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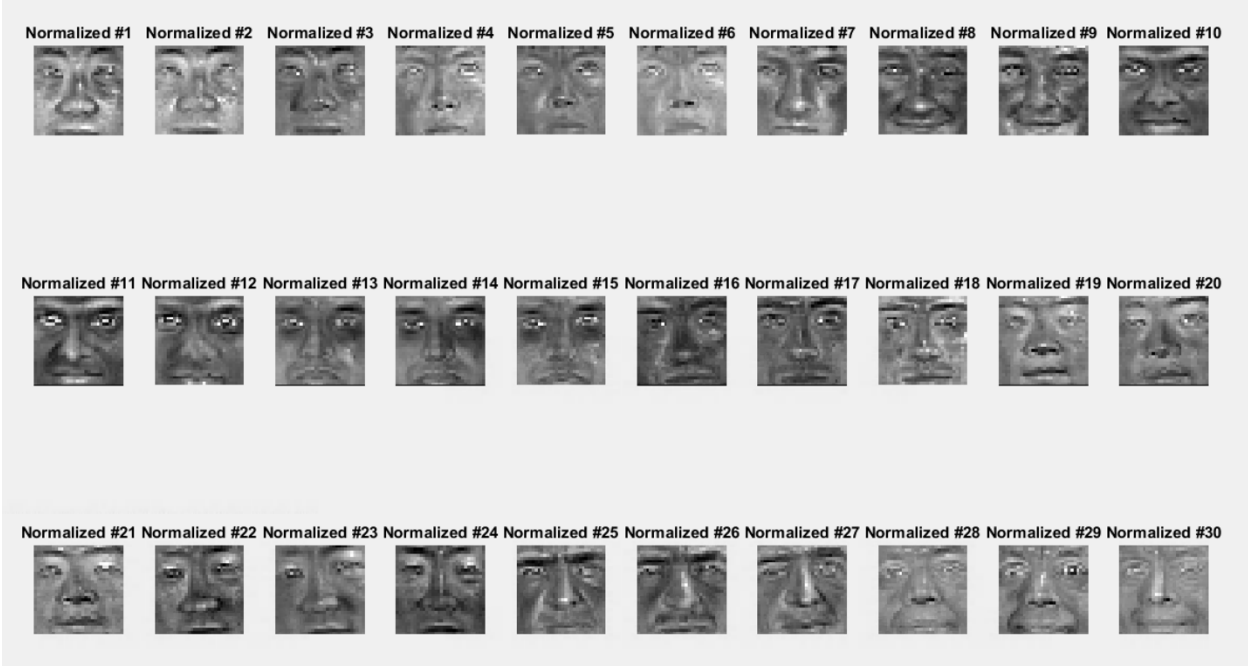
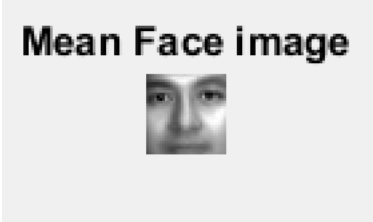
Dr. Ross

Project 3 Report

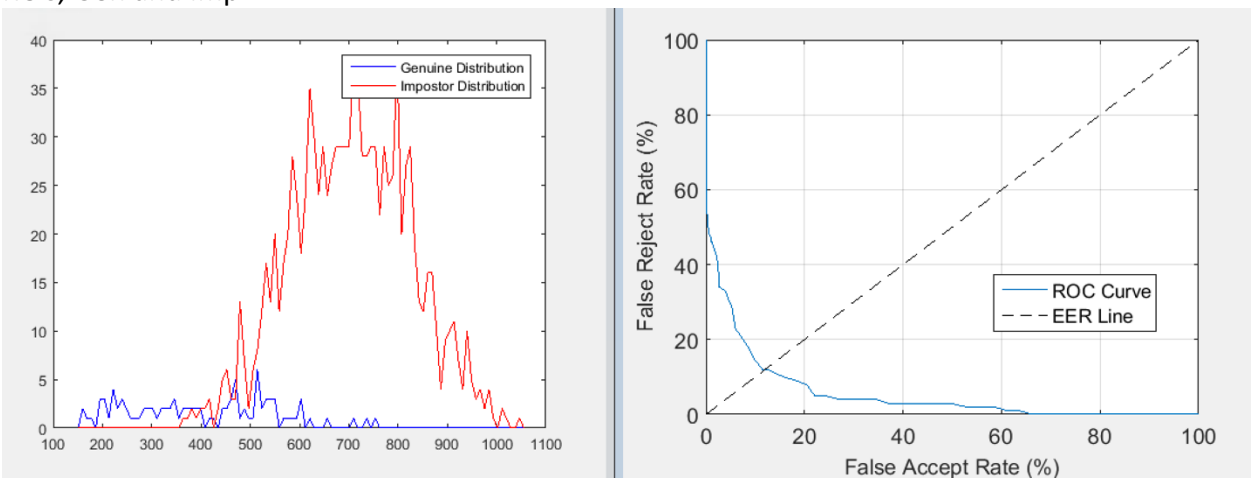
1) Mean Face and the 25 eigen values faces





