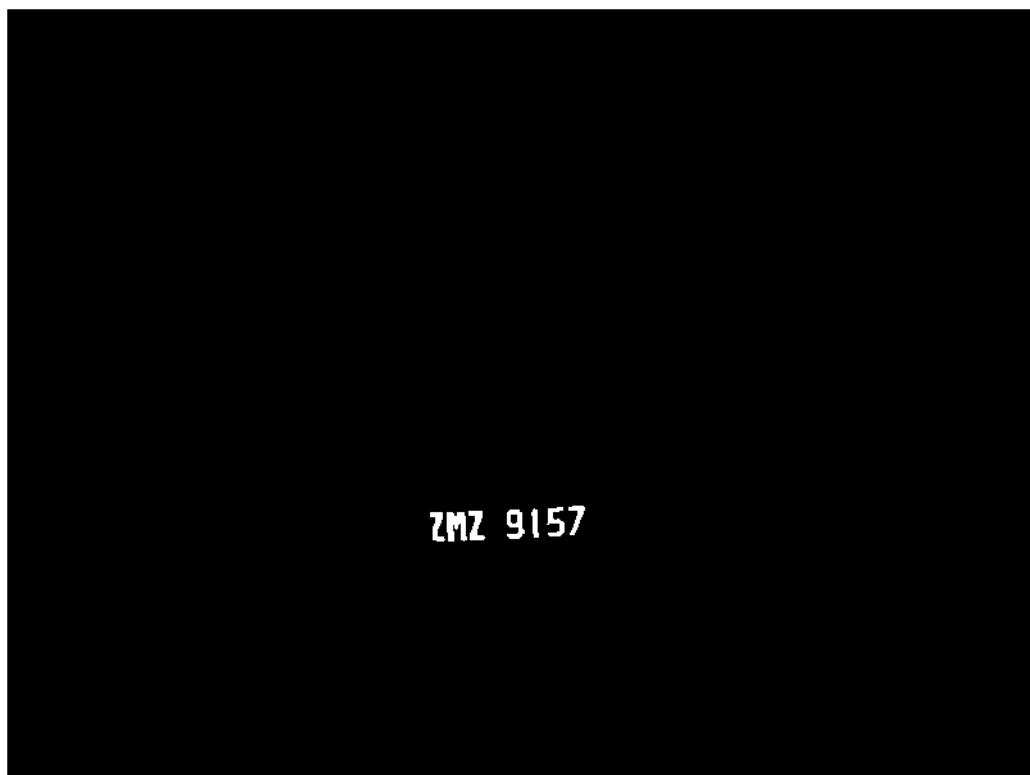
```
im_nums=cell(1,numcortexes);
```

```
for k=1:numcortexes
    im_nums{k}=F_SeleccionarNumeros(im_ors{k},im_mat2{k});
end

for k=1:numcortexes
    imres = im_ors{k};
    immat2 = imdilate(im_nums{k},strel("disk",5)) - im_nums{k};
    imres(:,:,:2) = imres(:,:,:2) .* uint8(~immat2);
    imres(:,:,:1) = imres(:,:,:1) .* uint8(~immat2);
    imres(:,:,:3) = imres(:,:,:3) + uint8(immat2)*256;

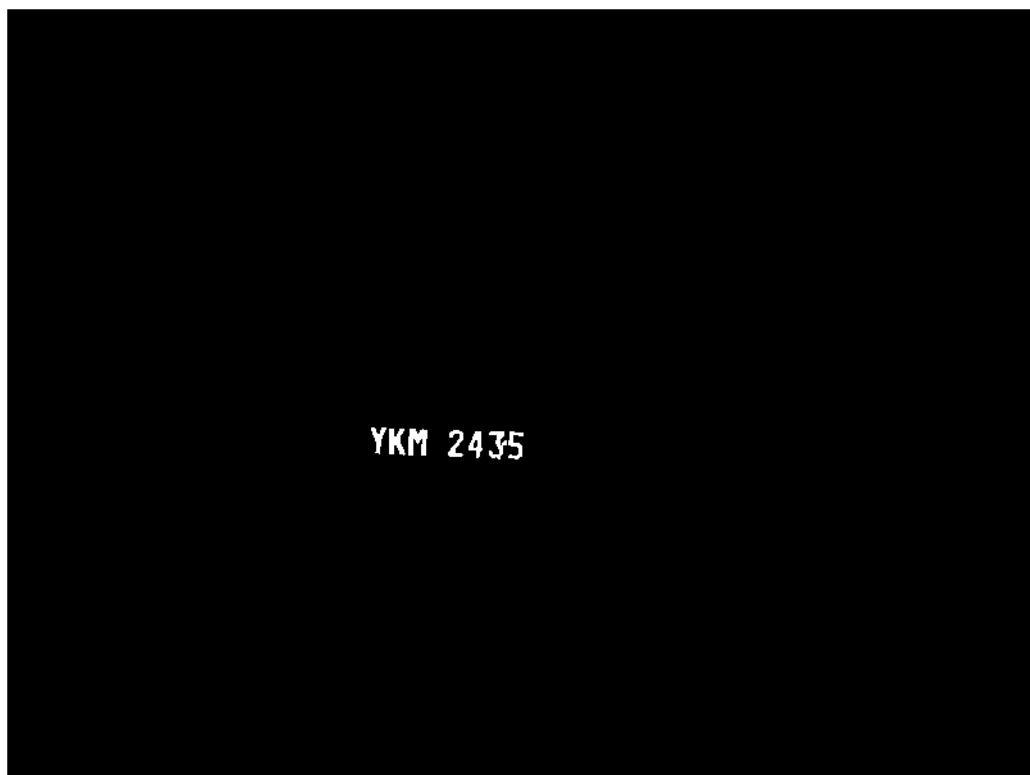
    figure;
    subplot(2,1,1), imshow(imres);
    subplot(2,1,2), imshow(im_nums{k});
    sgttitle(names(k))
end
```





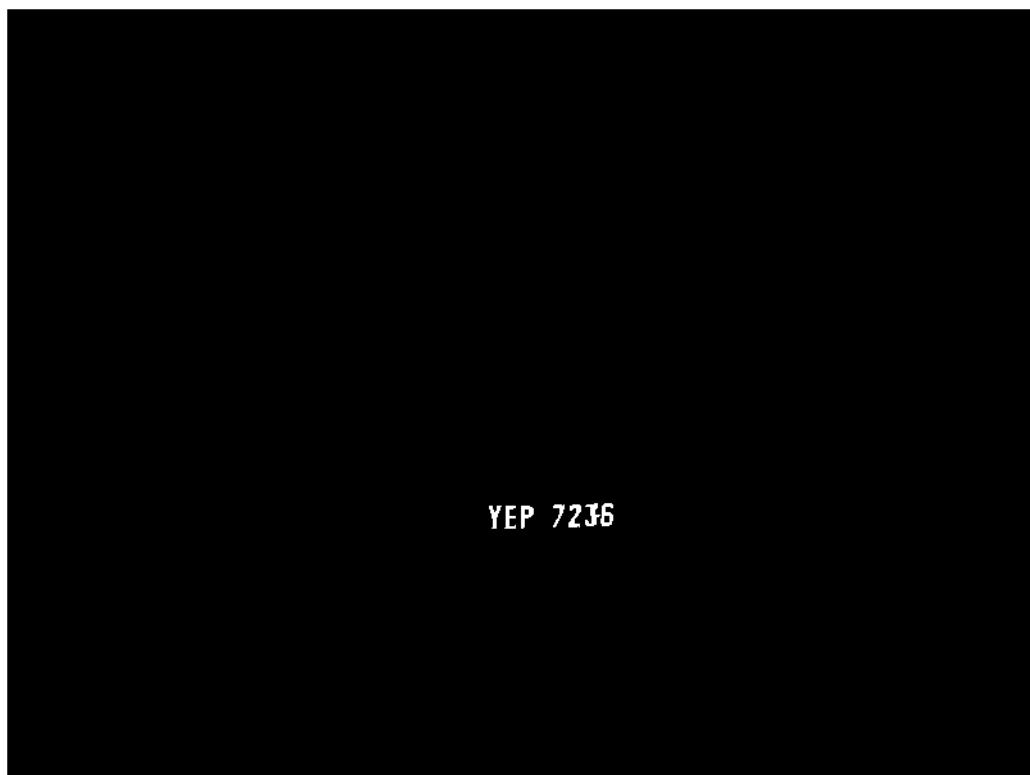
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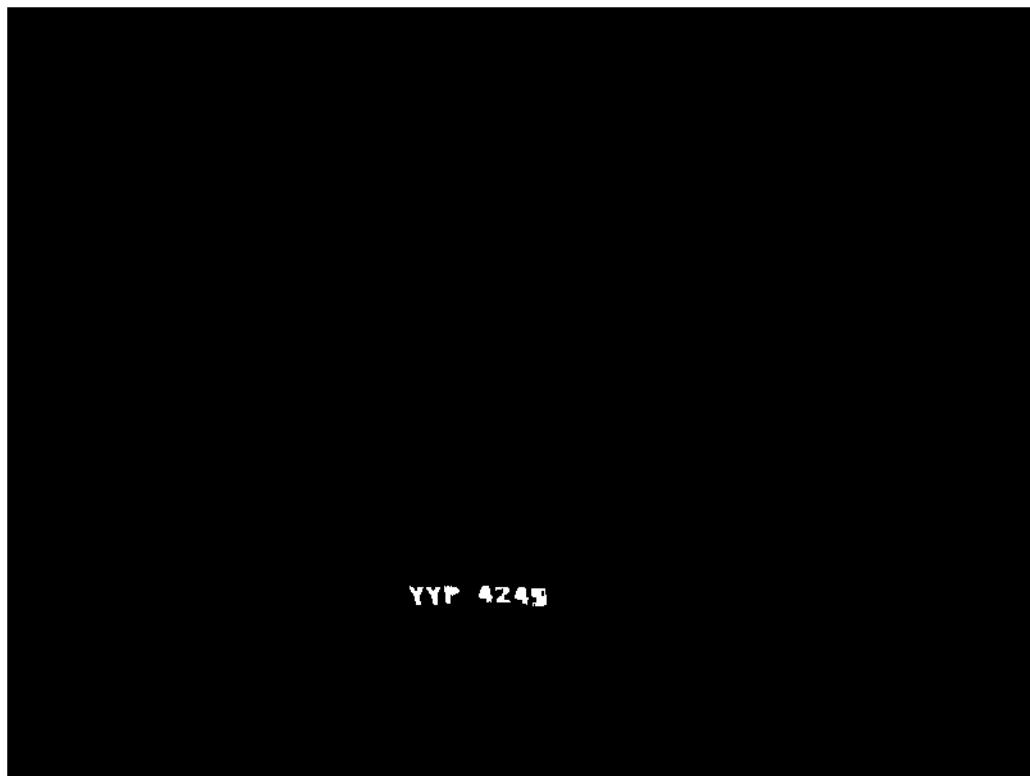
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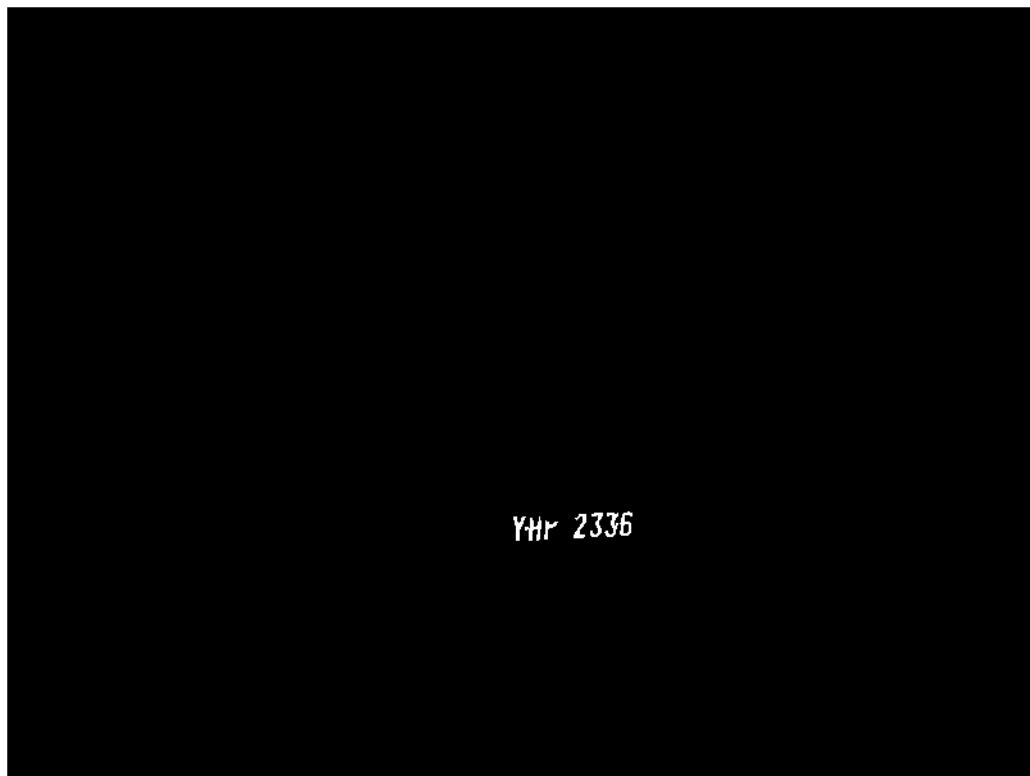
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DSCN0414





