Table of Contents

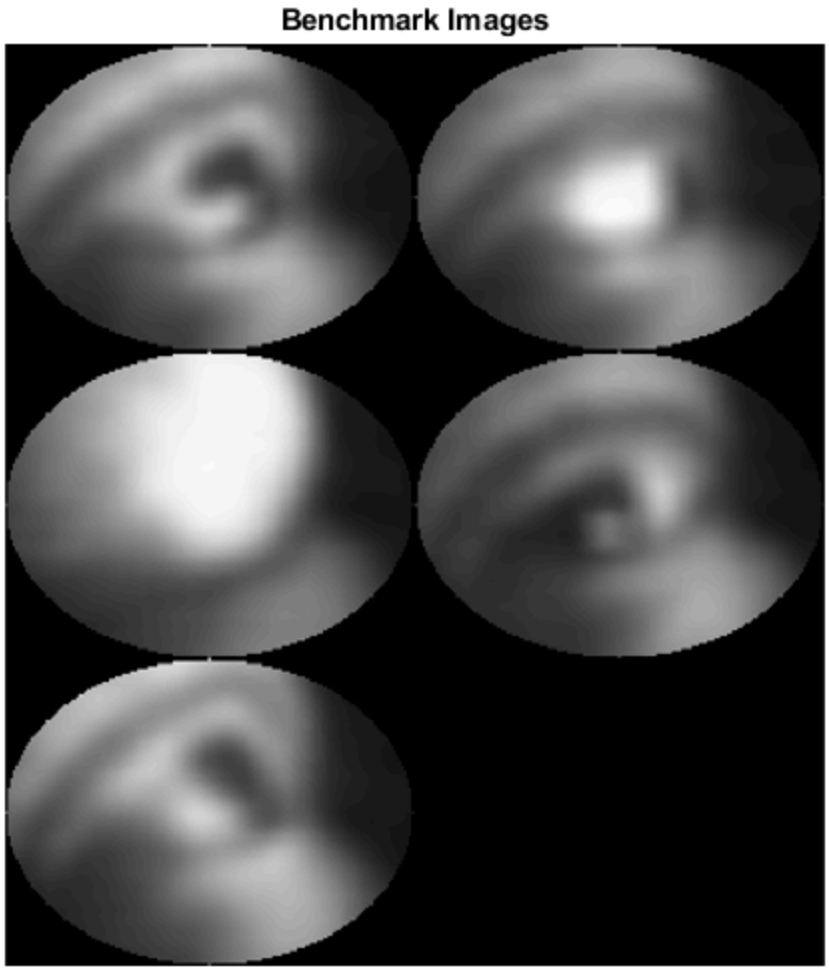
ECE 3770 - Lab 6 - Studying Eye Images

G.Davis
3/28/21

```
clc; clear; close all; clear sound;
```

Read in Benchmark Images

```
fileList = ["Lab6-NoiseEye/0.jpg","Lab6-NoiseEye/677.jpg","Lab6-
NoiseEye/1515.jpg",...
            "Lab6-NoiseEye/6637.jpg","Lab6-NoiseEye/9161.jpg"];
dim = size(mask(imread(fileList(1))),1:2); % Get image resolution

benchmark = zeros(dim(1),dim(2),numel(fileList)); % initialize array
 of benchmark images
H = fspecial('average',15); % averaging filter

% Greyscale images to help with correlation
% Filter helps remove noise artifacts
% Mask isolates only the parts of the image necessary to analyze
for i = 1:numel(fileList)
    benchmark(:,:,i) =
 mask(filter2(H,greyscale(imread(fileList(i))))/255);
end

figure
montage(benchmark);
title("Benchmark Images");
```



