# Signal CA2

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1)

It is just kind of an approach for checking similarities that may be in diffrent times.

2)

row1, col1 size of the first matrice and row2, col2 is for the second one.

Corr(k, l) = sigma from i = 1 to i = row(sigma (j = 1 to j = col)    mat1(i, j) * mat2(i - k, j- l))

when i - k or j - l becomes negative we consider it as -1

3)

first we calculate the correlation between our matrice with any other matrice in dataset then one which its maximum  value is maximum could be the matrice answer because by some shifting the simiarity become higher.

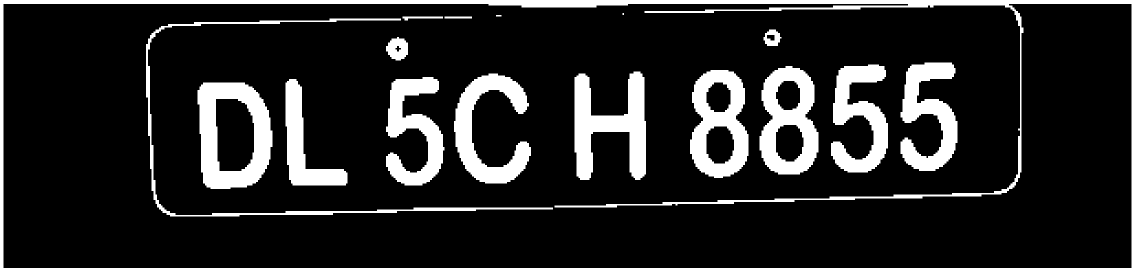
```
close all
clear
clc
plateArrC = openPlate();
```

Picture also has been shown after each operation in pipeline.

```
plateArrM = rgb2Bw(plateArrC);
```

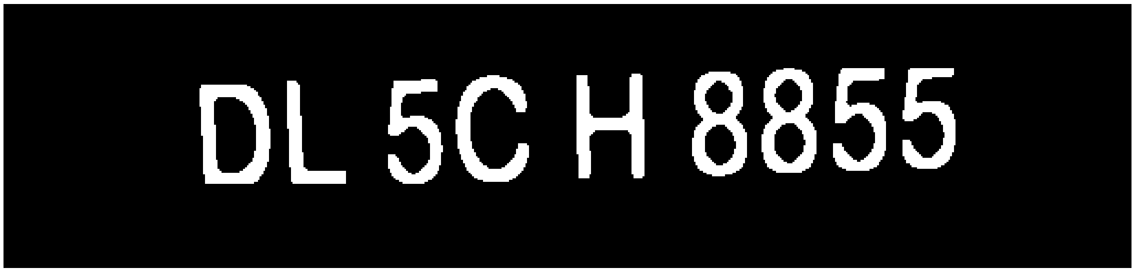
```
tresh_need = 96.4745
```

```
figure
imshow(plateArrM)
```



```
[row, col] = size(plateArrM);
imgClean = CleanBw(plateArrM, [10, 50, 500, fix(col / 300), fix(col/200)]);
```

```
figure
imshow(imgClean)
```



```
[L, Ne] = bwlabel(imgClean);
```