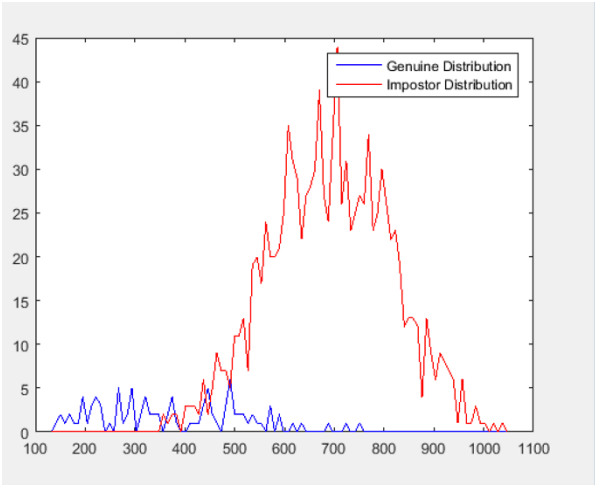
2) Top 25 feature vector faces

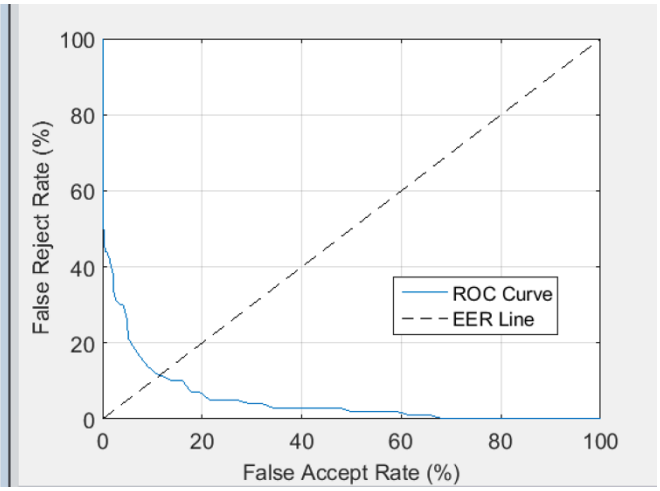
3) ROC, Gen and Imp



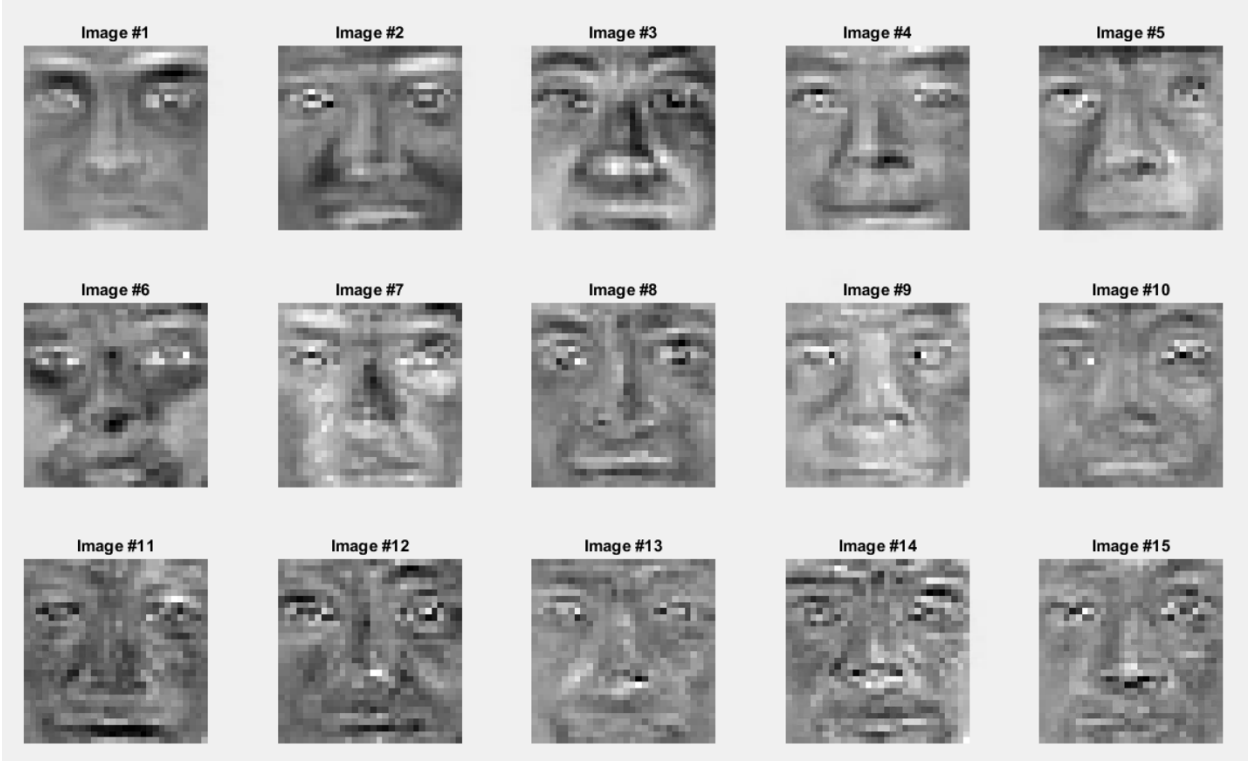
4) Top 20 feature vector faces

ROC, Gen and Imp of 20

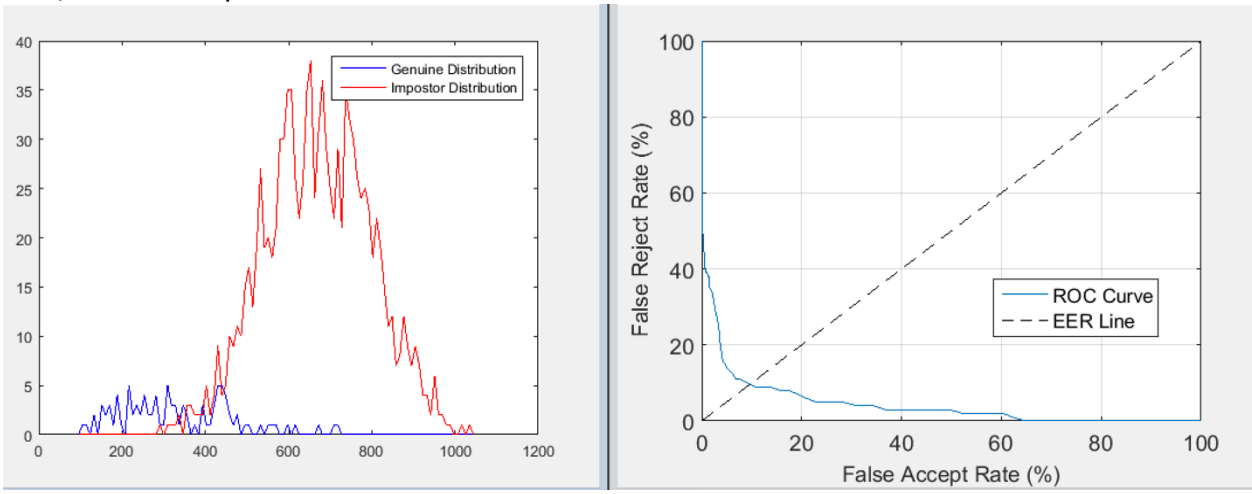




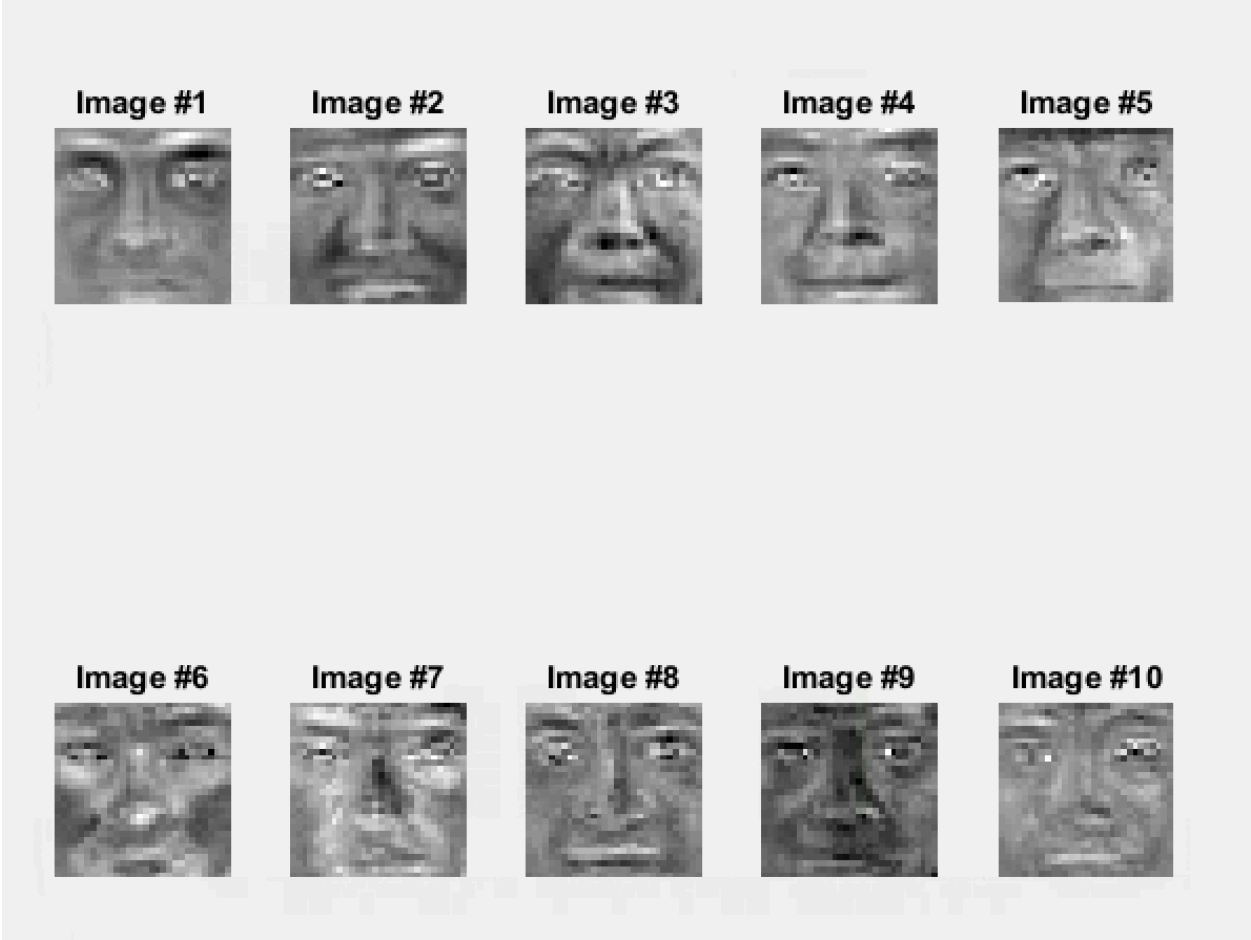
Top 15 feature vector faces



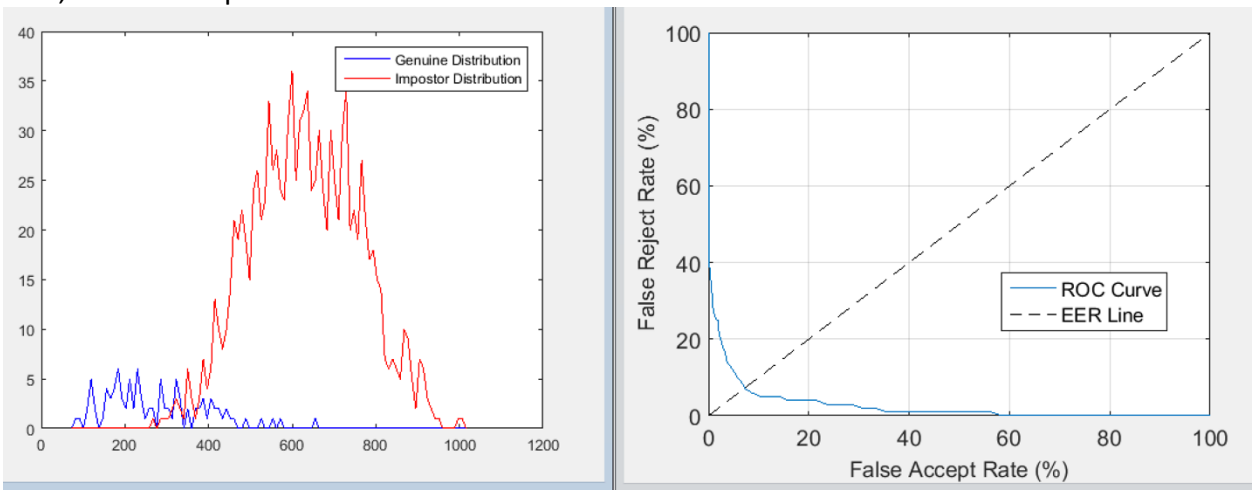
ROC, Gen and Imp for 15



Top 10 feature vector faces

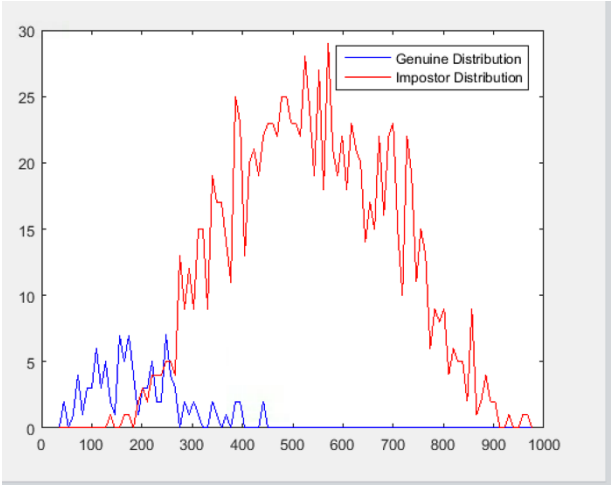


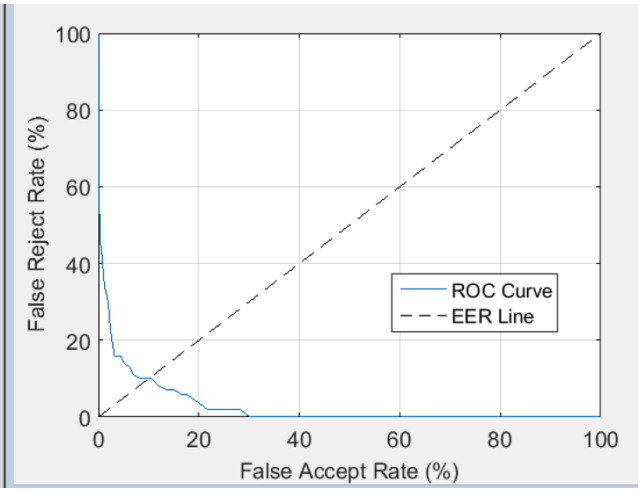
ROC, Gen and Imp for 10



Top 5 feature face vector

ROC, Gen, Imo for 5

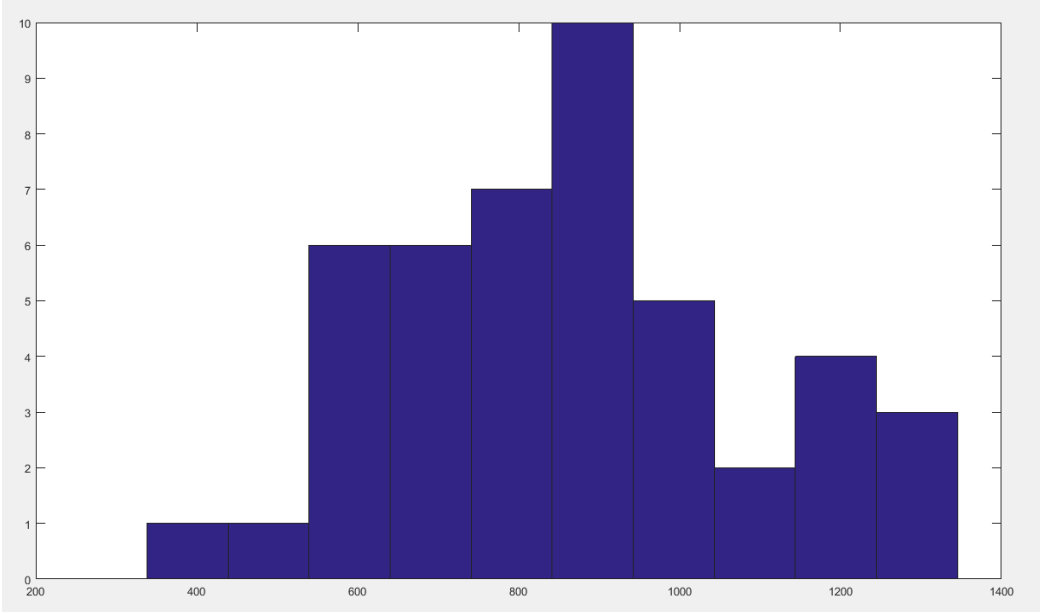




According to the ROC curves of all the different samples you can see that as less Eigen-faces are chosen the ROC curve got closer/ tighter to the 0 mark for the FAR and FRR. The reason the FAR and FRR were closer is because with less amount of samples there is less discrepancy and less variation between the images and the mean face. This is why they are closer together.

5) My faces