DSCN0415





DSCN0416

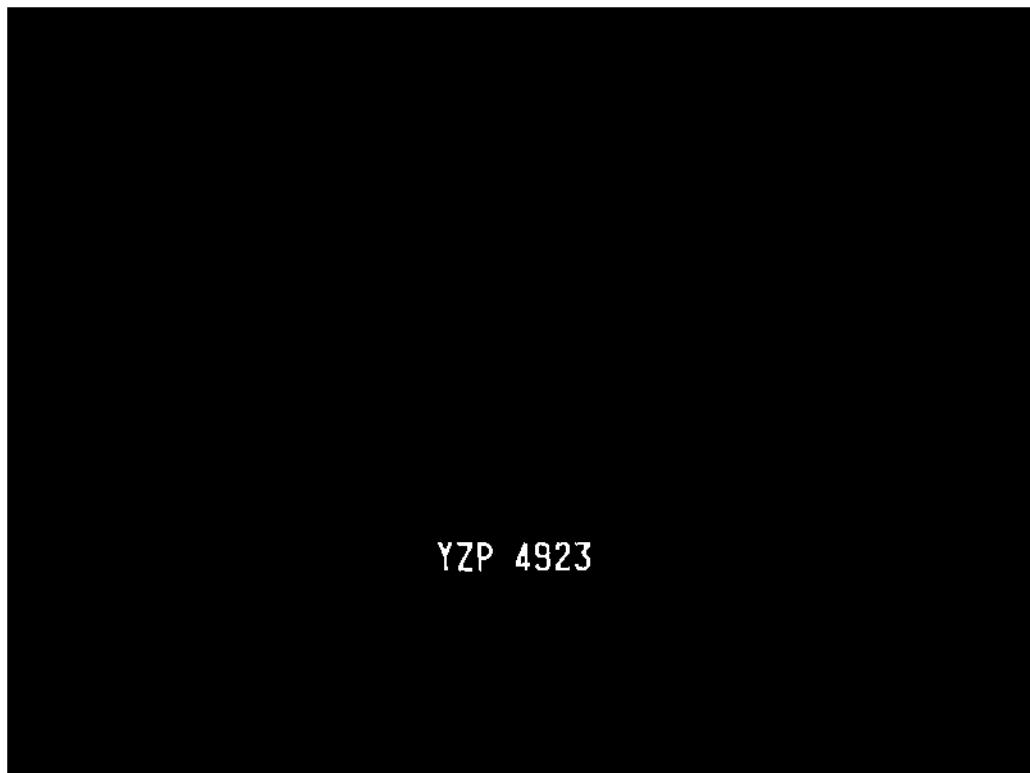




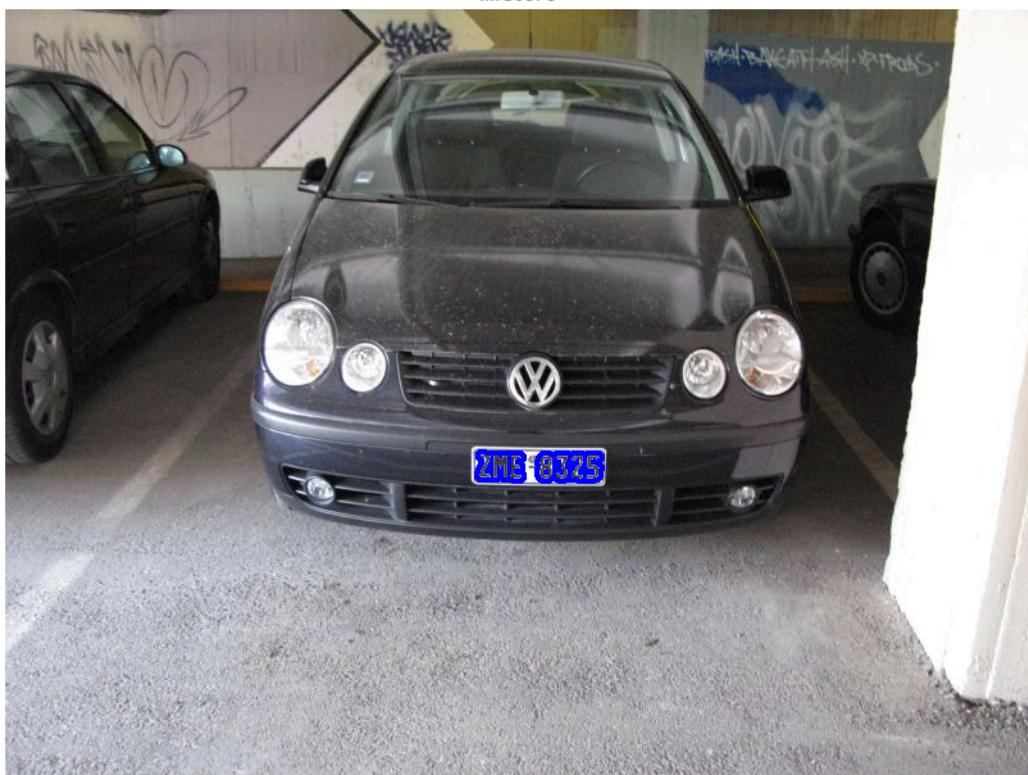
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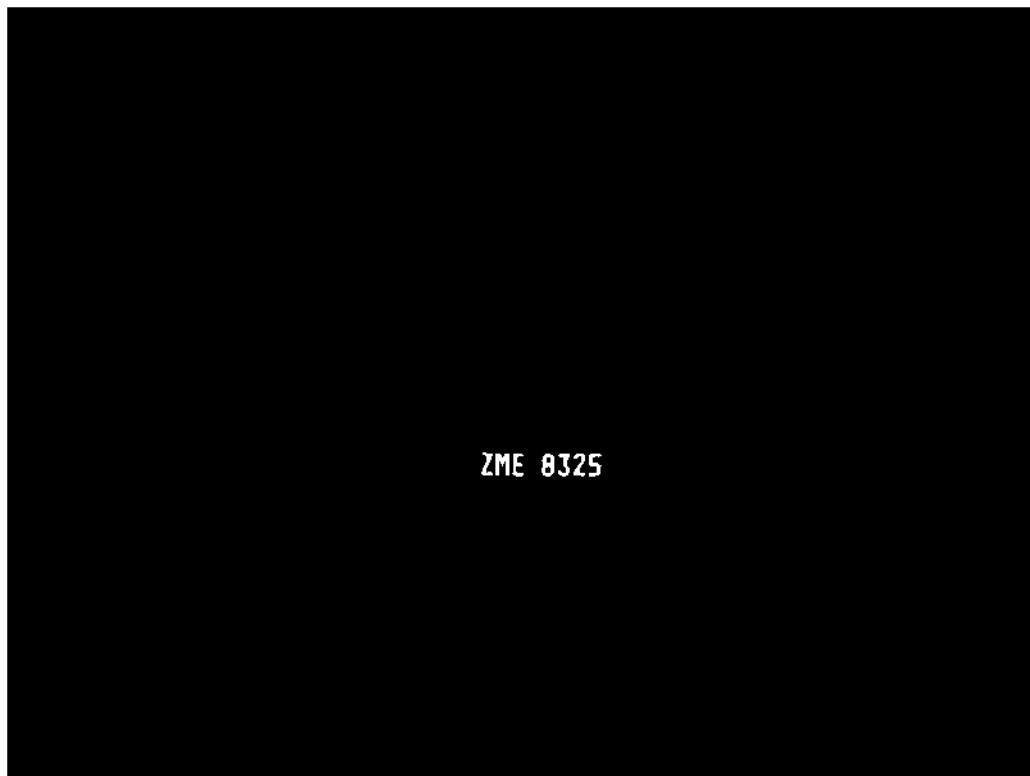
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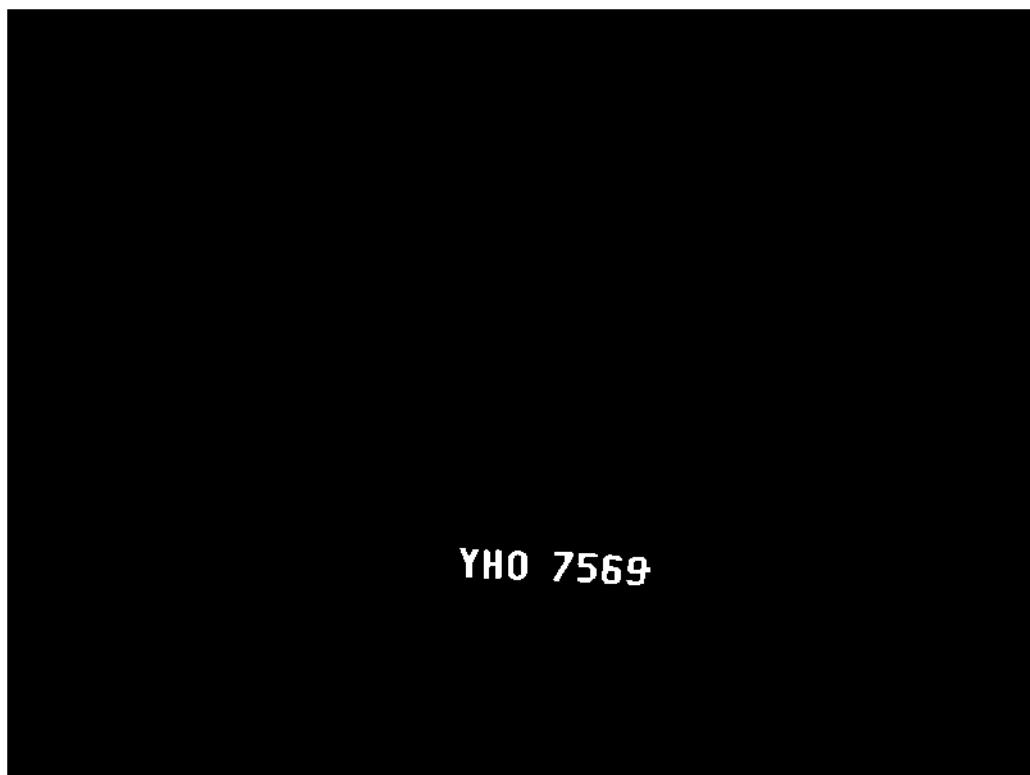
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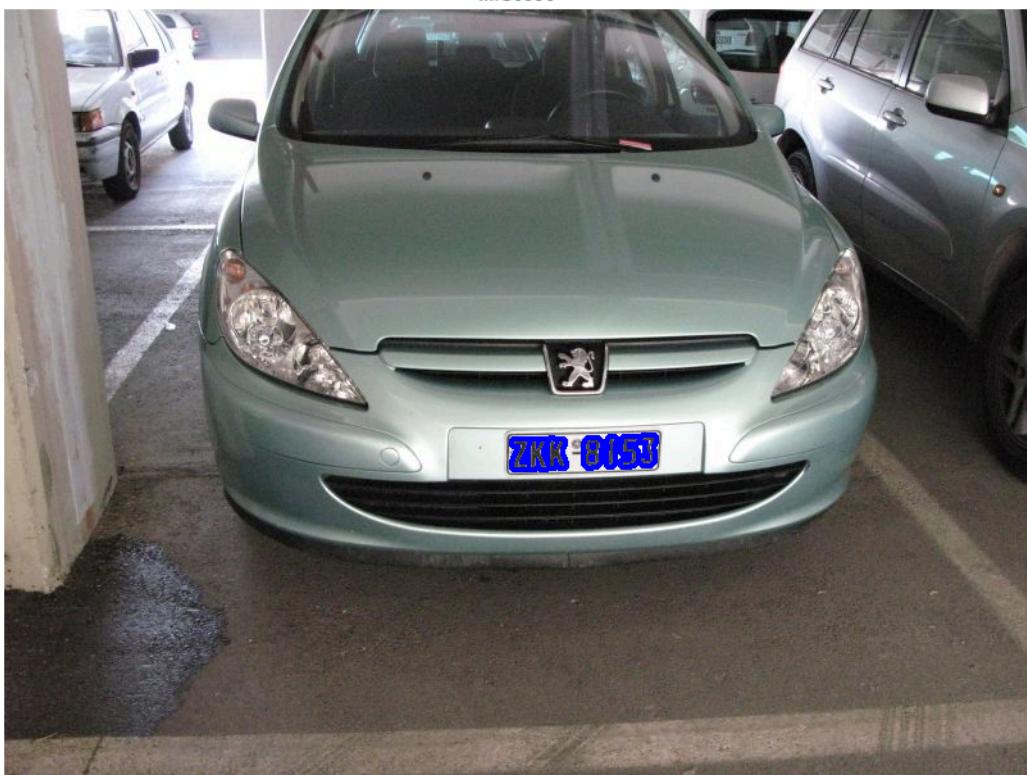