Setup Test Images

Select several test images at random and greyscale, filter, and mask

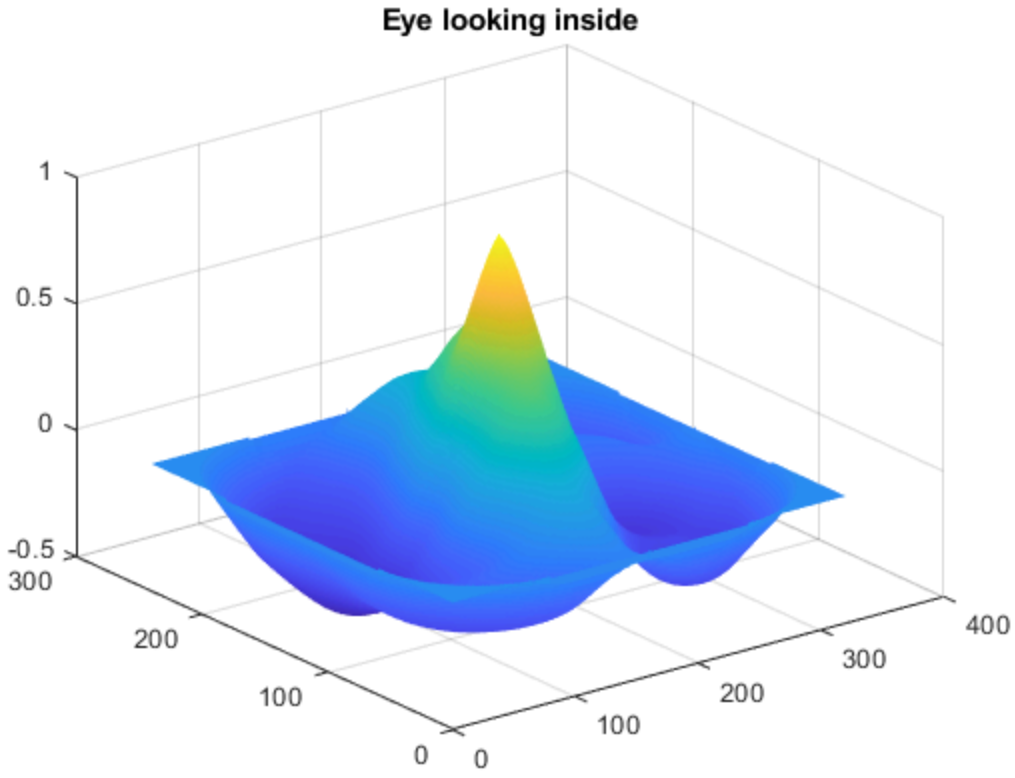
```
imgList = dir("Lab6-NoiseEye");

n = 10; % number of test images
x = floor(rand(1,n)*numel(imgList));
imgs = ones(dim(1),dim(2),n);
c1 = 1:numel(fileList);

for i = 1:n
    st = imgList(x(i));
    if find(fileList=="Lab6-NoiseEye/"+st.name)>0
        % RNG selected a testimage
        st = imgList(x(i)+1);
    end
```

```
    imgs(:,:,i) = mask(filter2(H,greyscale(imread(sprintf("%s\\
%s",st.folder,st.name))))/255);
    fprintf("\n%s\n",st.name);
    c1 = 1:numel(fileList);
    for j = 1:numel(fileList)
        c(:,:,j) = normxcorr2(benchmark(:,:,j),imgs(:,:,i));
        c1(j) = max(max(abs(c(:,:,j))));
    end
    fprintf("Looking Straight Correlation : %g\n" + ...
            "Looking Inside Correlation   : %g\n" + ...
            "Closed / Blinking Correlation: %g\n" + ...
            "Looking Outside Correlation  : %g\n" + ...
            "Looking Up Correlation       : %g\n",+ ...
            c1(1),c1(2),c1(3),c1(4),c1(5));
    index = find(c1==max(c1));
    decideEye(index, c);
end

figure
montage(imgs);
title("Test Images"), snapnow
```