My faces genuine histogram



The accuracy of the face matcher worked well. As you can see form the above histogram most of the faces are towards the middle to the left mostly. This tells us that the face matcher worked well but not perfectly. The reason the face matcher was not able to work perfectly or close to perfectly is because as you can see in my images most of them have many facial expression, has different poses and mainly the pictures are not a perfect square they have to be compressed and forced into 30x30 grid which resulted in distortion of the image.

Table of Contents


```
clear;
close all;
clc;

files = dir('images/*.bmp');
images = cell(1,30);
eigen_values = zeros(1,30);
all_images = cell(1,50);
count = 1;
figure;
c = 1;
```

Getting the face images

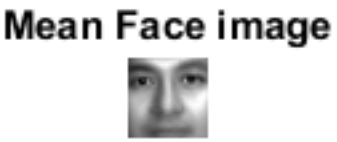
```
disp('Getting all faces from the directory');
for i = 1:length(files)
    filename =  ['images/' files(i).name];

    if mod(i,5)<= 3 && mod(i,5) >= 1
        file = imread(filename);

        subplot(3,10,c);
        imshow(file,[]);
        title(['Orig #' num2str(c)]);

        % Mean face calculation
        file = reshape(file,900,1);
        images{count} = file;


        count = count + 1;
        c = count;
    end
    all_images{i} = reshape(imread(filename),900,1);
end
```

Getting all faces from the directory

Mean face calculations

```
images = cell2mat(images);
sumImage = zeros(900,1);

all_images = cell2mat(all_images);
disp('calculating the mean face');
for j = 1:30
    for k =  1:900
        sumImage(k,1) = mean(images(k,:));

    end
end

meanFace = reshape(sumImage,30,30);
figure;
imshow(meanFace,[]);
title('Mean Face image')
```

calculating the mean face



Original face subtracted by the mean face

```
for i = 1: sqrt(length(images))
   A(:,i)=double(images(:,i))-sumImage(:,1);
end
```

Mean Faces subtracted images

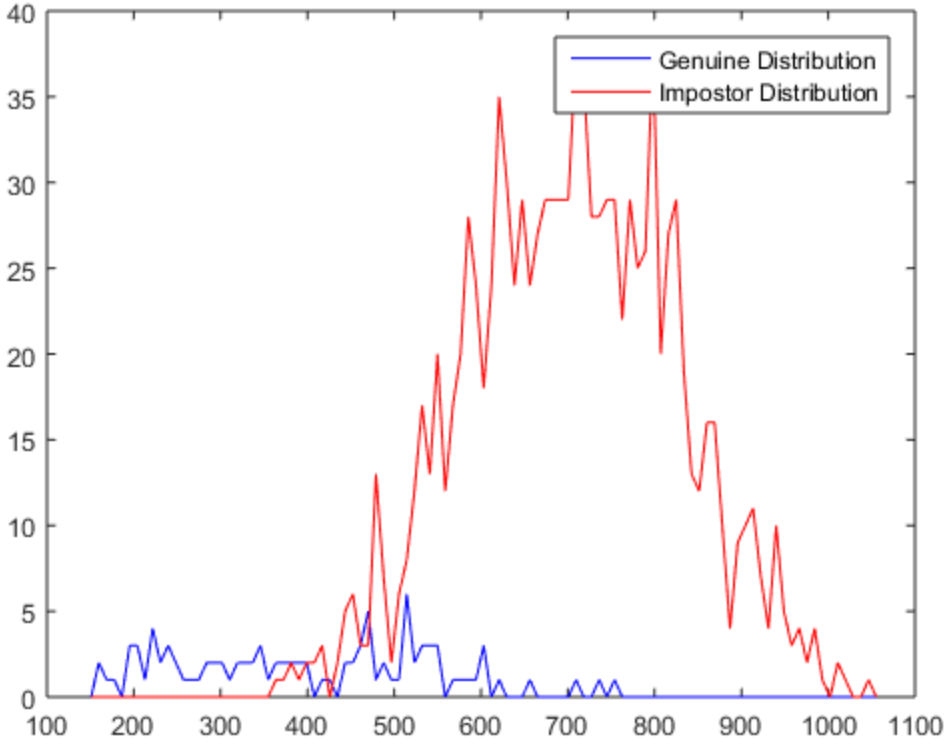
```
figure;
for i = 1:30
    subplot(3,10,i);
    imshow(reshape(A(:,i),30,30),[]);
    title(['Normalized #' num2str(i)]);
end
covariance = cov(A');
```