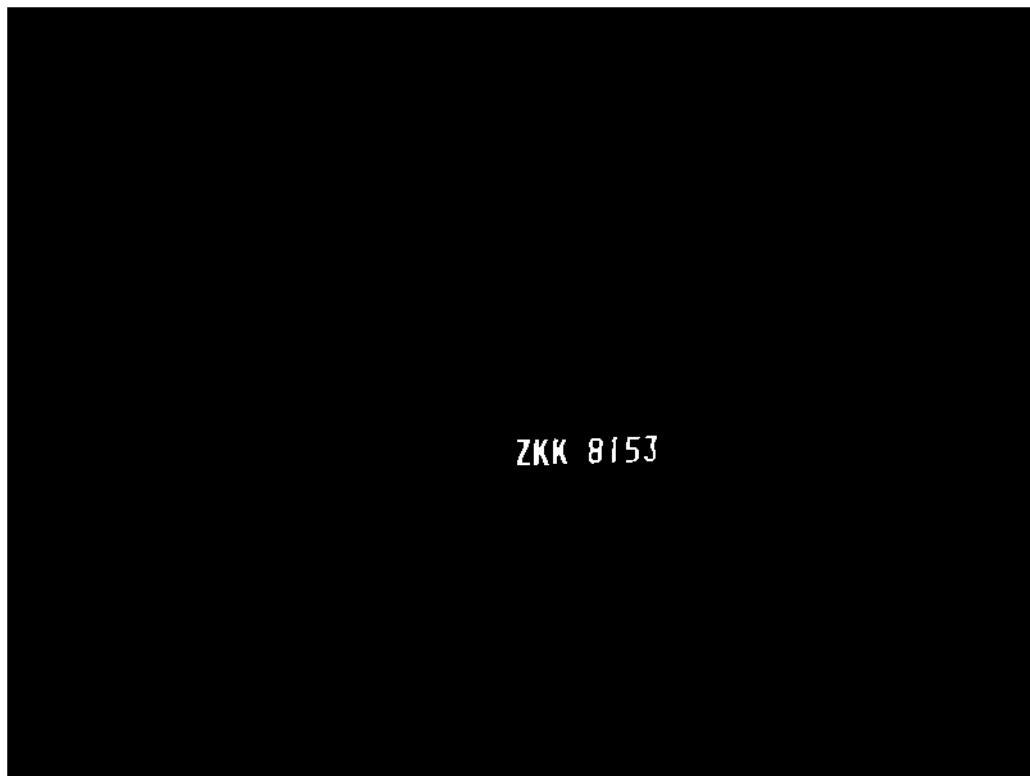
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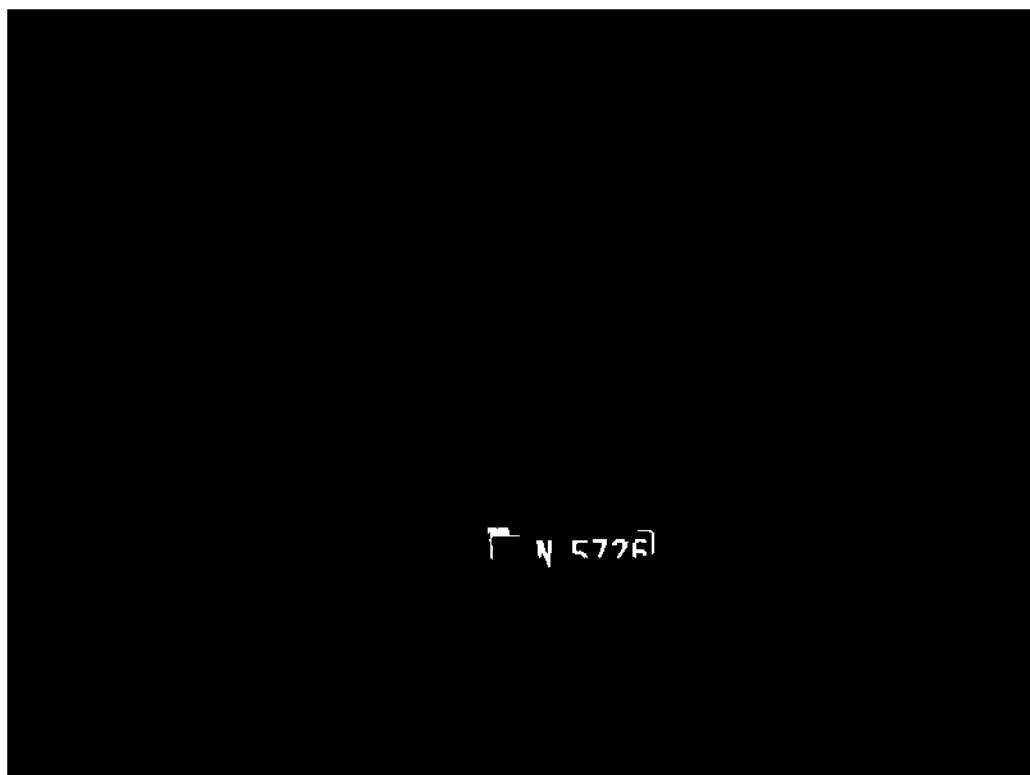
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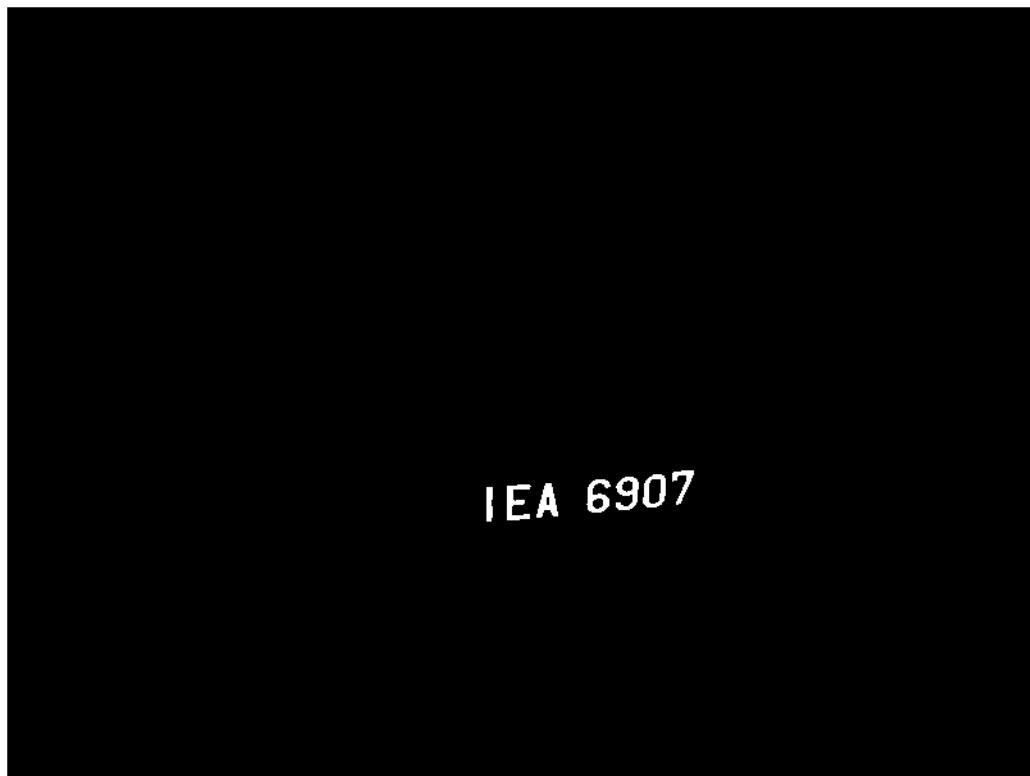
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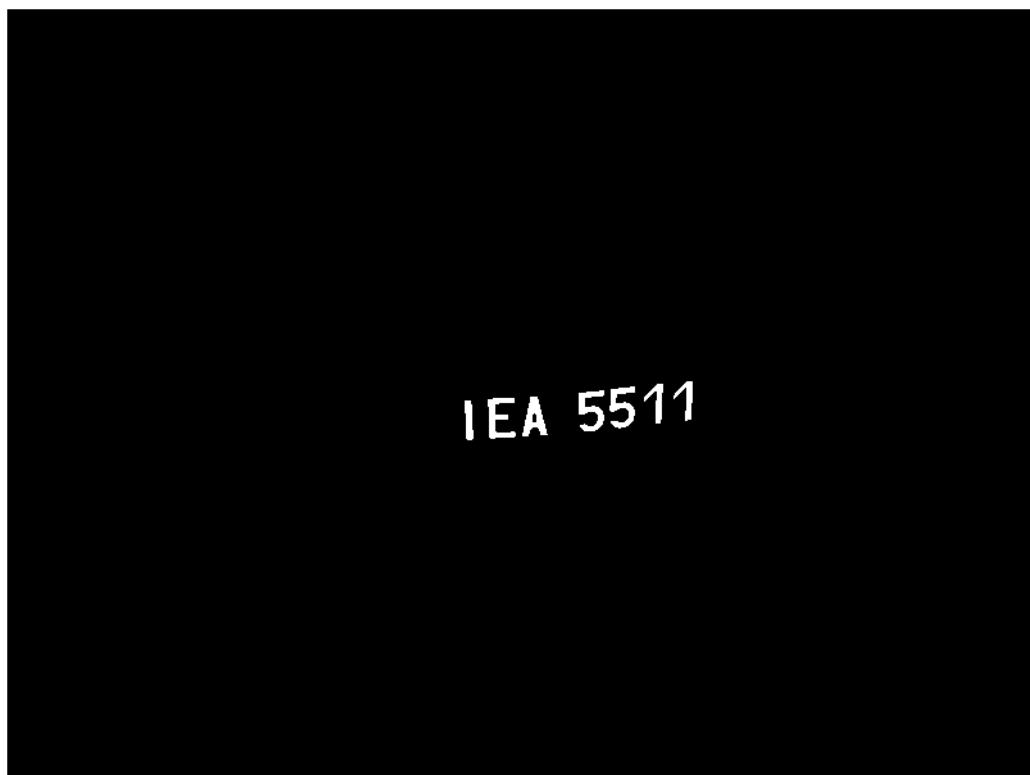
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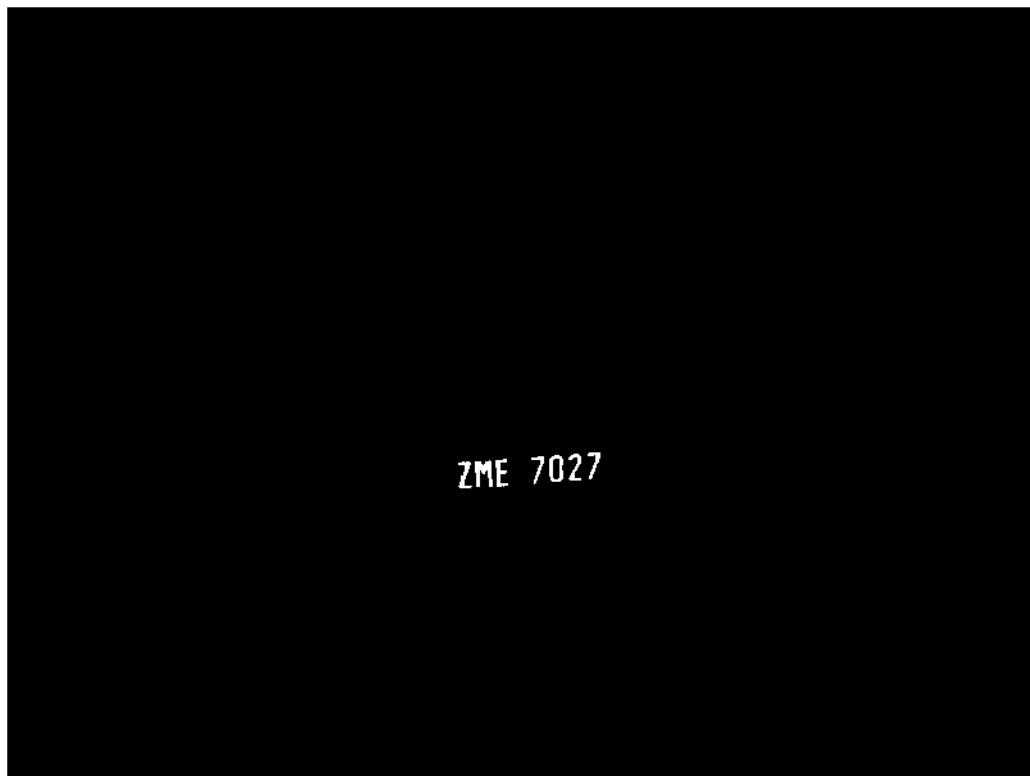
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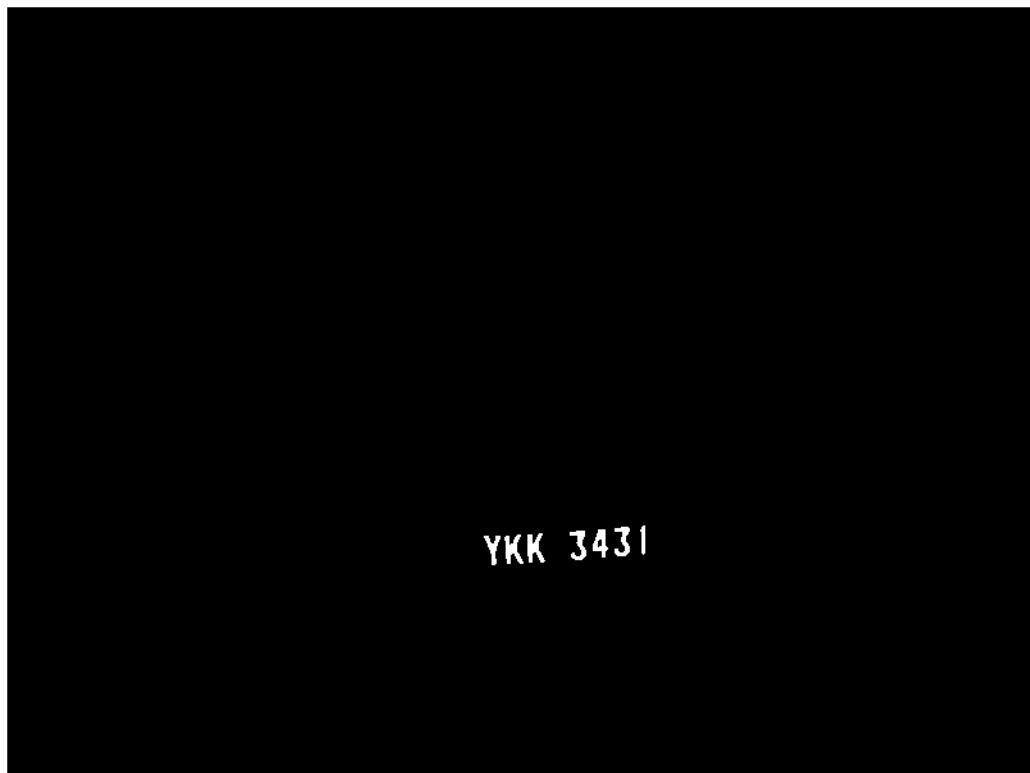
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IMG0386