Functions

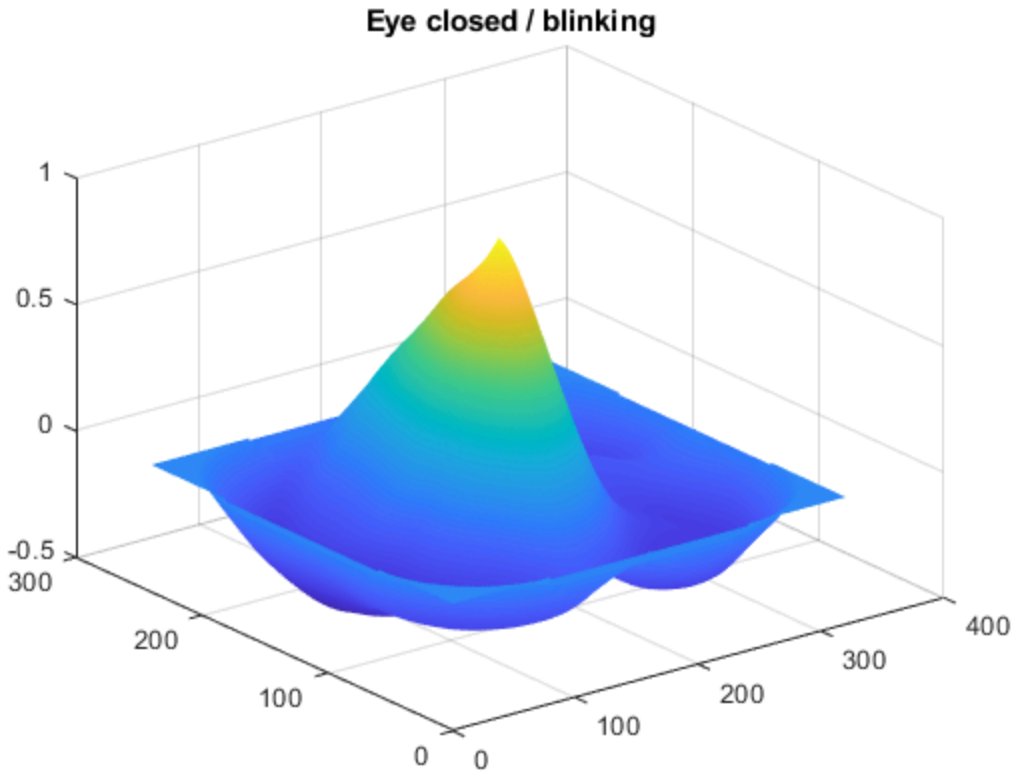
```
function img = greyscale(in)
    img = uint8(0.2989 * in(:,:,1) + 0.5870 * in(:,:,2) + 0.1140 *
 in(:,:,3));
end

function img = mask(img)
    h = 200;
    k = 150;
    c_radius = 80;
    r_radius = 60;
    c_radius_squared = c_radius * c_radius;
    r_radius_squared = r_radius * r_radius;
    for r = 1:size(img, 1)    % for number of rows of the image
        for c = 1:size(img, 2)    % for number of columns of the image
            if ( ( (c-h)^2/c_radius_squared + (r-k)^2/
r_radius_squared ) <= 1)
                img(r, c) = img(r, c);
            else
                img(r, c) = 0;
            end
        end
    end
    img = img(k-r_radius:k+r_radius,h-c_radius:h+c_radius);
end

function decideEye(index, c)
    switch index
        case 1
            fprintf("Eye is looking straight.\n\n");
```

```
            figure, surf(c(:,:,index)), shading flat
            title("Eye looking straight")
        case 2
            fprintf("Eye is looking inside.\n\n");
            figure, surf(c(:,:,index)), shading flat
            title("Eye looking inside")
        case 3
            fprintf("Eye is closed / blinking.\n\n");
            figure, surf(c(:,:,index)), shading flat
            title("Eye closed / blinking")
        case 4
            fprintf("Eye is looking outside.\n\n");
            figure, surf(c(:,:,index)), shading flat
            title("Eye looking outside")
        case 5
            fprintf("Eye is looking upwards.\n\n");
            figure, surf(c(:,:,index)), shading flat
            title("Eye looking upwards")
    end
    snapnow
end
```

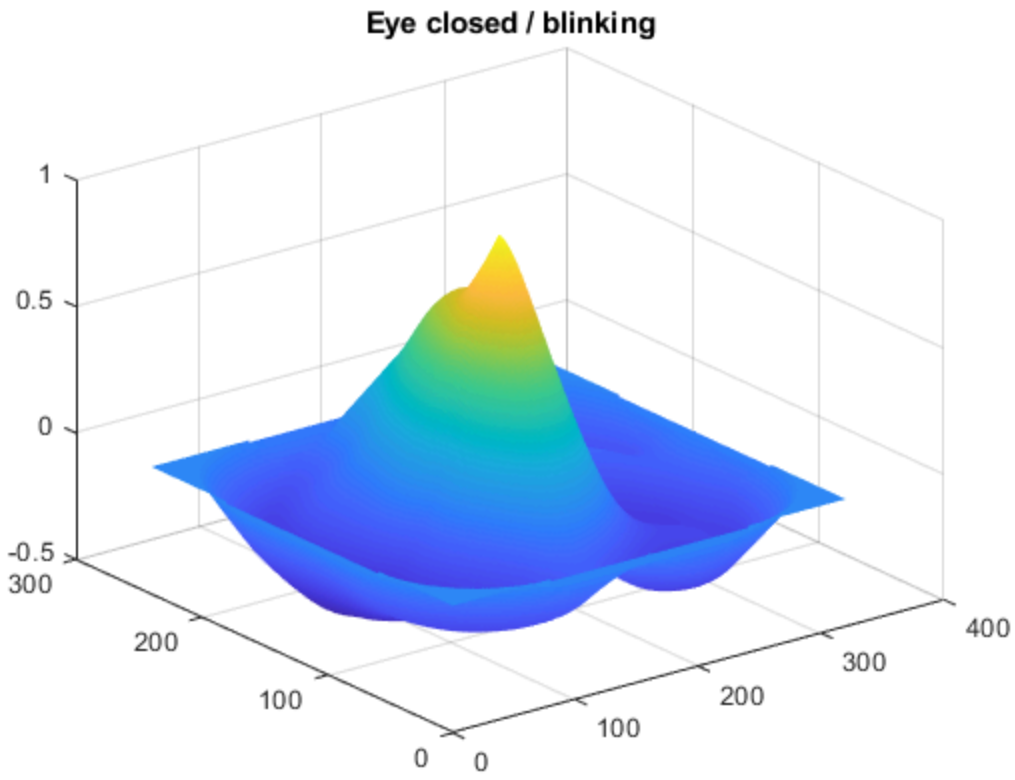



```
26147.jpg
Looking Straight Correlation : 0.83803
Looking Inside Correlation   : 0.865393
```