Each Function Calling

```
disp('Processing 25...');
face(50,25,5,5, covariance, all_images, sumImage,'n');
disp('End of process for 25');

disp('Processing 20...');
face(50,20,5,4, covariance, all_images, sumImage,'n');
disp('End of process for 20');

disp('Processing 15...');
face(50,15,3,5, covariance, all_images, sumImage,'n');
disp('End of process for 15');

disp('Processing 10...');
face(50,10,2,5, covariance, all_images, sumImage,'n');
disp('End of process for 10');

disp('Processing 5...');
face(50,5,1,5, covariance, all_images, sumImage,'n');
disp('End of process for 5');
```

```
Processing 25...
Begin ROC..
End ROC..
End of process for 25
```

```
Processing 20...
Begin ROC..
End ROC..
End of process for 20
Processing 15...
Begin ROC..
End ROC..
End of process for 15
Processing 10...
Begin ROC..
End ROC..
End of process for 10
Processing 5...
Begin ROC..
End ROC..
End of process for 5
```


Genuine Distribution
Impostor Distribution
40
35
30
25
20
15
10
5
0
100
200
300
400
500
600
700
800
900
1000
1100

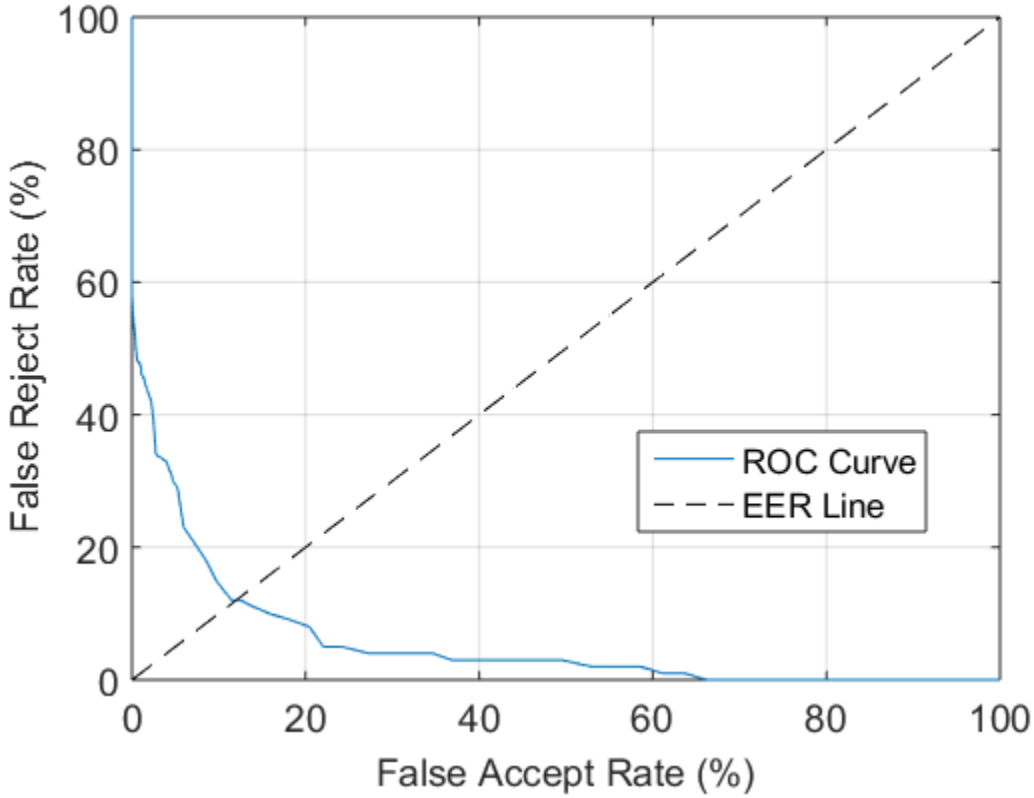
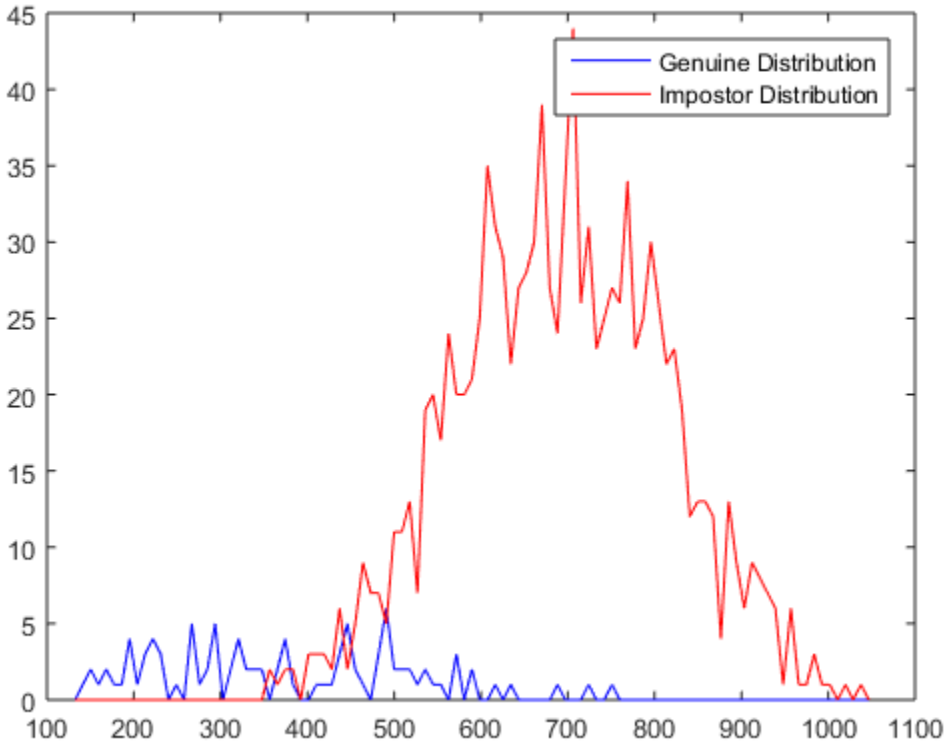
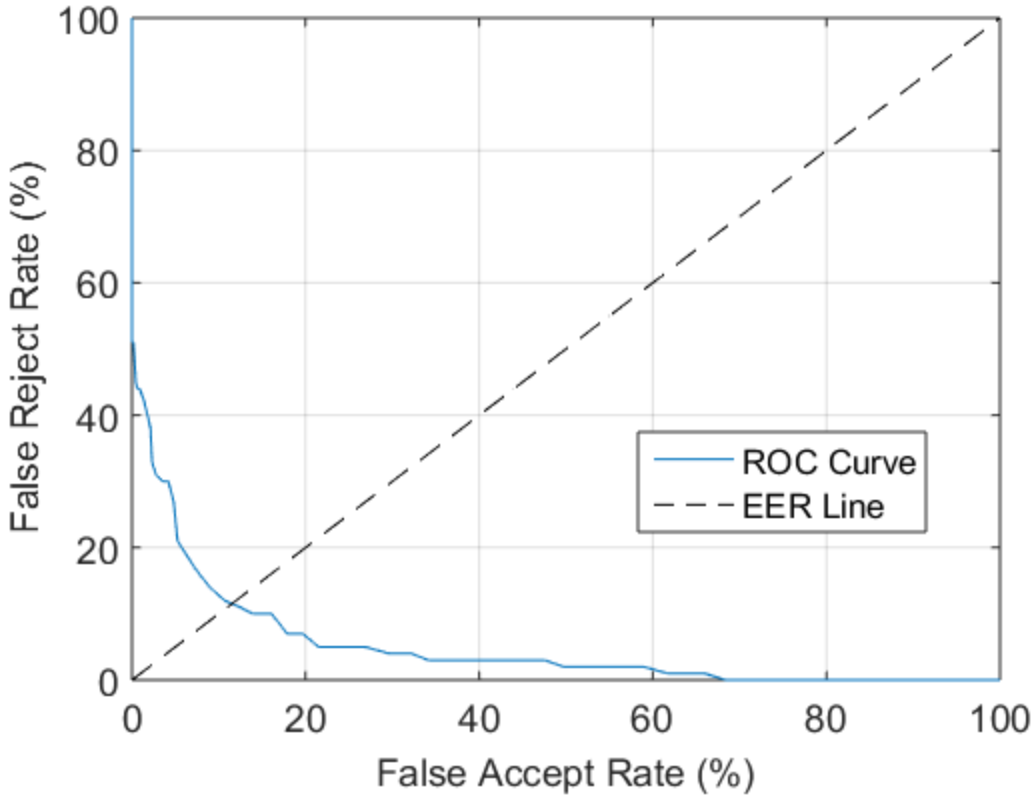