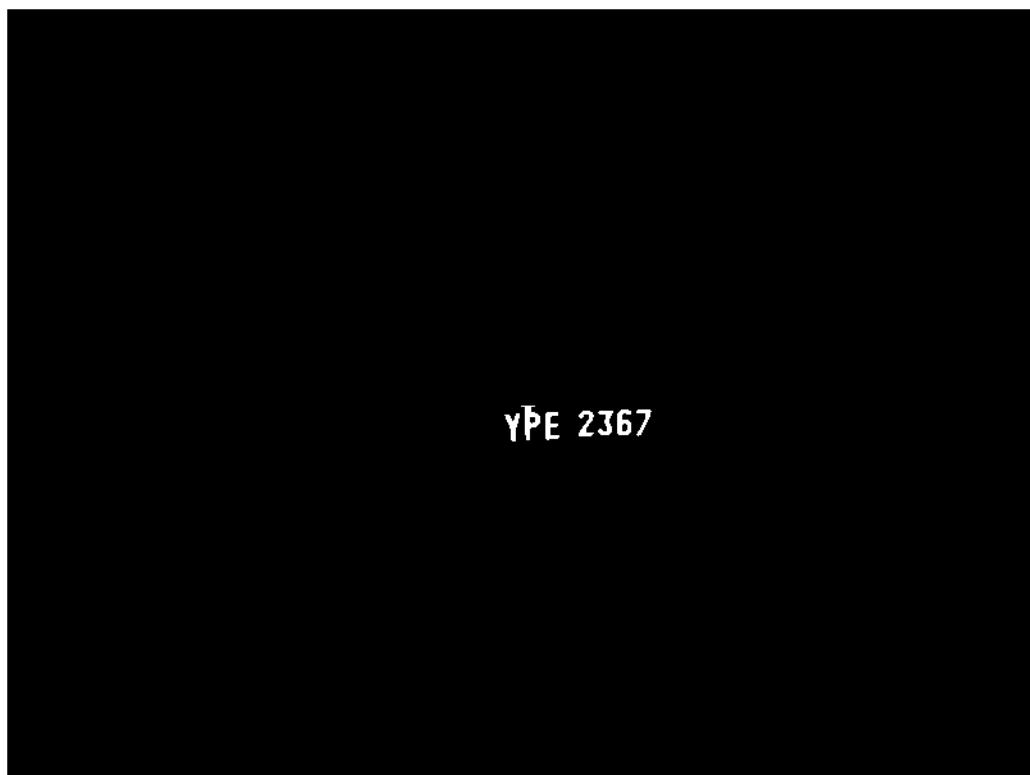
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IMG0388





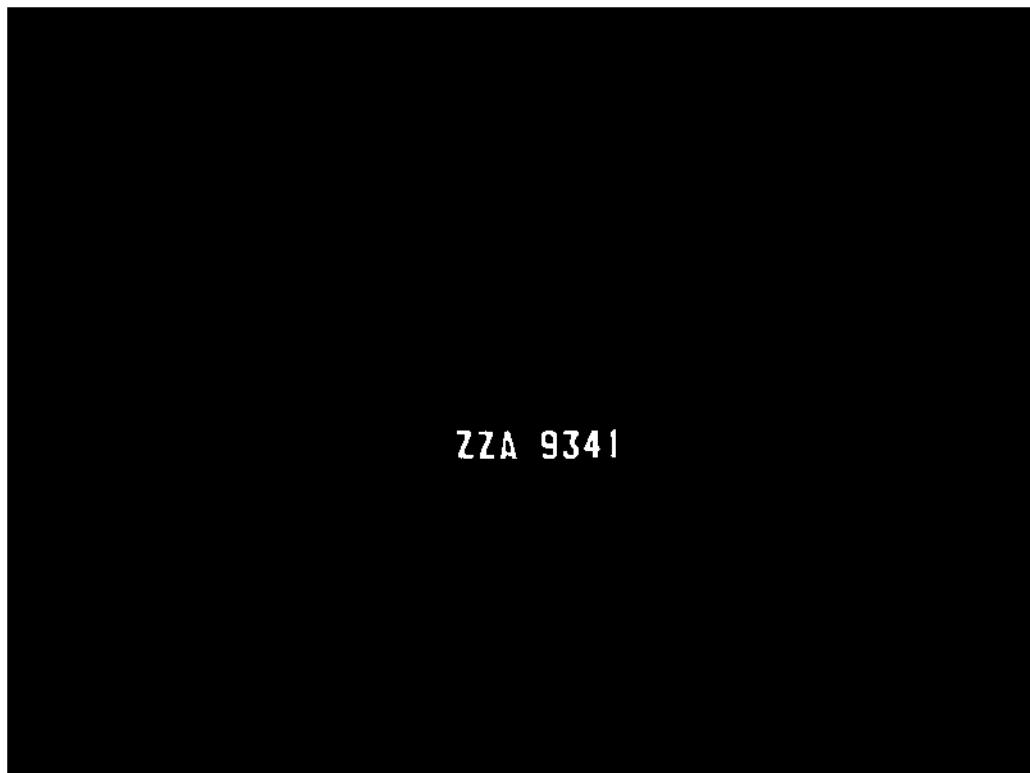
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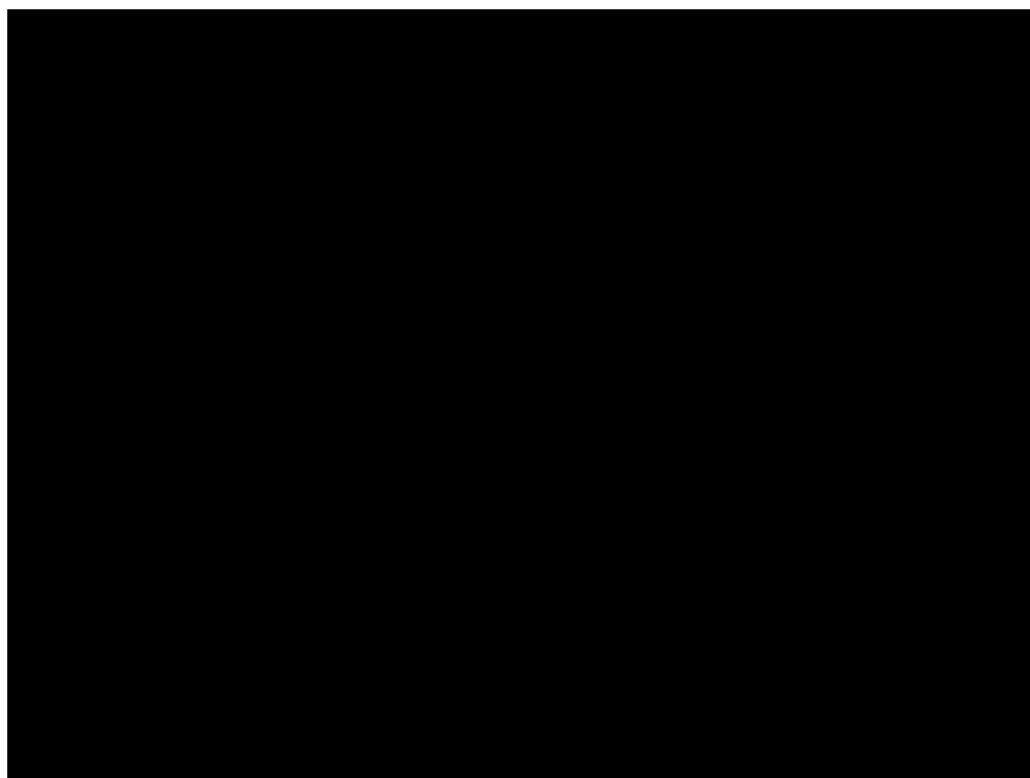
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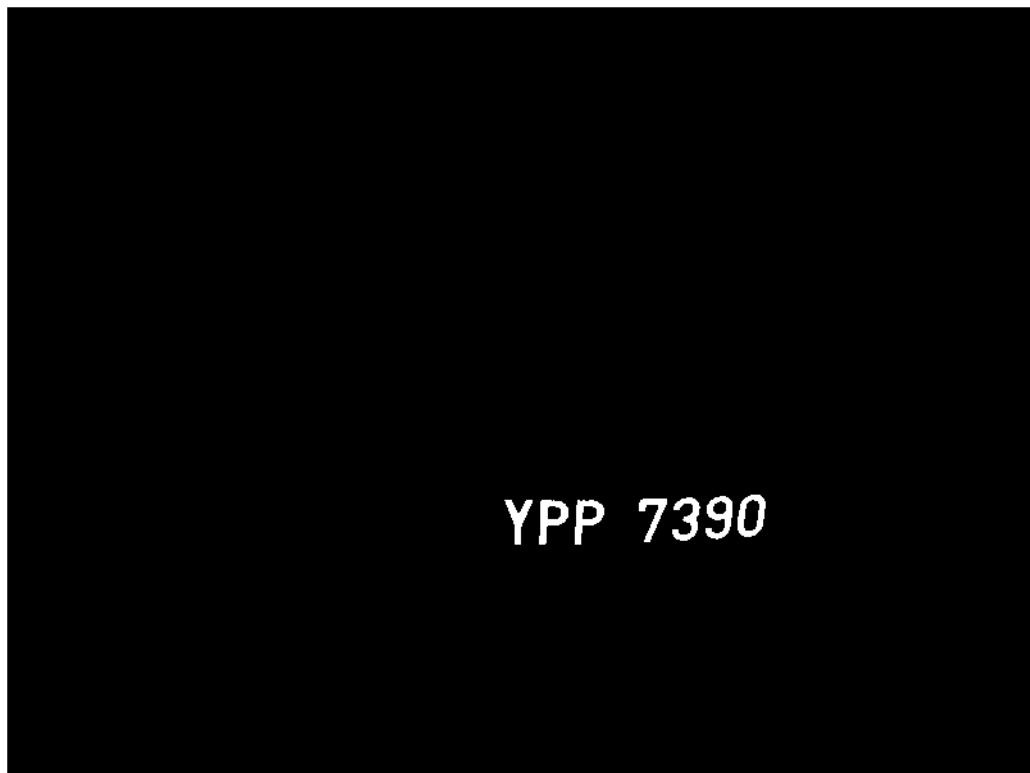
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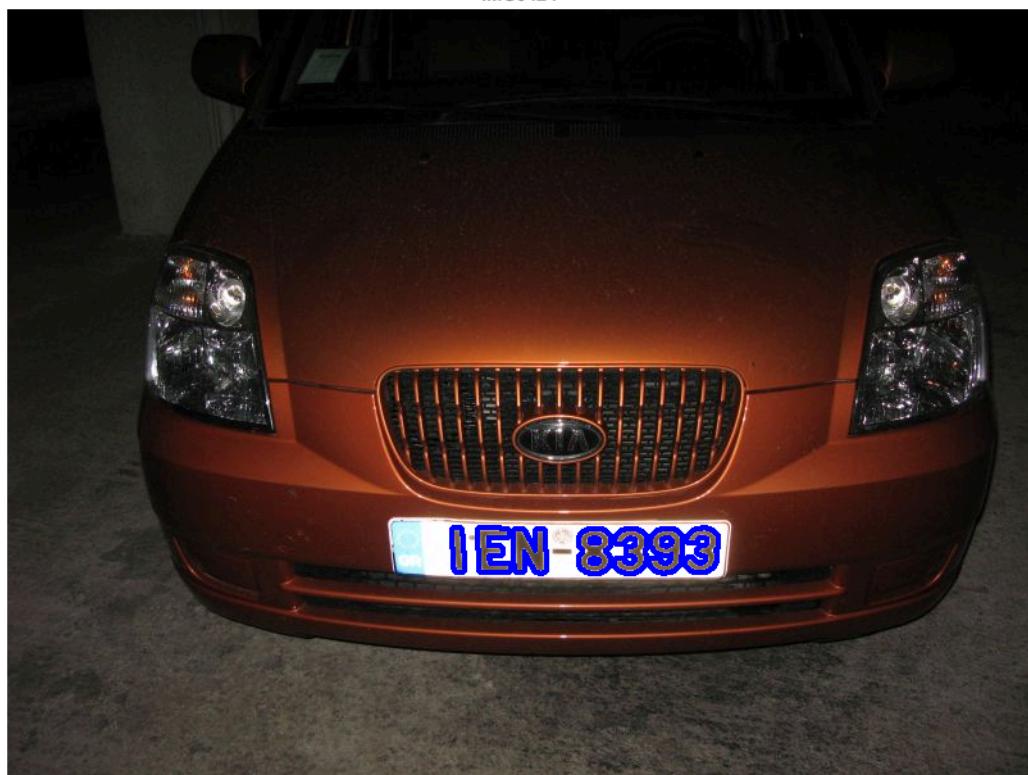