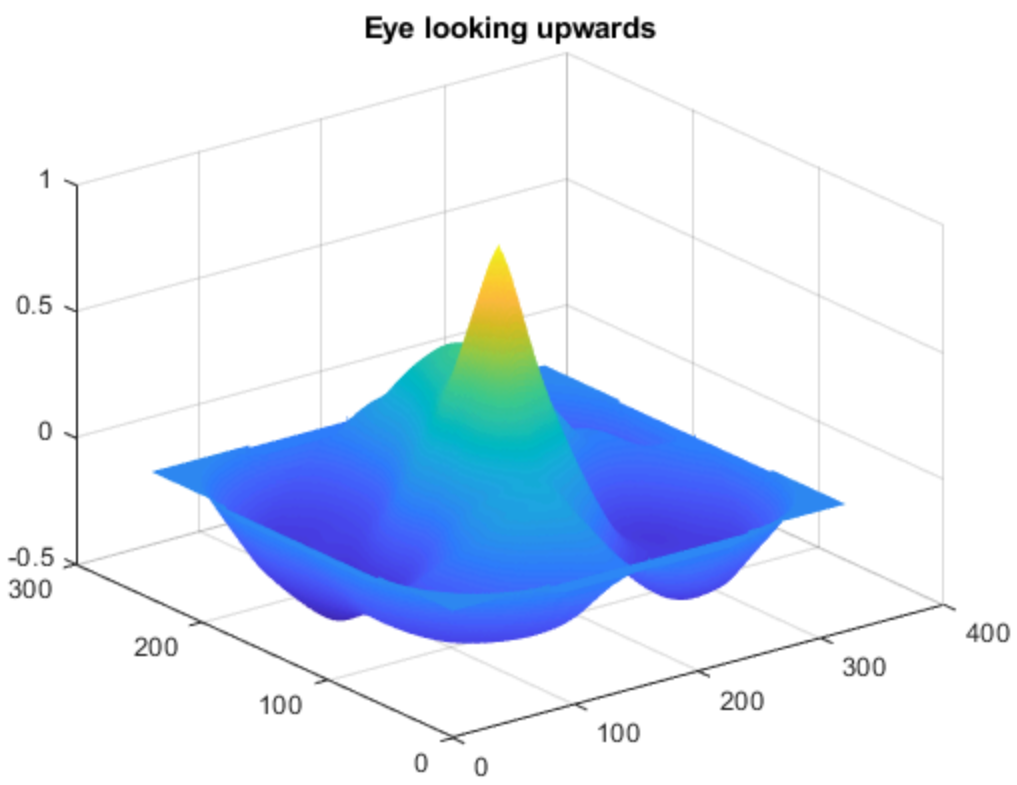
Closed / Blinking Correlation: 0.962032
Looking Outside Correlation : 0.804076
Looking Up Correlation   : 0.82577
Eye is closed / blinking.



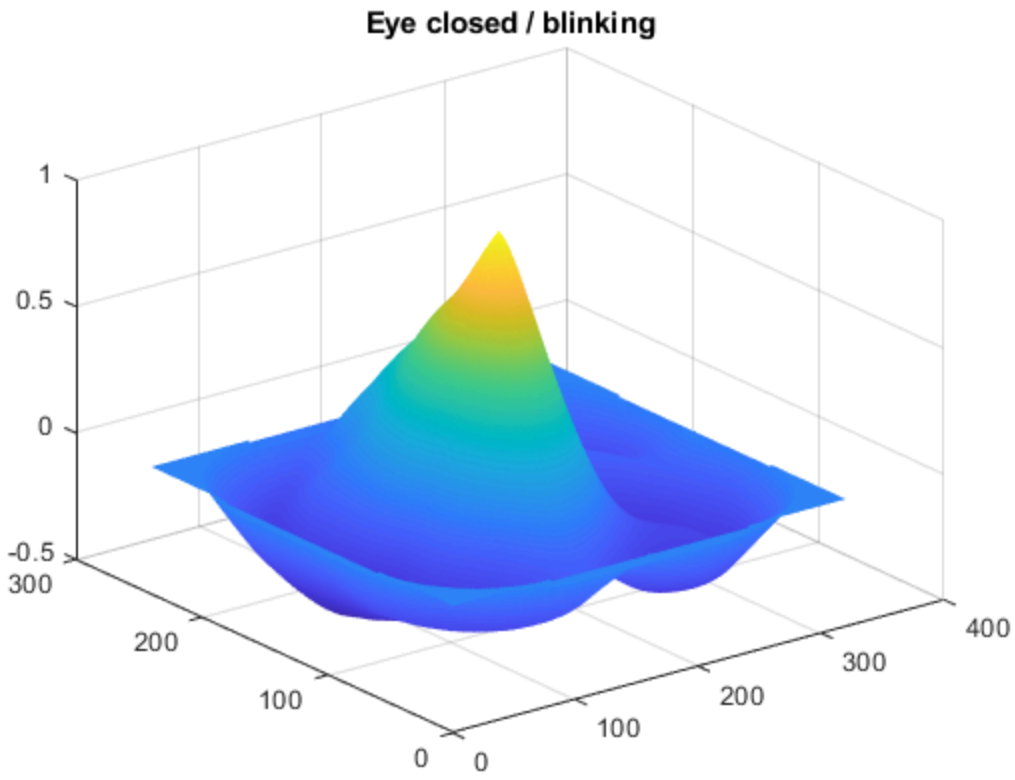
10334.jpg
Looking Straight Correlation : 0.865089
Looking Inside Correlation   : 0.863252
Closed / Blinking Correlation: 0.983902
Looking Outside Correlation : 0.851431
Looking Up Correlation   : 0.852112
Eye is closed / blinking.



