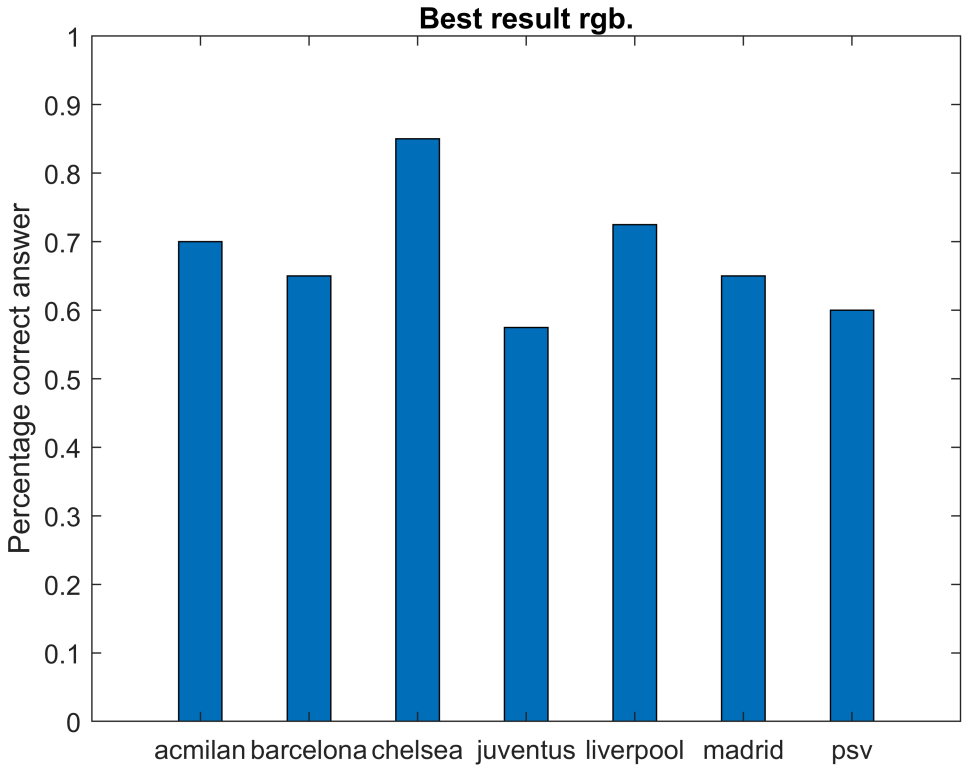
```
clear
format long G
all_teams = ["acmilan" "barcelona" "chelsea" "juventus" "liverpool" "madrid","psv"];
%all_teams = ["barcelona","acmilan"];
%experimento(distance, space_color, nbins, BD, error, teams, nimagenes)
pdd_teams = ones(1,length(all_teams));
for i = 1:length(all_teams)
    [pdd] = experimento ("chi", "rgb", 50, 1, 1.5, all_teams(i),40);
    pdd_teams(i) = pdd;
end
```

```
ans =
     0
ans =
                    0.65
ans =
     0
ans =
     0
ans =
     0
ans =
     0
ans =
     0
```

```
bar(pdd_teams, 0.4);
set(gca,'XTickLabel',{"acmilan", "barcelona", "chelsea", "juventus", "liverpool", "madrid","psv
ylim([0 1]);
ylabel("Percentage correct answer");
title("Best result rgb.");
```

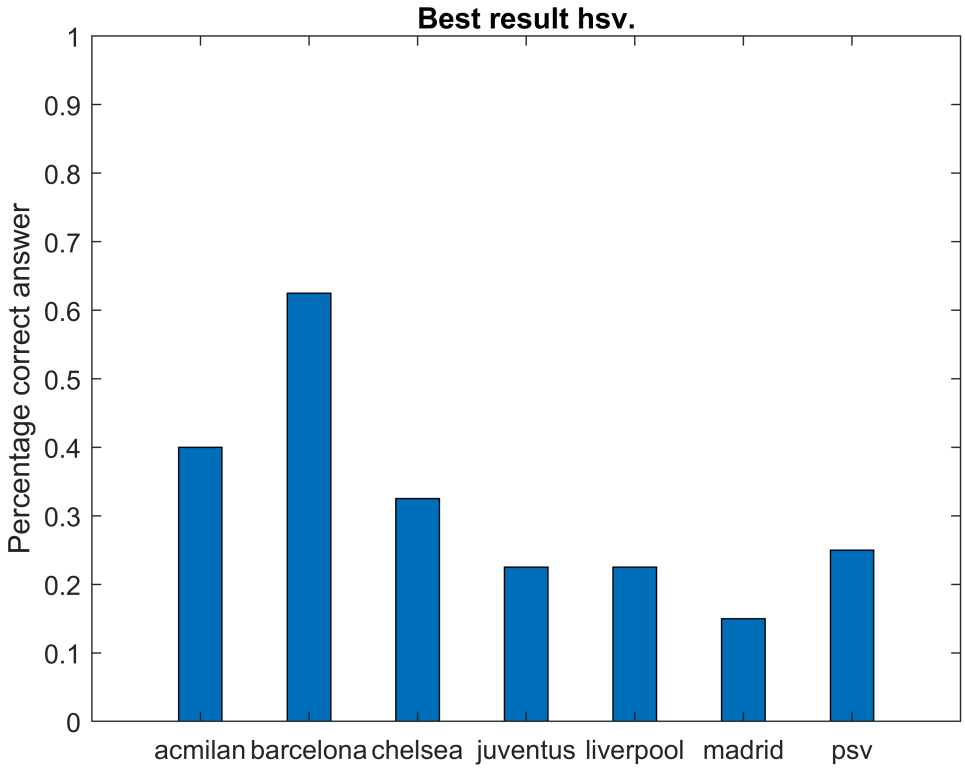



```
clear
format long G
all_teams = ["acmilan" "barcelona" "chelsea" "juventus" "liverpool" "madrid","psv"];
%all_teams = ["barcelona","acmilan"];
%experimento(distance, space_color, nbins, BD, error, teams, nimagenes)
pdd_teams = ones(1,length(all_teams));
for i = 1:length(all_teams)
    [pdd] = experimento ("chi", "hsv", 50, 1, 4.6, all_teams(i),40);
    pdd_teams(i) = pdd;
end
```

```
ans =
     0
ans =
                  0.625
ans =
     0
ans =
     0
ans =
     0
ans =
     0
ans =
```

```
0
```

```
bar(pdd_teams, 0.4);
set(gca,'XTickLabel',{"acmilan", "barcelona", "chelsea", "juventus", "liverpool", "madrid","psv
ylim([0 1]);
ylabel("Percentage correct answer");
title("Best result hsv.");
```




```
function [pdd] = experimento(distance, space_color, nbins, BD, error, teams, nimagenes)
    pdd = 0;
    aux = 0;
    for iterator_team = 1:length(teams)
        team = teams(iterator_team);
        for k2 = 1:nimagenes
            %k2
            if k2 < 10
                    imTest = imread(strcat(team ,'\','0', int2str(k2) ,'.jpg'));
            else
                    imTest = imread(strcat(team ,'\',int2str(k2) ,'.jpg'));
            end
            chiTotal = Inf;
            [h, w, d] = size(imTest);
            %height_of_the_windows = size_windows;
            %width_of_the_windows = size_windows;
            %pasos_y = 40;
            %pasos_x = 40;
```

```
height_of_the_windows = fix(h/2);