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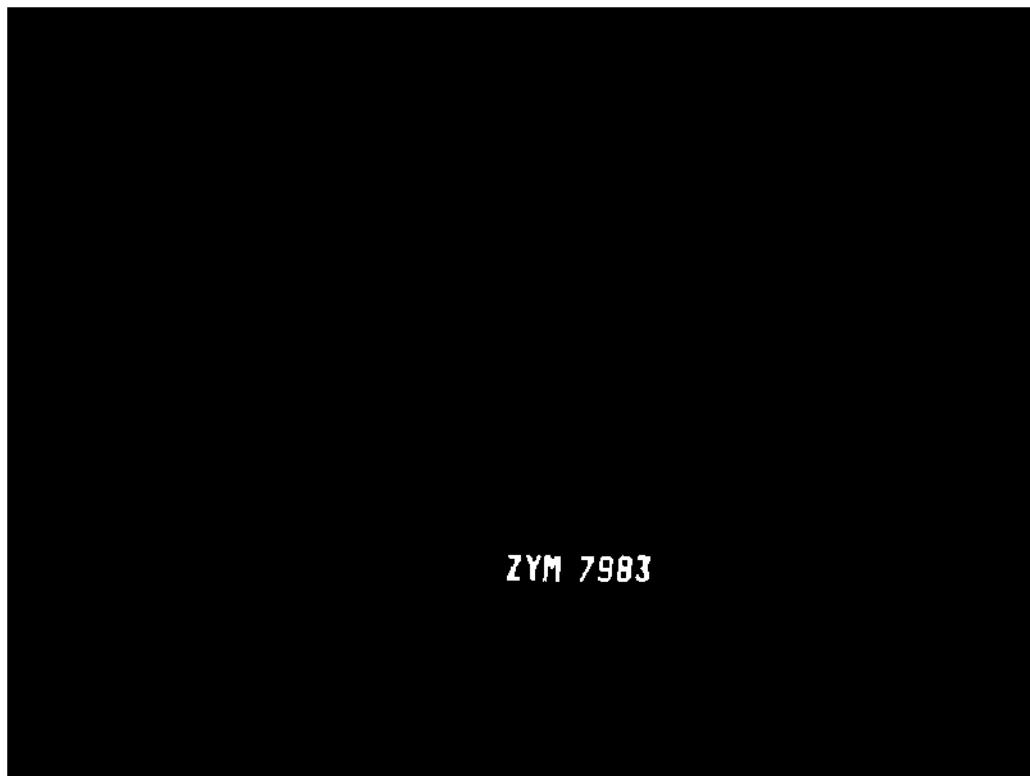




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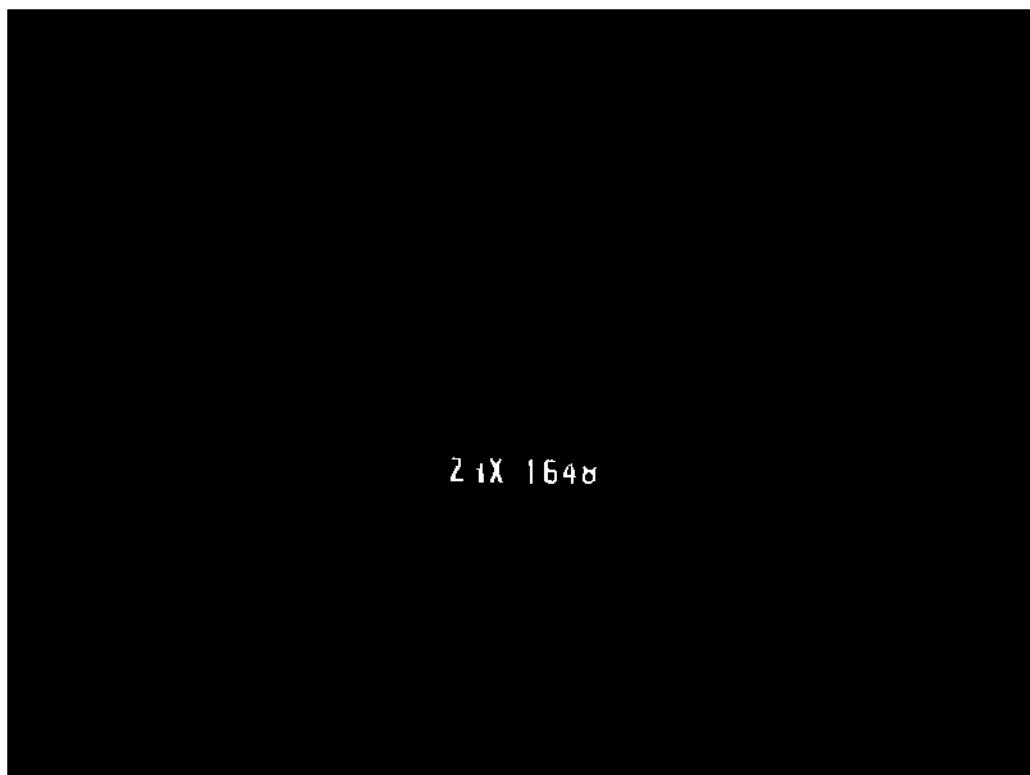
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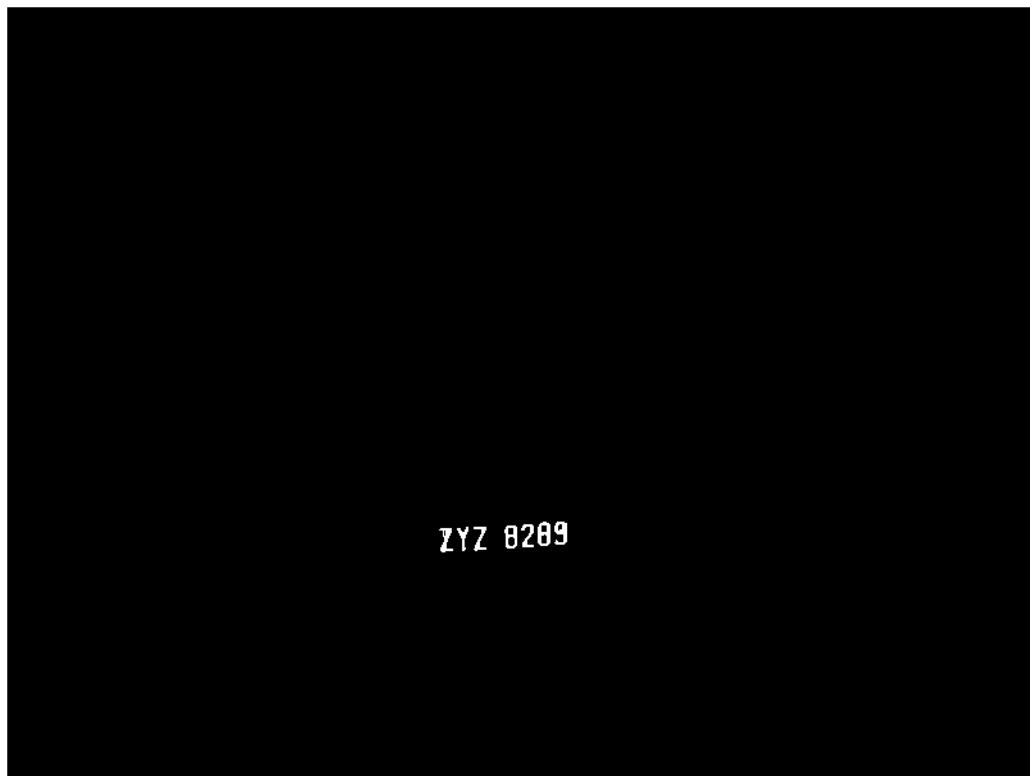
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IMG0453