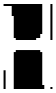
```
mapSet = loadmap("./Map Set");
```

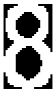
```
license_answer = []
```

```
license_answer =

     []
```

```
for iPatch = 1: Ne
    [r, c] = find(L == iPatch);
    best_answer = 0;
    patchCrop = imgClean(min(r):max(r), min(c):max(c));
    patchCrop = imresize(patchCrop, [42,24]);
    tresh_need = multithresh(patchCrop, 1);
    [row, col] = size(patchCrop);
    for i = 1:row
        for j = 1:col
            if patchCrop(i, j) > tresh_need
                patchCrop(i, j) = 1;
            else
                patchCrop(i, j) = 0;
            end
        end
    end
    figure
    imshow(patchCrop);
    rho = mapCorr(patchCrop, mapSet);
    [num] = size(rho, 1) ;
    [row, col] = size(patchCrop);
    name_map = '1';
    for j = 1:num
        mat_now = rho{j, 2};
        ans2 = 0;
        for k = 1:row
            for l=1:col
                if(mat_now(k, l) > ans2)
                    ans2 = mat_now(k, l);
                end
            end
        end
        if(ans2 > best_answer)
           best_answer = ans2;
           name_map = rho{j, 1};
           mat_now(k, l);
        end
    end
    license_answer = [license_answer, name_map];
end
```





```
disp(license_answer);
```

```
DL5CH8855
```

```
function [rho] = mapCorr(map1, mapSet)
    len = size(mapSet, 1);
    [row, col] = size(map1);
    rho = cell(len, 2);
    for i=1:len
        avg = 0;
        mat_now = mapSet{i, 2};
        for t = 1:row
```

```
            for t2 = 1:col
                avg = avg + map1(t, t2) + mat_now(t, t2);
            end
        end
        avg = avg / (row * col * 2);
        mat_ans = zeros(row, col);
        for k=1:row
            for l=1:col
                sum2 = 0;
                sum3 = 0;
                sum4 = 0;
                for t = 1:row
                    for t2 = 1:col
                        if (t - k) >= 0 && (t2 - l) >= 0
                            mul1 = mat_now(t - k + 1,  t2 - l + 1) - avg;
                            mul2 = map1(t, t2) - avg;
                            mat_ans(k, l) = mat_ans(k, l) + mul2 * mul1;
                            mul1 = map1(t - k + 1,  t2 - l + 1) - avg;
                            mul2 = mat_now(t, t2) - avg;
                            sum2 = sum2 + mul1 * mul2;
                            mul1 = map1(t - k + 1,  t2) - avg;
                            mul2 = mat_now(t, t2 - l + 1) - avg;
                            sum3 = sum3 + mul1 * mul2;
                            mul1 = map1(t,  t2 - l + 1) - avg;
                            mul2 = mat_now(t - k + 1, t2) - avg;
                            sum4 = sum4 + mul1 * mul2;
                        end
                    end
                end
                if(sum2 > mat_ans(k, l))
                    mat_ans(k, l) = sum2;
                end
                 if(sum3 > mat_ans(k, l))
                    mat_ans(k, l) = sum3;
                end
                 if(sum4 > mat_ans(k, l))
                    mat_ans(k, l) = sum4;
                 end
            end
        end
        rho{i, 1} = mapSet{i, 1};
        rho{i, 2} = mat_ans;
    end
end
```

This function loads all the pictures through the mapSet, which is a cell that each index has a path

```
function [mapSet] = loadmap(mapDir)
    picture_dir = dir(mapDir);
    mapSet = cell(size(picture_dir, 1) - 2,2);
    for i = 3: size(picture_dir, 1)
        name_now = picture_dir(i).name(1);
        mapSet{i - 2, 1} = name_now;
        path = strcat(mapDir, '/');
        path = strcat(path, picture_dir(i).name);
        mat_now = imread(path);
        mapSet{i - 2, 2} = mat_now;
    end
end
```

This function is used for cleaning the noise pathes from picture first it find some rows that should be black by checking cleaningParams. Then by using eroding and dilation(type disk) method it eliminate small patches from the picture.

```
function [imgClean] = CleanBw(imgNoisy, cleaningParams)
    imgClean = imgNoisy;
    [row, col] = size(imgNoisy);
    for i = 1:row
        cnt_count = 0;
        last_seen = -1;
        flag = 0;
        cnt_now = 0;
        for j = 1:col
           if imgNoisy(i, j) ~= last_seen
               cnt_count = cnt_count + 1;
               last_seen = imgNoisy(i, j);
               cnt_now = 0;
           end
           cnt_now = cnt_now + 1;
           if(cnt_now > cleaningParams(3))
               flag = 1;
           end
        end
        if(cnt_count < cleaningParams(1)) || (cnt_count > cleaningParams(2)) || (flag =
            for j = 1:col
                imgClean(i, j) = 0;
            end
        end
    end
    se = strel('disk', cleaningParams(4));
    imgClean = imerode(imgClean, se);
    se = strel('square', cleaningParams(5));
    imgClean = imdilate(imgClean, se);
end
```

This function takes the image, and convert it to a binary matrix with otso method.

```
function [imgBw] = rgb2Bw(imgColored)
    [row, col, temp] = size(imgColored);
    imgBw = zeros(row, col);
    for i = 1:row
        for j = 1:col
           imgBw(i, j) = 0.299 * imgColored(i, j, 1) +  imgColored(i, j, 2) * 0.587 + i
        end
    end
    tresh_need = multithresh(imgBw, 1)
    for i = 1:row
        for j = 1:col
            if imgBw(i, j) > tresh_need
                imgBw(i, j) = 0;
            else
                imgBw(i, j) = 1;
            end
        end
    end
end
```

This function request a path and a filename from the user, and imread function transform the given image file to 3-dimensional array, which represent RGB of this picture.

```
function [plateArrC] = openPlate()
    [file, path] = uigetfile('*.jpg');
    complete_path = strcat(path, file);
    plateArrC = imread(complete_path);
end
```