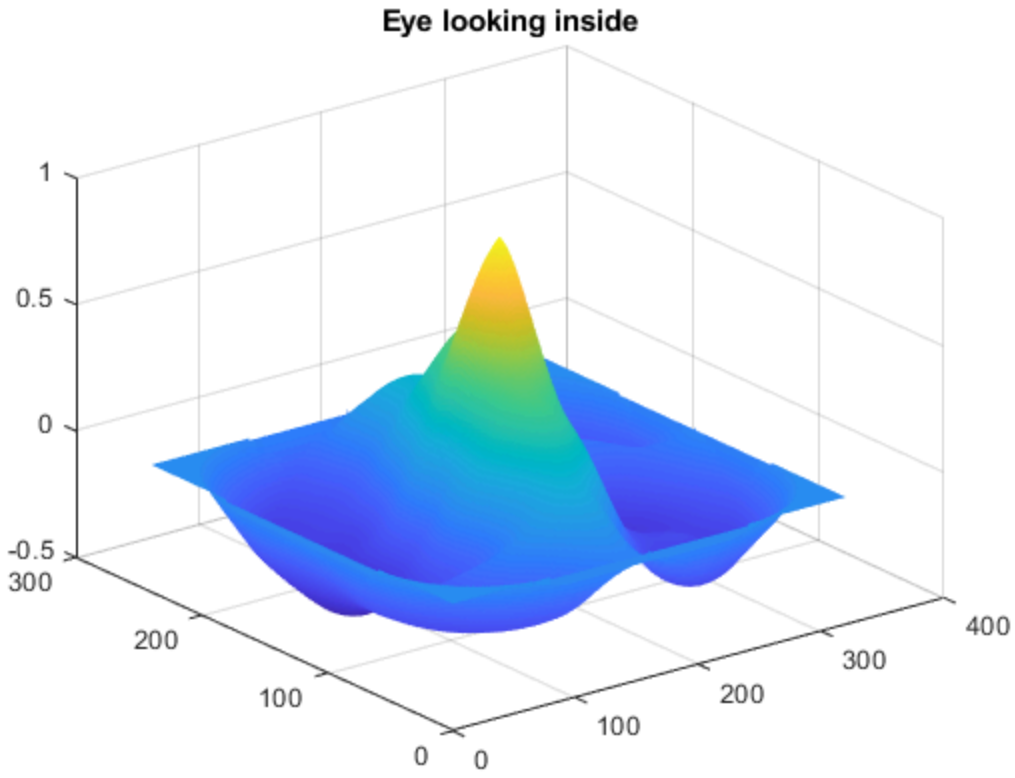

```
9396.jpg
Looking Straight Correlation : 0.911514
Looking Inside Correlation   : 0.87904
Closed / Blinking Correlation: 0.74372
Looking Outside Correlation  : 0.838416
Looking Up Correlation       : 0.965008
Eye is looking upwards.
```