IMG0454





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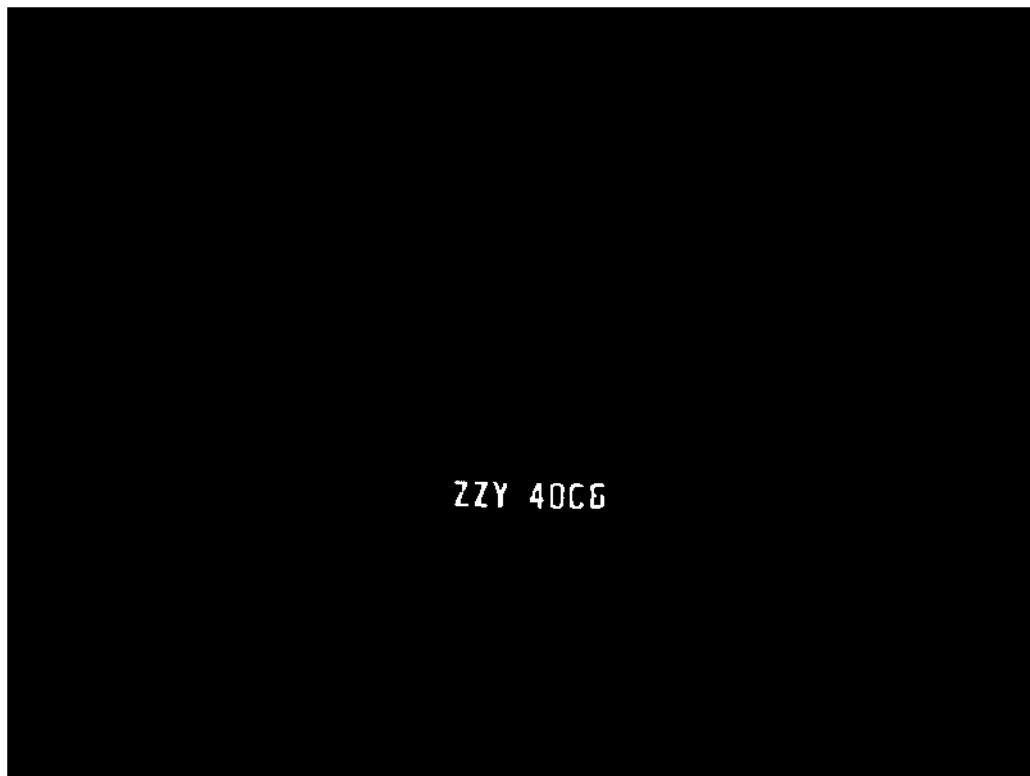
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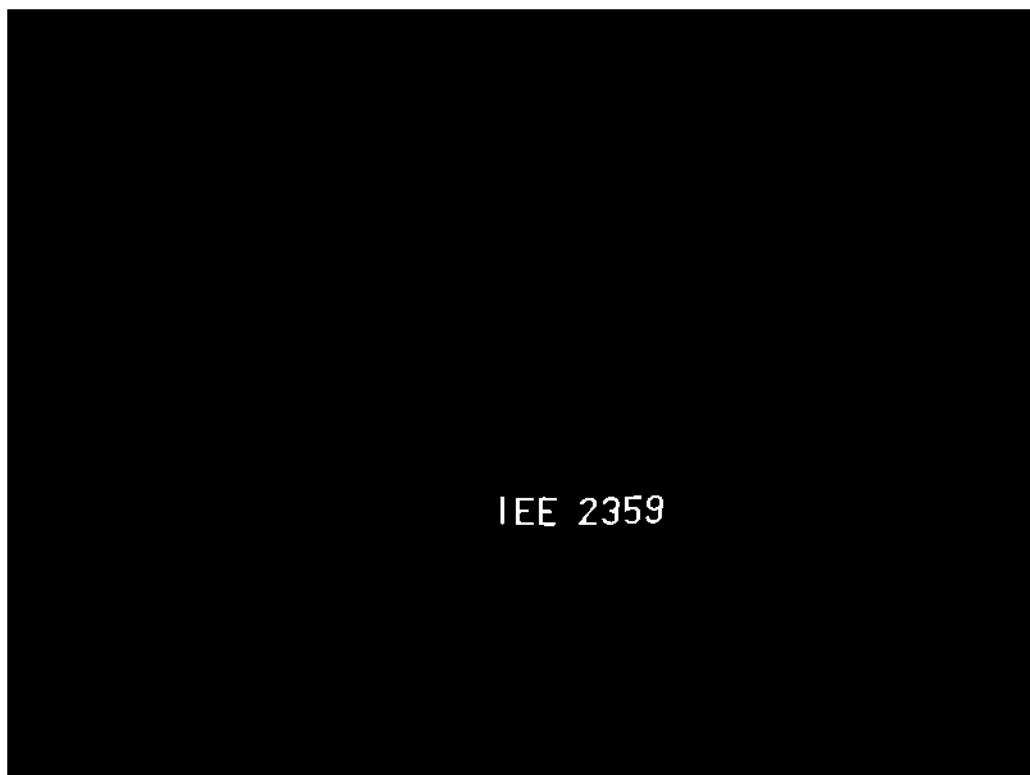
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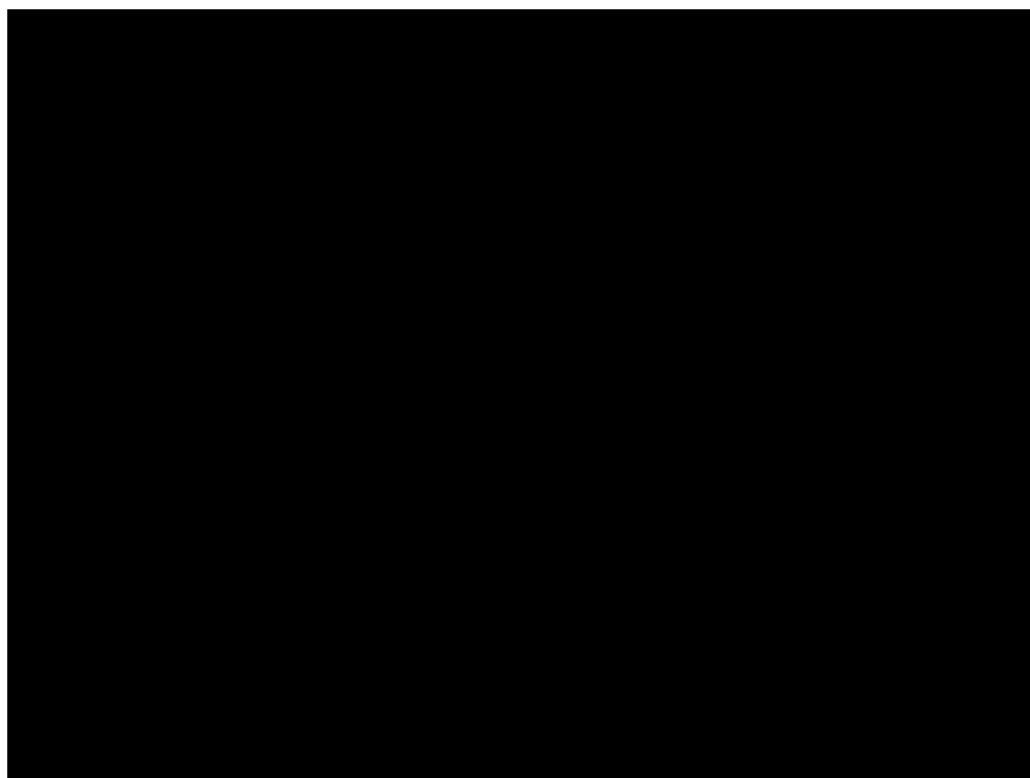
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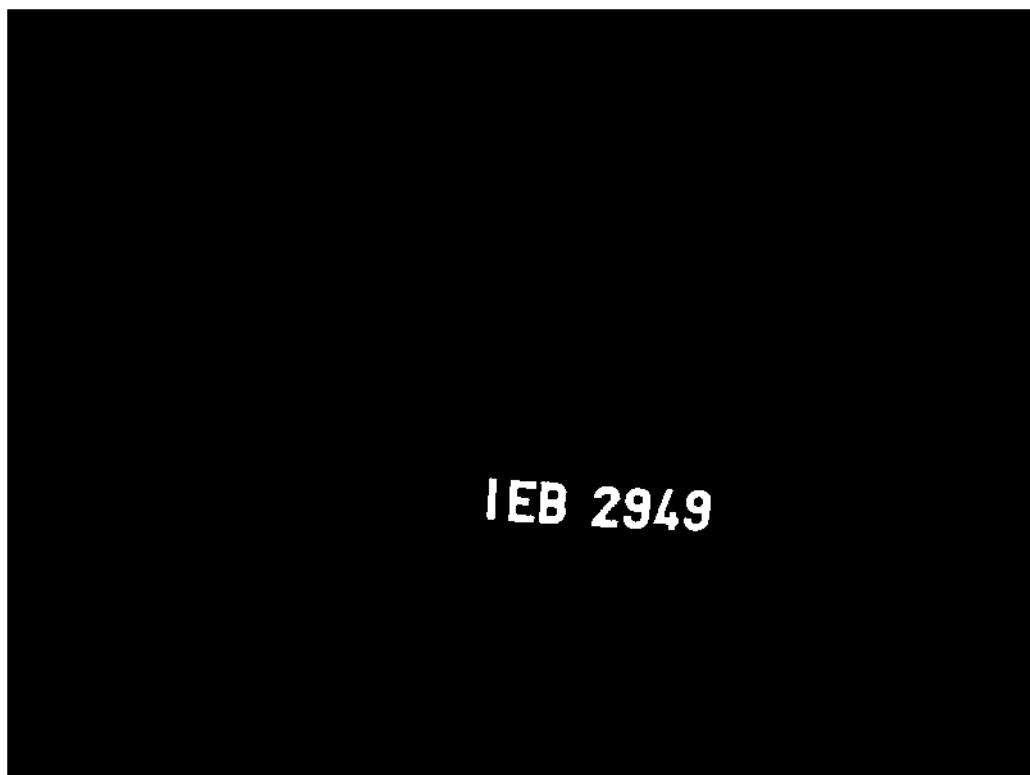
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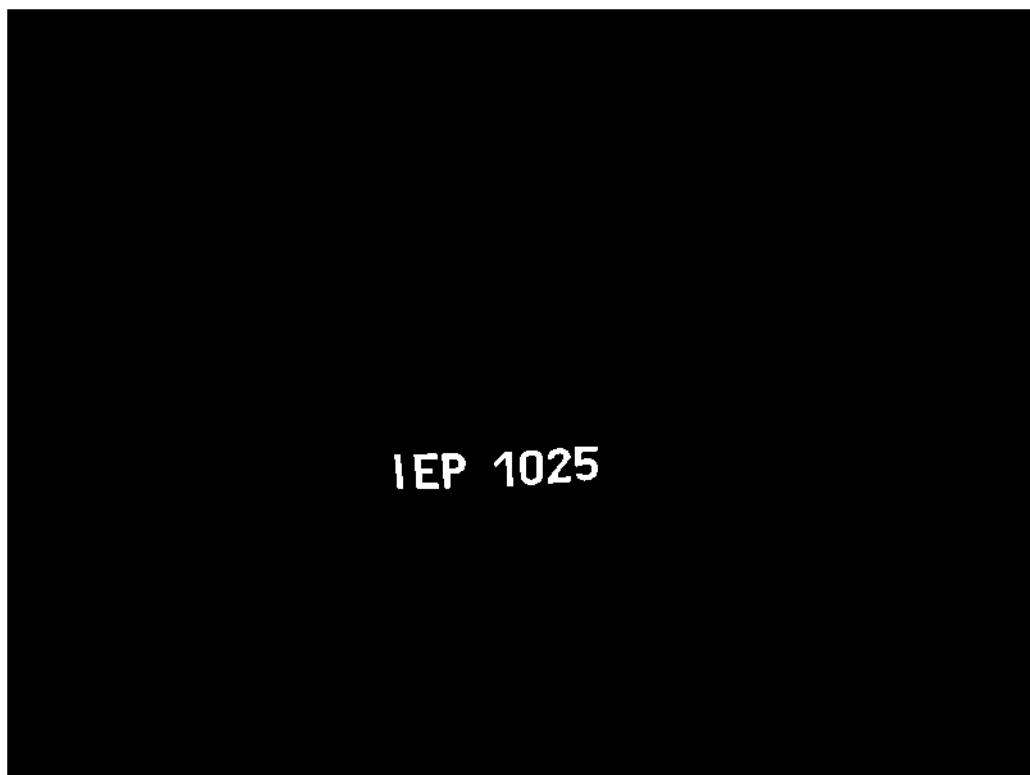
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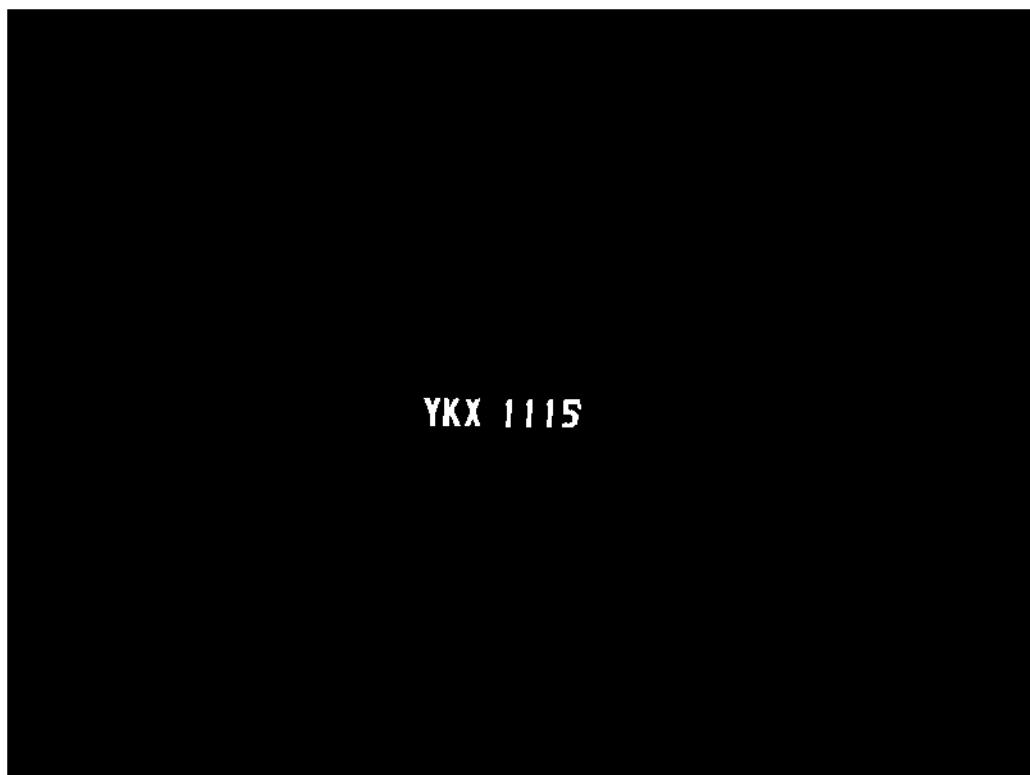
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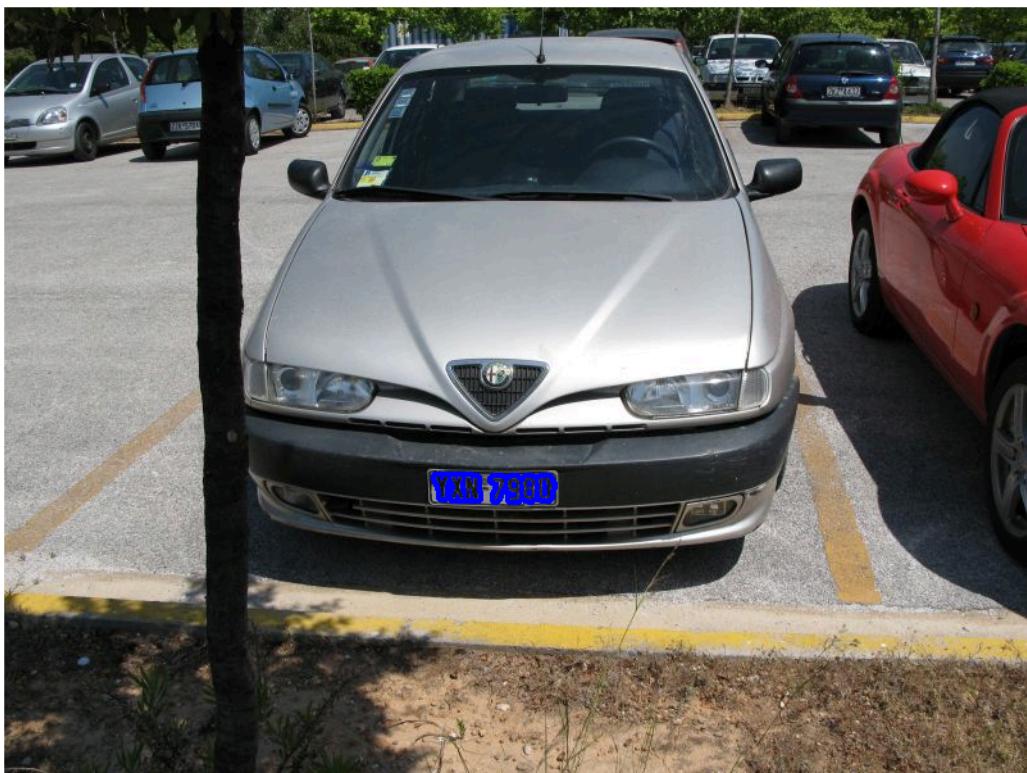
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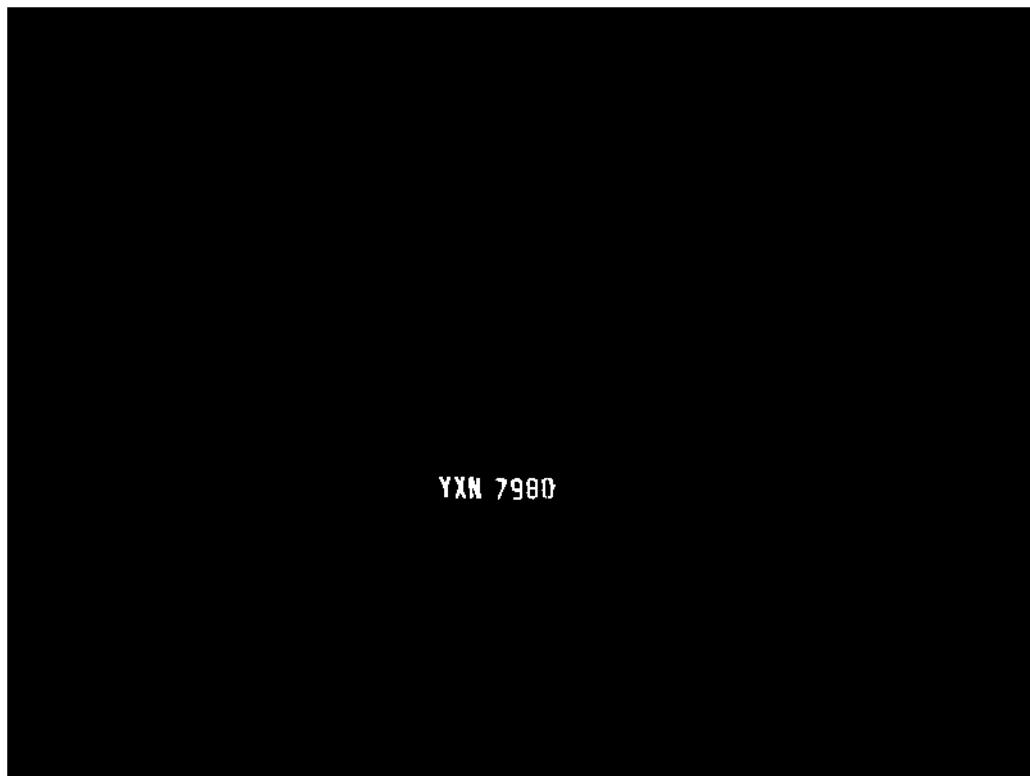