False Reject Rate (%)
False Accept Rate (%)
ROC Curve
EER Line
100
80
60
40
20
0
0
20
40
60
80
100


Image #1
Image #2
Image #3
Image #4
Image #5
Image #6
Image #7
Image #8
Image #9
Image #10
Image #11
Image #12
Image #13
Image #14
Image #15
Image #16
Image #17
Image #18
Image #19
Image #20


Genuine Distribution
Impostor Distribution
45
40
35
30
25
20
15
10
5
0
100
200
300
400
500
600
700
800
900
1000
1100


100
80
60
40
20
0
0
20
40
60
80
100
False Reject Rate (%)
False Accept Rate (%)
ROC Curve
EER Line

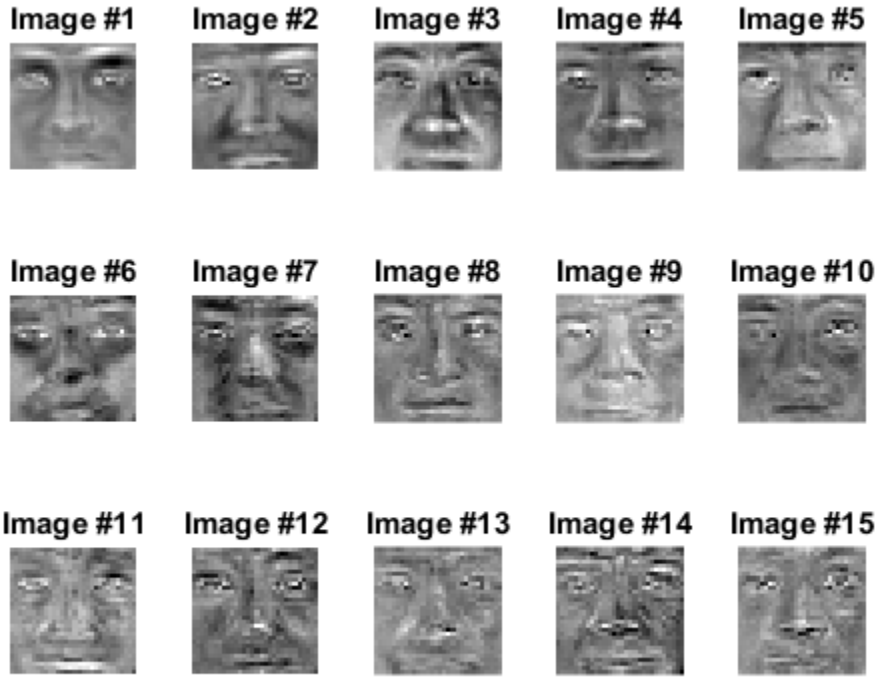
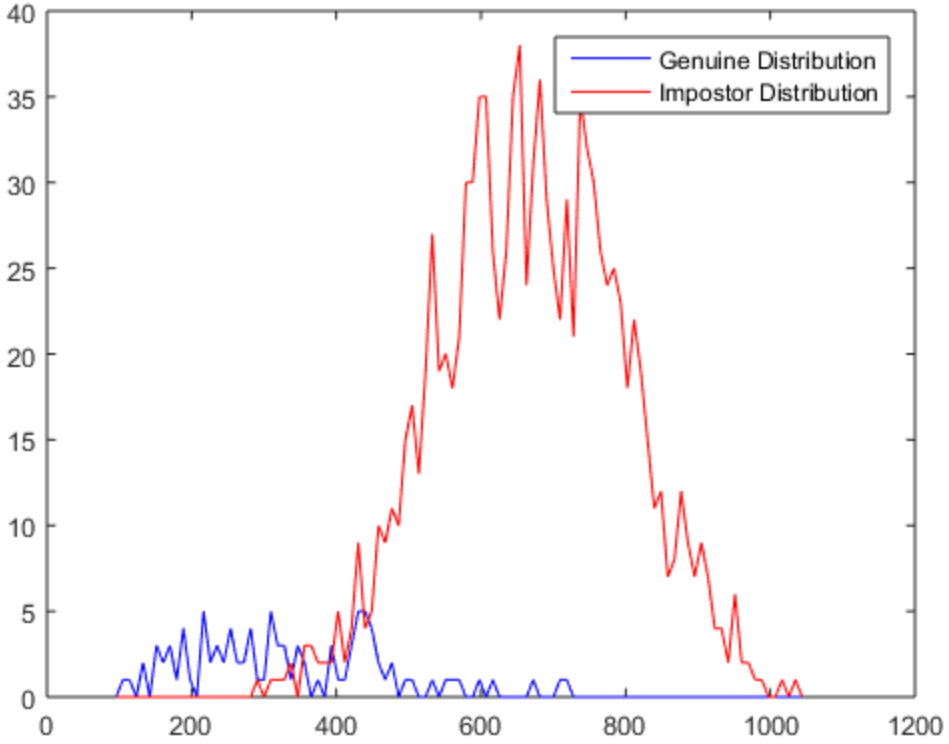
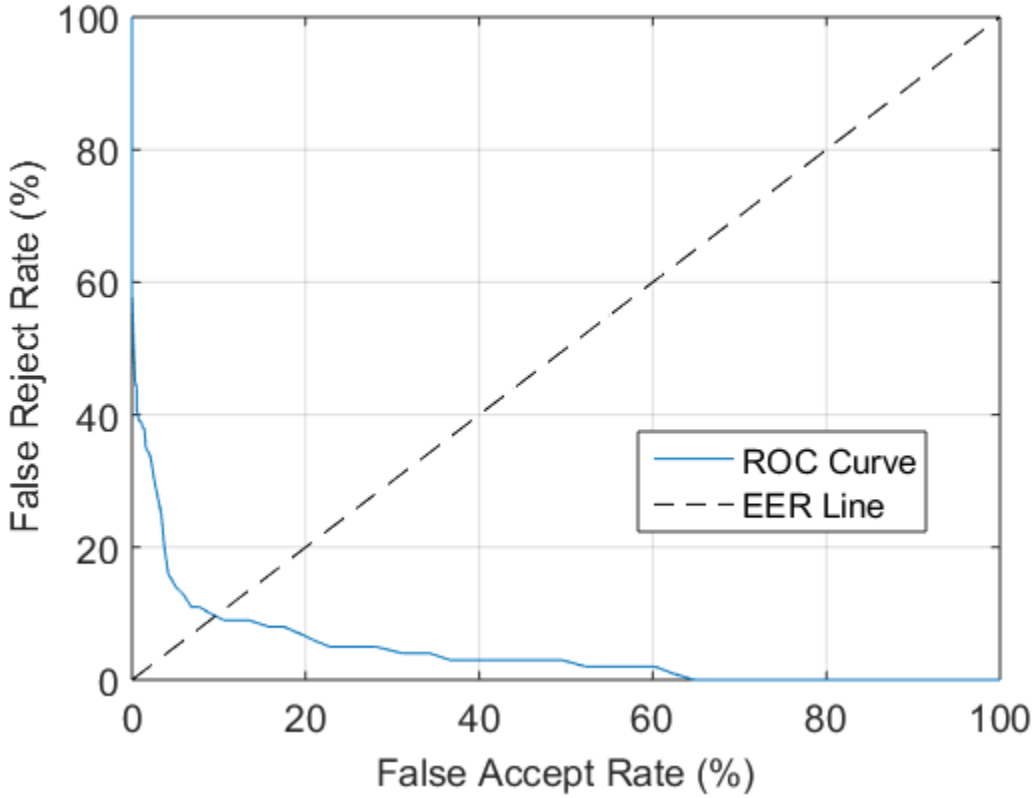


Image #1
Image #2
Image #3
Image #4
Image #5
Image #6
Image #7
Image #8
Image #9
Image #10
Image #11
Image #12
Image #13
Image #14
Image #15


Genuine Distribution
Impostor Distribution
0
5
10
15
20
25
30
35
40
0
200
400
600
800
1000
1200


ROC Curve
EER Line
False Reject Rate (%)
False Accept Rate (%)
0
20
40
60
80
100

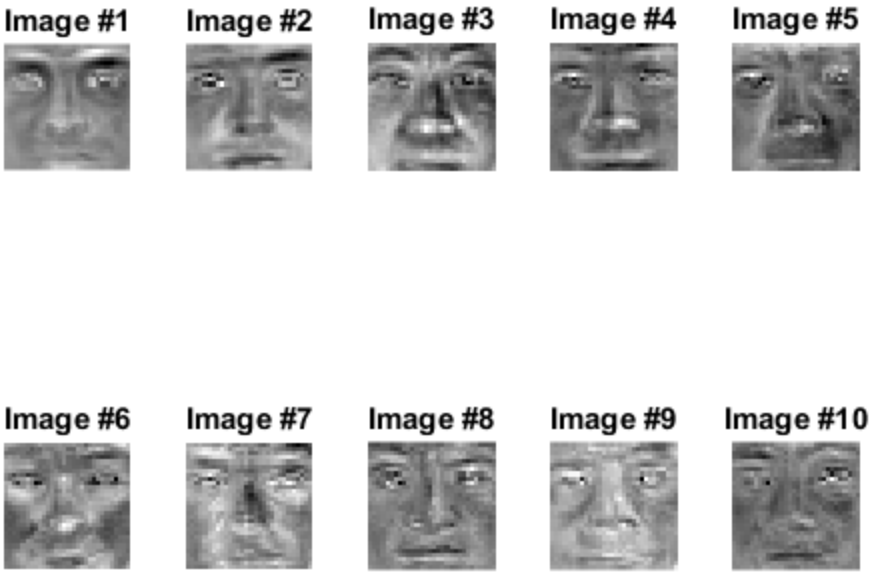
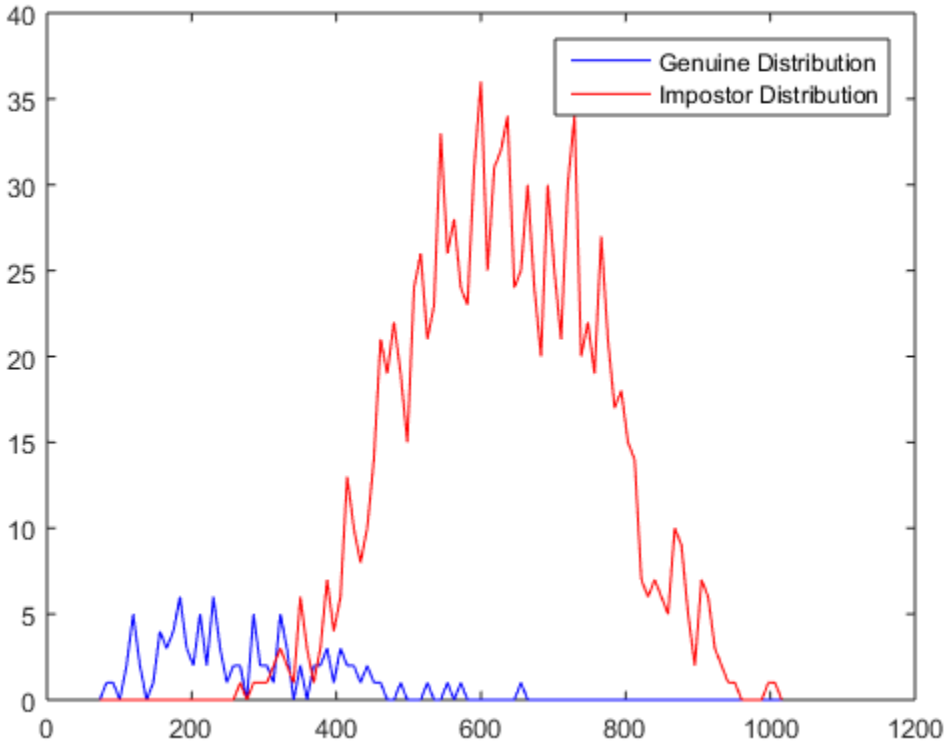