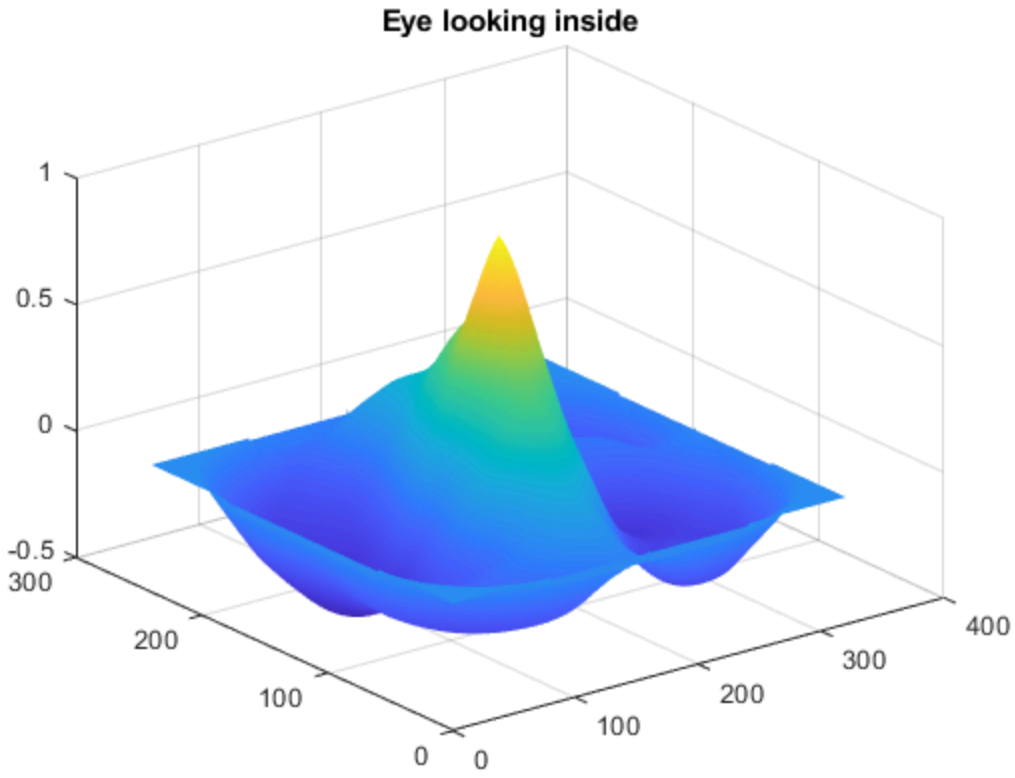

```
1697.jpg
Looking Straight Correlation : 0.85734
Looking Inside Correlation   : 0.873247
Closed / Blinking Correlation: 0.999088
Looking Outside Correlation  : 0.786154
Looking Up Correlation       : 0.833424
Eye is closed / blinking.
```



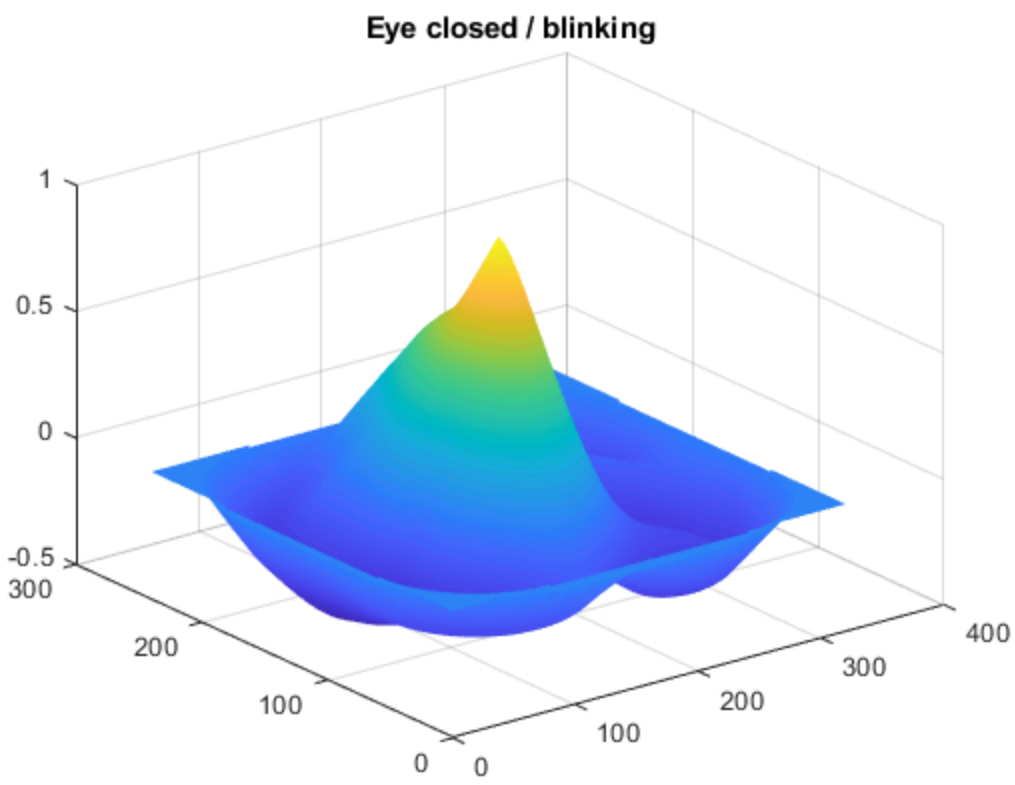

```
14844.jpg
Looking Straight Correlation : 0.901294
Looking Inside Correlation   : 0.967398
Closed / Blinking Correlation: 0.873333
Looking Outside Correlation  : 0.846783
Looking Up Correlation       : 0.888994
Eye is looking inside.
```