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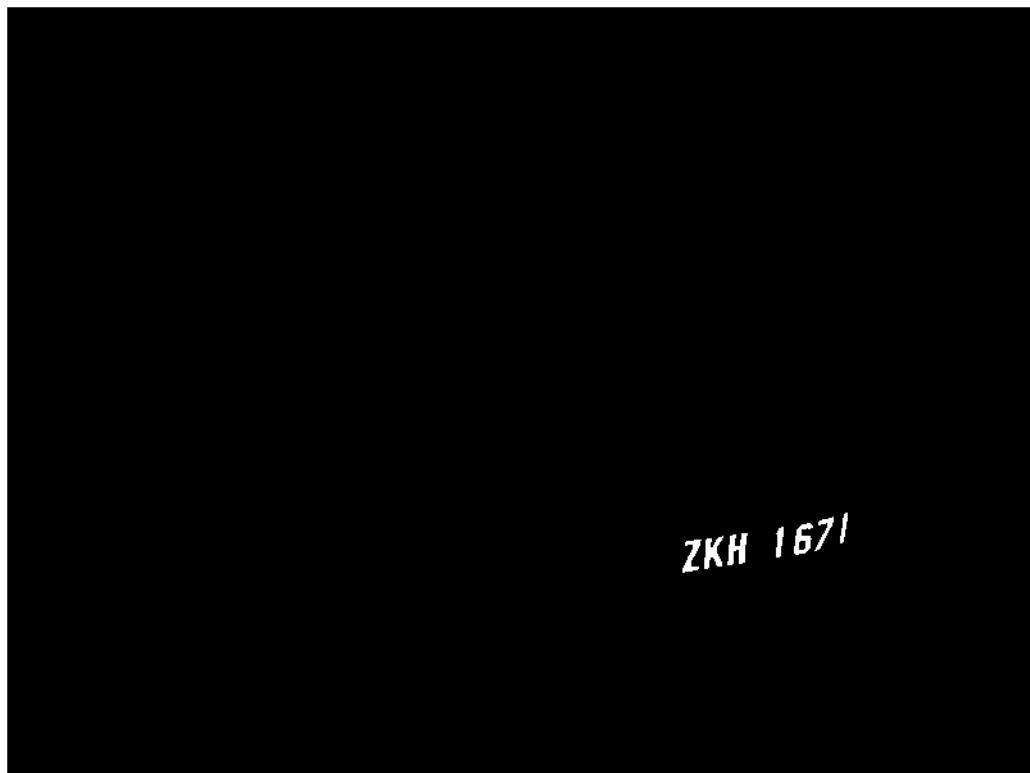
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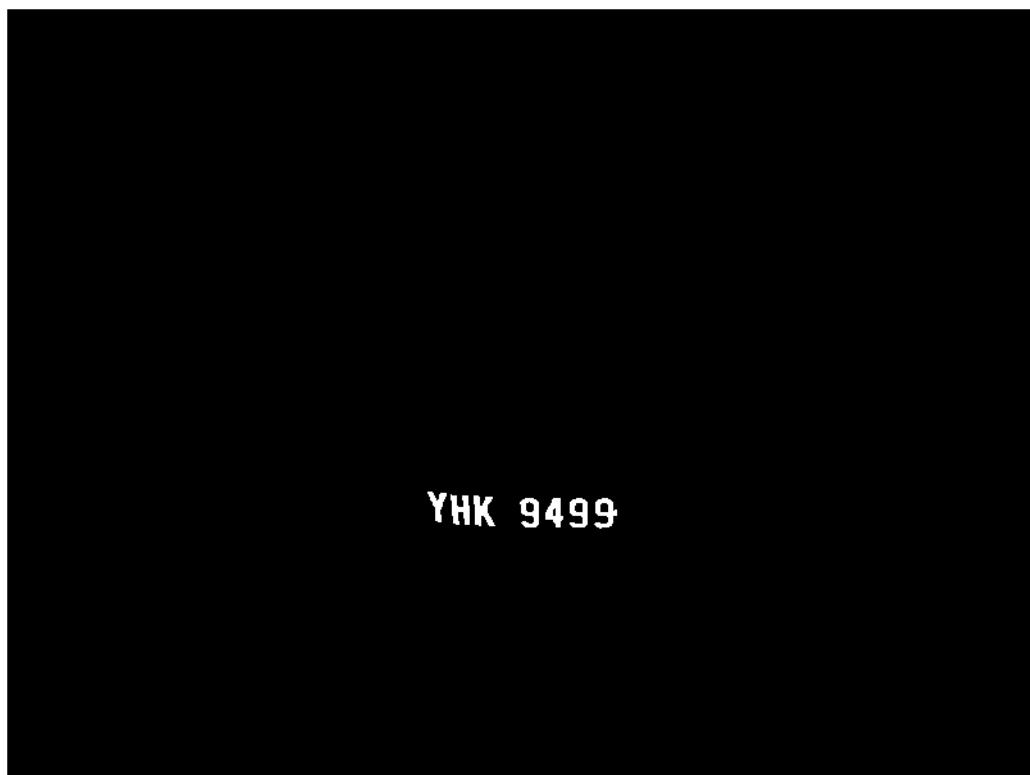
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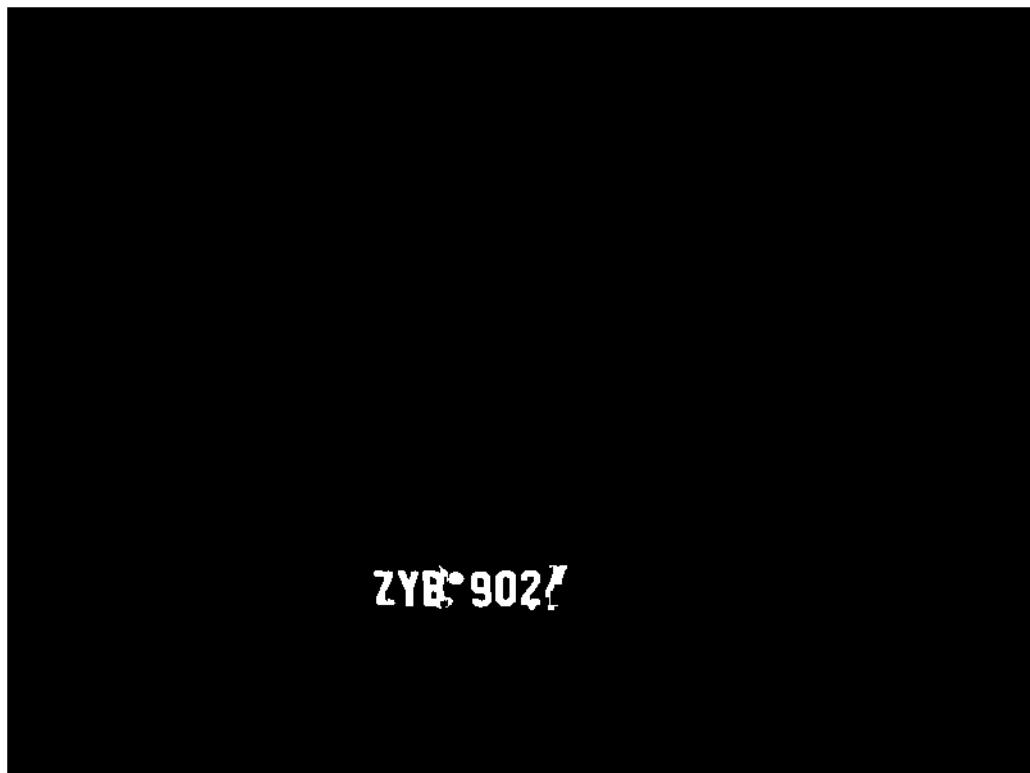
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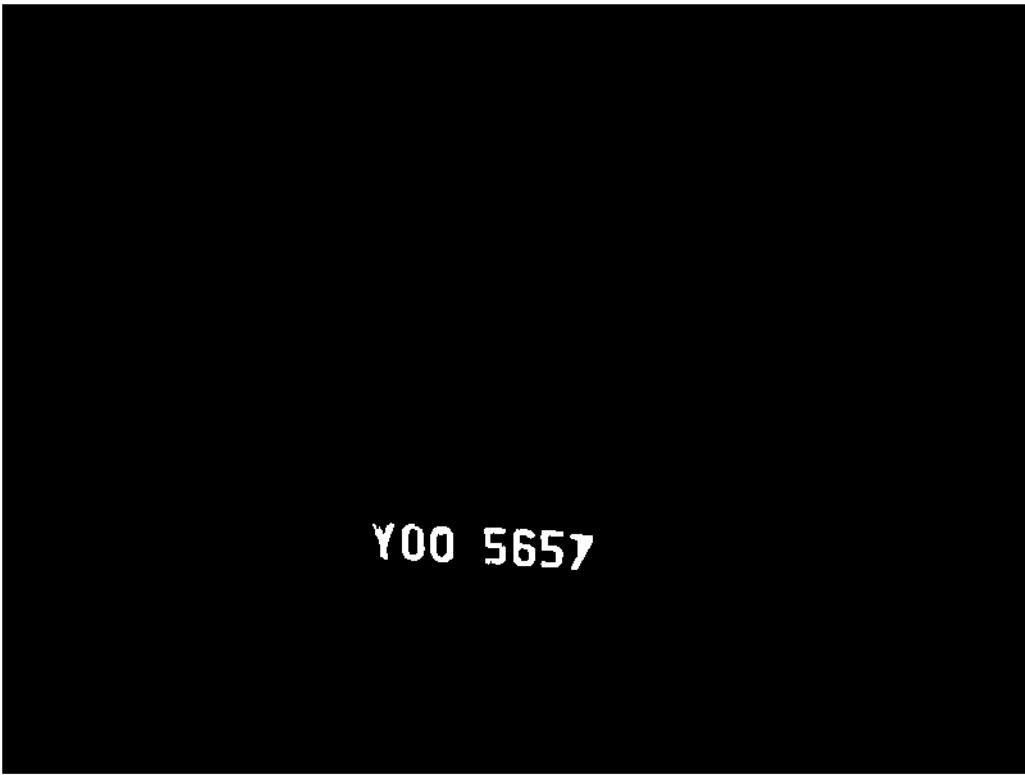
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IMG0472