width_of_the_windows = fix(w/2);
pasos_y =  fix(height_of_the_windows/6);
pasos_x = fix(width_of_the_windows/6);
i_total = 1;
j_total = 1;
i_total2 = 1;
j_total2 = 1;
for i = 1:pasos_y:(h-pasos_y-height_of_the_windows)
    salida = 0;
    for j = 1:pasos_x:(w-pasos_x-width_of_the_windows)
        height_of_the_windows_aux = height_of_the_windows;
        width_of_the_windows_aux = width_of_the_windows;
        if (i+height_of_the_windows> h)
            height_of_the_windows_aux = h-i;
        end
        if (j+width_of_the_windows> w)
            width_of_the_windows_aux = w-j;
        end
        subImagen = imTest(i:(i+height_of_the_windows_aux-1),j:(j+width_of_the_win
            for k = 5:7
                im = imread(strcat('BD',int2str(BD),'\' ,int2str(k) ,'.jpg'));
                %im = imresize(im, [height_of_the_windows_aux width_of_the_windows_
                if (space_color == "rgb")
                    [l1,rbsubImagen] = getHistoRGB(subImagen,nbins);
                    [l2,rbim] = getHistoRGB(im,nbins);
                elseif(space_color == "hsv")
                    [l1,hs] = getHistoHSV(subImagen,nbins);
                    [l2,hs] = getHistoHSV(im,nbins);
                end

                if (distance == "euclidean")
                    total = distEuclidean(l1,l2);
                elseif (distance == "kl")
                    total = distKL(l1,l2);
                elseif (distance == "chi")
                    total = distChi(l1,l2);
                end

                if (total < error)
                %if (total < chiTotal)
                    r = im;
                    i_total = i;
                    j_total = j;
                    i_total2 = (i+height_of_the_windows_aux-1);
                    j_total2 = (j+width_of_the_windows_aux-1);
                    chiTotal = total;
                    salida = 1;
                    break;
                end
            end
            if (salida == 1)
                break;
```

```
                        end
                    end
                    if (salida ==1)
                        break;
                    end
                end
                %chiTotal

                if chiTotal == Inf && team ~= "barcelona"