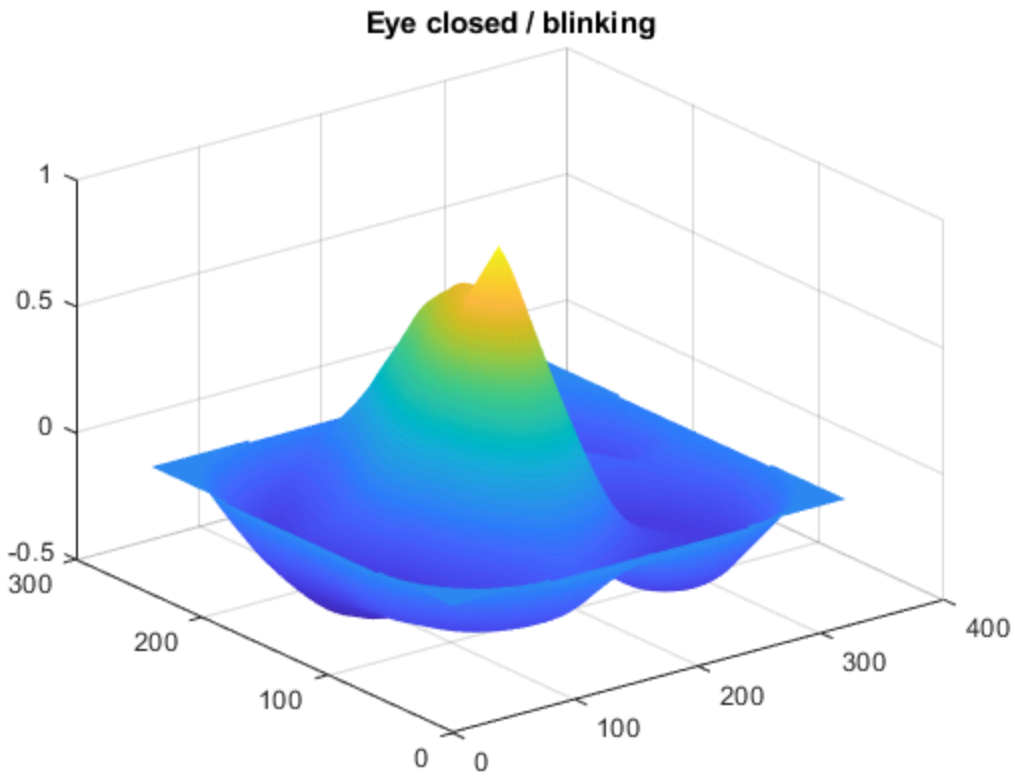

```
2417.jpg
Looking Straight Correlation : 0.911514
Looking Inside Correlation   : 0.973761
Closed / Blinking Correlation: 0.846754
Looking Outside Correlation  : 0.859542
Looking Up Correlation       : 0.914361
Eye is looking inside.
```



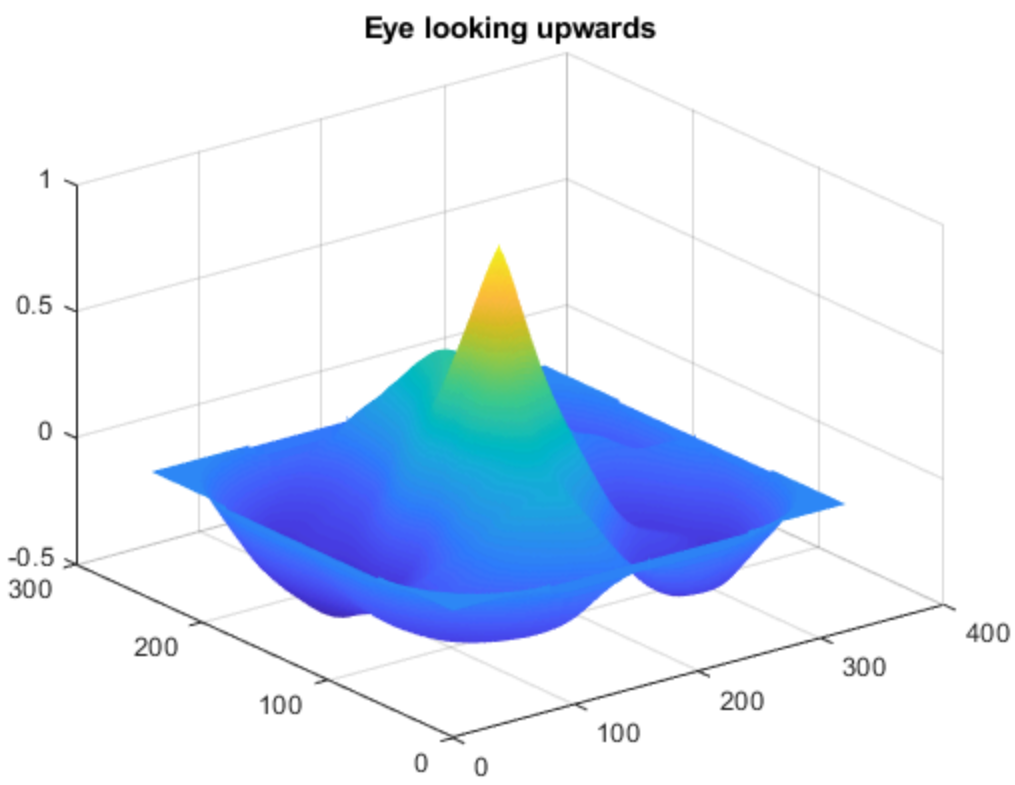

```
1797.jpg
Looking Straight Correlation : 0.852465
Looking Inside Correlation   : 0.856368
Closed / Blinking Correlation: 0.99582
Looking Outside Correlation  : 0.798017
Looking Up Correlation       : 0.830718
Eye is closed / blinking.
```