YOO 5657

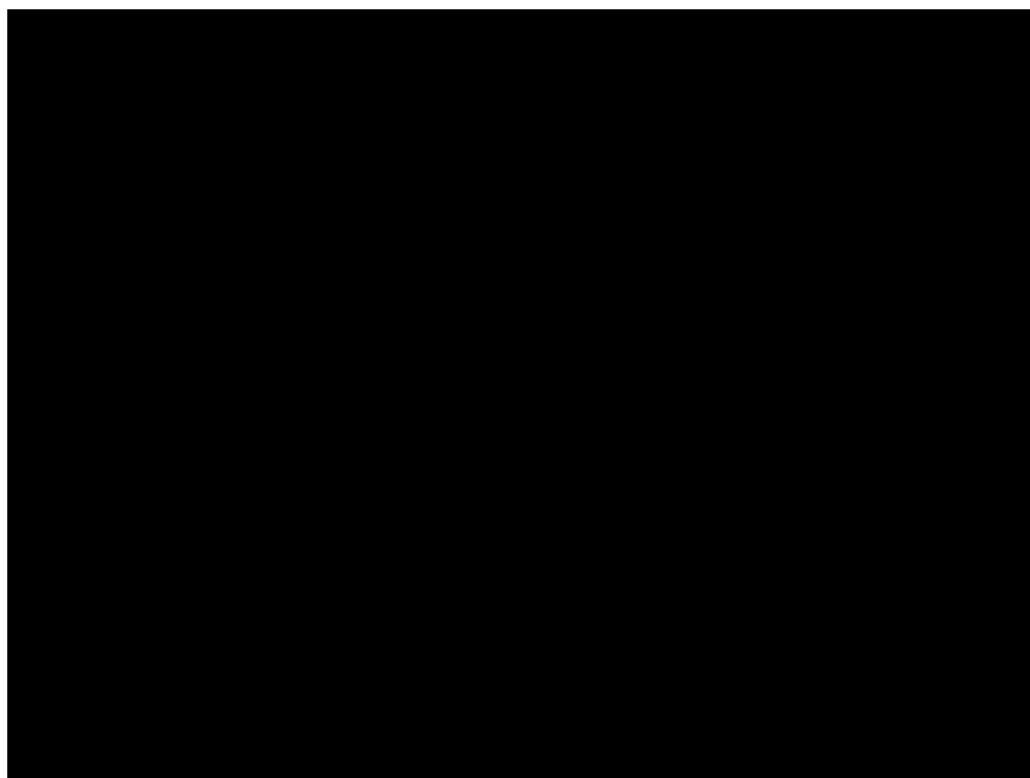
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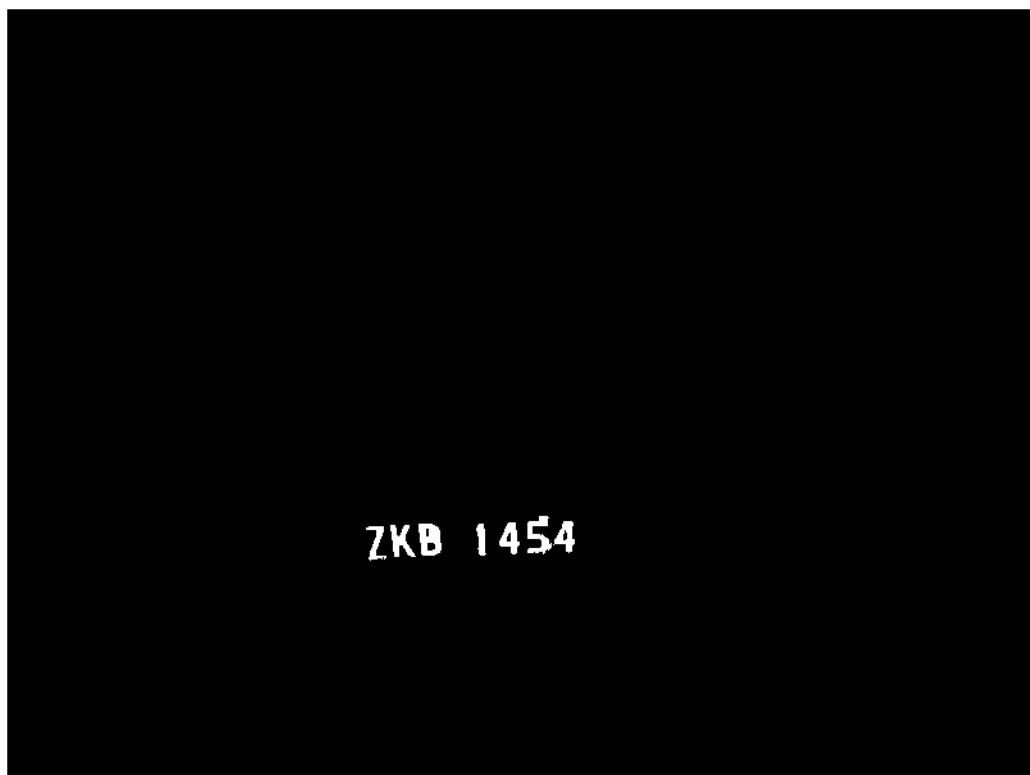
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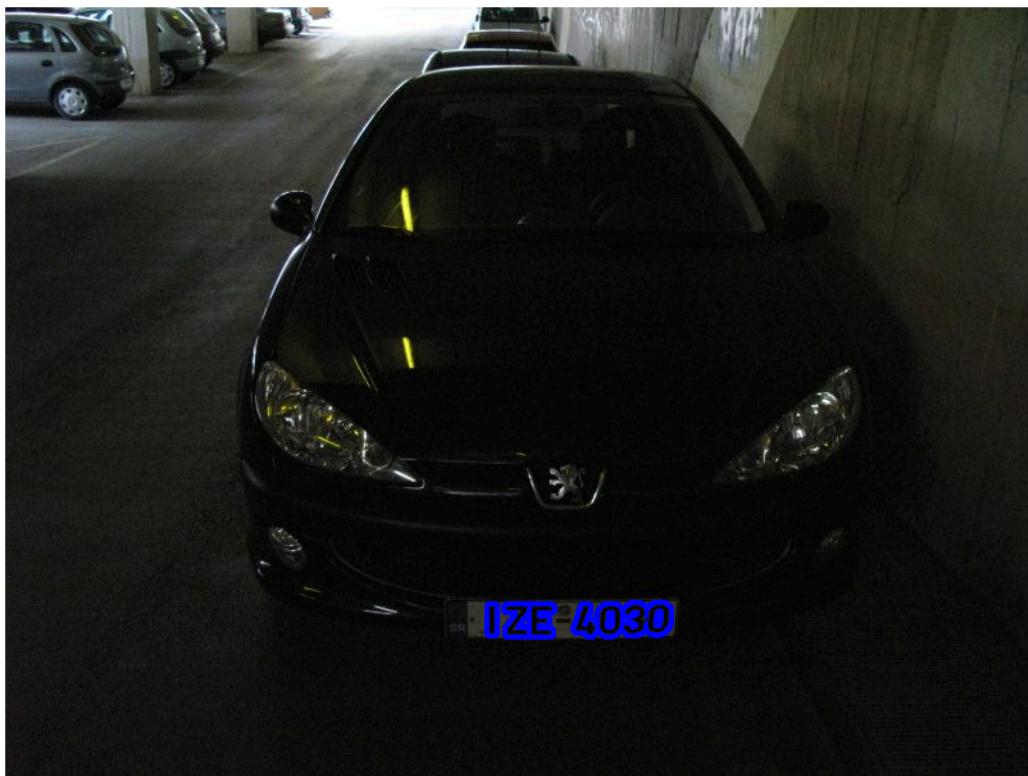
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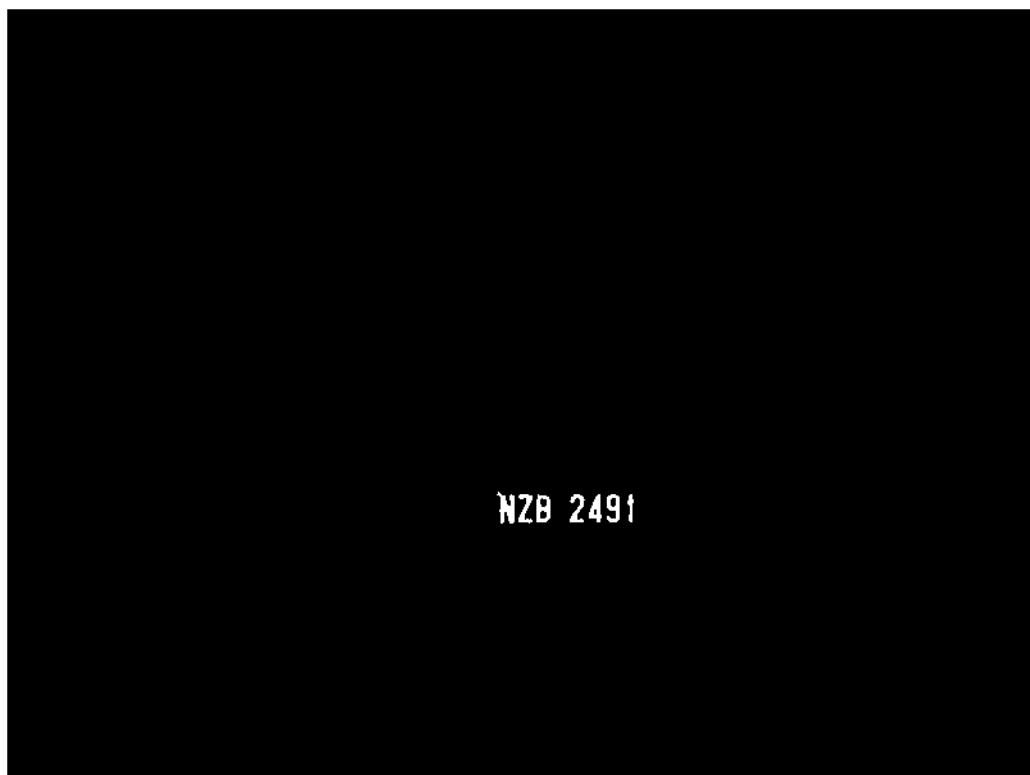
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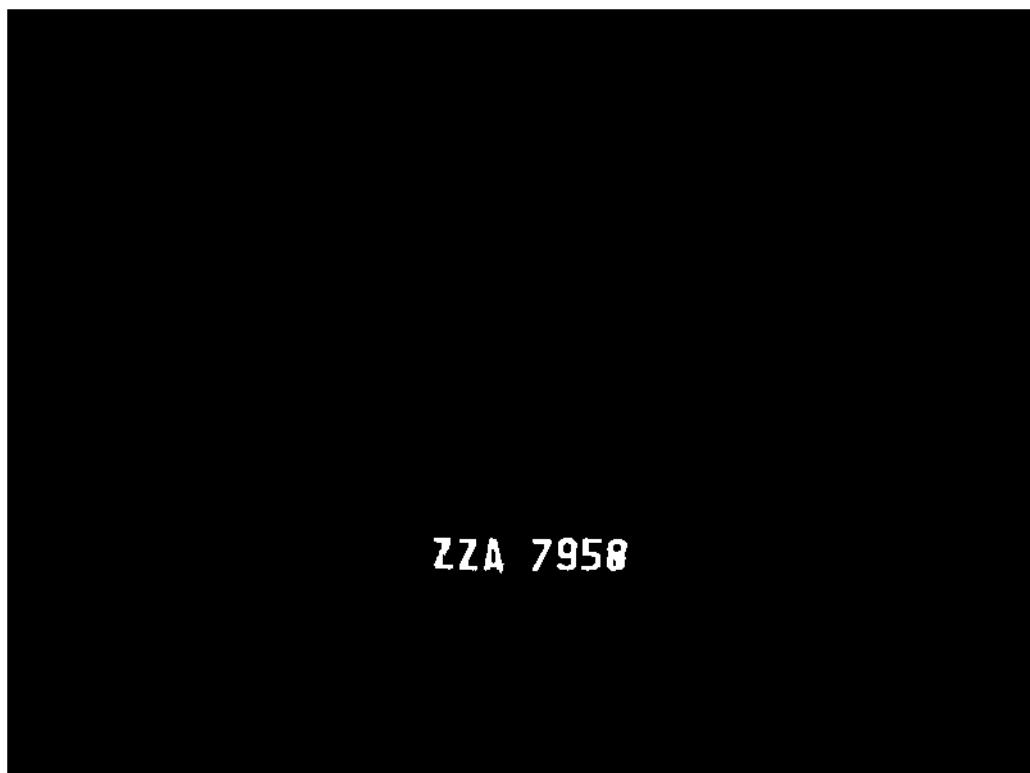
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