                    pdd = pdd+1;
                elseif chiTotal ~= Inf && team == "barcelona"
                    aux = aux+1;
                    pdd = pdd+1;
                end

            end
        end
        aux/40
        pdd = pdd/(nimagenes*length(teams));
end

function d = distChi(l1,l2)
    aux = (l1 == l2);
    l1 = l1 + double(aux);
    l2 = l2 + double(aux);
    d = sum(sum(((l1-l2).^2)./(l1+l2)));
    d = d/2;
end
function d = distEuclidean(l1,l2)
    aux = (l1 == l2);
    l1 = l1 + double(aux);
    l2 = l2 + double(aux);
    d = sum(sum((l1-l2).^2));
end
function d = distKL(l1,l2)
    d = sum(sum((l1+log(l1./l2))));
end
function  [h,hs] = getHistoHSV(im, NBINS)
    %hGaus = fspecial('gaussian', 10, 4);
    %im = imfilter(im,hGaus,'conv');
    r = im(:,:,1);
    g = im(:,:,2);
    b = im(:,:,3);
    I = double(r)+double(g)+double(b);
    hsv = rgb2hsv(im);
    I = hsv(:,:,3)*max(max(max(I)));
    rn = uint8((double(r)./I)*255);
    gn = uint8((double(g)./I)*255);
    bn = uint8((double(b)./I)*255);
    rgbn = cat(3,rn,gn,bn);
    hsv = rgb2hsv(rgbn);
    h = hsv(:,:,1);
    s = hsv(:,:,2);
```

```
    [f c d] = size(im);
    x = [];
    y = [];
    for i = 1:f
        x2 = h(f,:);
        x = [x x2];
        y2 = s(f,:);
        y = [y y2];
    end
    x = x';
    y = y';
    hs = [x y]*256;
    h = hist3(hs,'nbins',[NBINS NBINS]);
    h = h/max(max(h));
    h = imgaussfilt(h,2);
end

function [h,rg] = getHistoRGB(im,NBINS)
    %hGaus = fspecial('gaussian', 10, 4);
    %im = imfilter(im,hGaus,'conv');
    r = im(:,:,1);
    g = im(:,:,2);
    b = im(:,:,3);
    I = double(r)+double(g)+double(b);
    I = I/3;
    rn = double(uint8((double(r)./I)*255));
    bn = double(uint8((double(b)./I)*255));
    [f c d] = size(im);
    x = [];
    y = [];
    for i = 1:f
        x2 = rn(f,:);
        x = [x x2];
        y2 = bn(f,:);
        y = [y y2];
    end
    x = x';
    y = y';
    rg = [x y];
    h = hist3(rg,'nbins',[NBINS NBINS]);
    h = h/max(max(h));
    h = imgaussfilt(h,2);

    %windowSize = NBINS/10; % Adjust to control level of smoothing.
    %aux = ones(windowSize, windowSize)/windowSize^2;
    %h = conv(h(:), aux, 'valid');
end
```