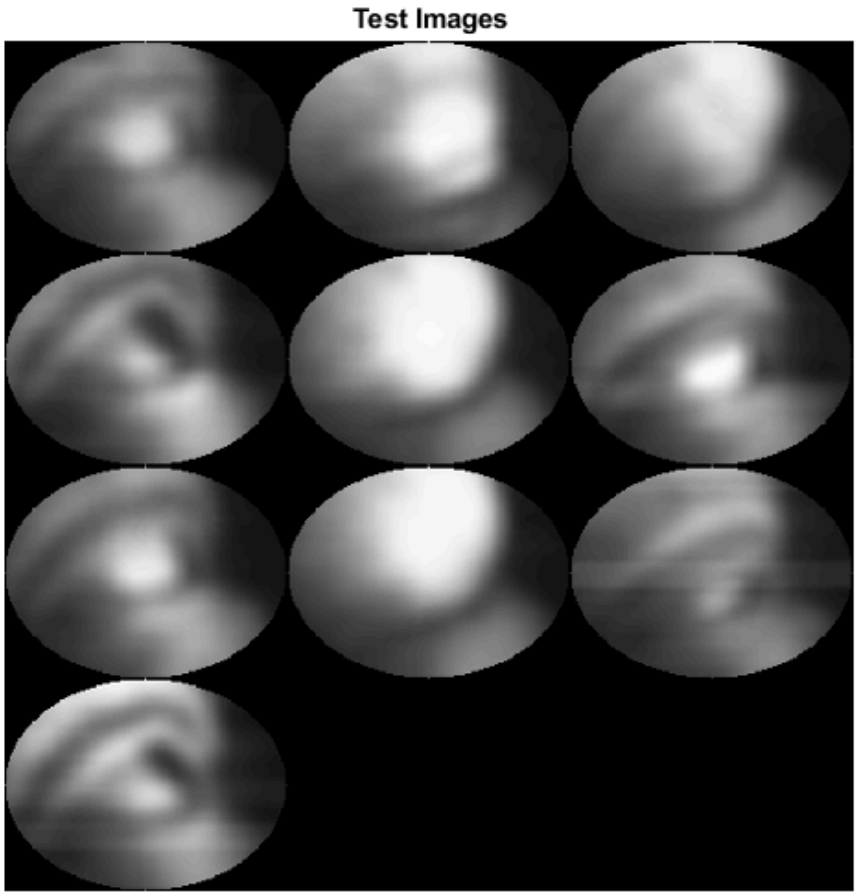



```
Warning: JPEG library error (8 bit), "Premature end of JPEG file".

28188.jpg
Looking Straight Correlation : 0.92317
Looking Inside Correlation   : 0.892952
Closed / Blinking Correlation: 0.939929
Looking Outside Correlation  : 0.888615
Looking Up Correlation       : 0.916662
Eye is closed / blinking.
```




```
Warning: JPEG library error (8 bit), "Premature end of JPEG file".

22991.jpg
Looking Straight Correlation : 0.963442
Looking Inside Correlation   : 0.879133
Closed / Blinking Correlation: 0.862153
Looking Outside Correlation  : 0.834916
Looking Up Correlation       : 0.965108
Eye is looking upwards.
```


Eye looking upwards
1
0.5
0
-0.5
300
200
100
0
0
100
200
300
400



Published with MATLAB® R2019b