Image #1
Image #2
Image #3
Image #4
Image #5
Image #6
Image #7
Image #8
Image #9
Image #10


Genuine Distribution
Impostor Distribution
0
5
10
15
20
25
30
35
40
0
200
400
600
800
1000
1200

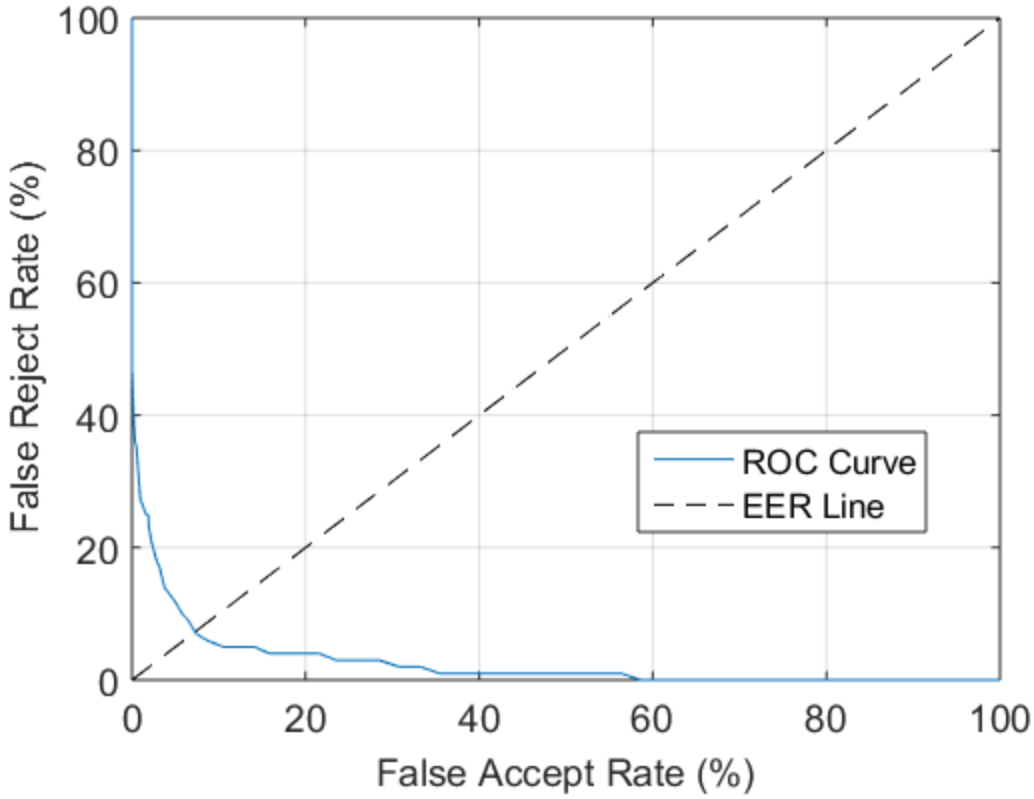
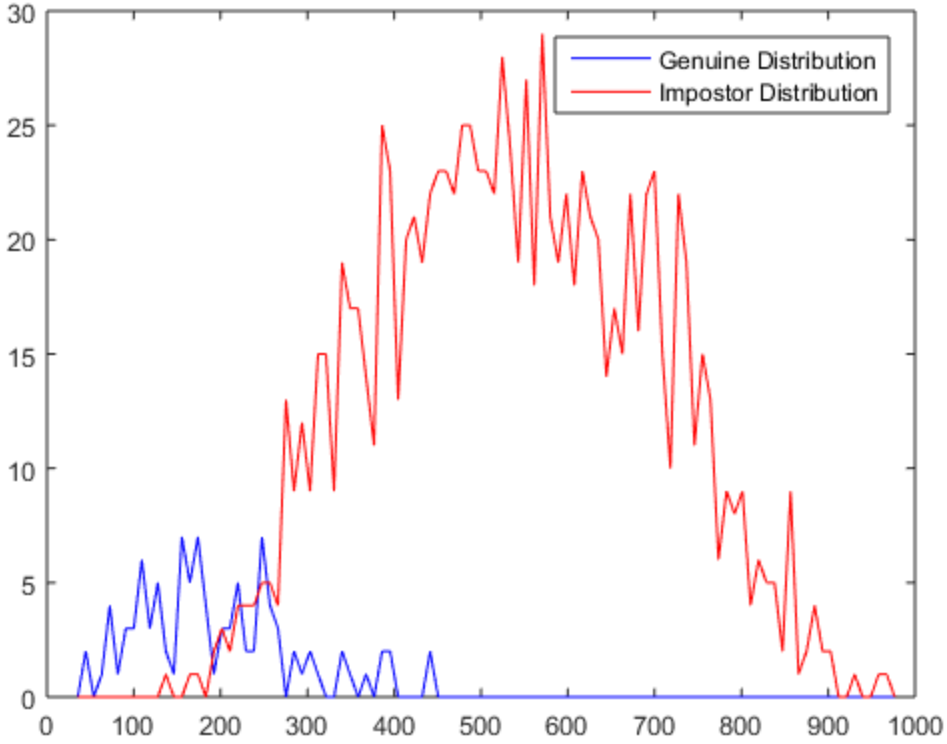
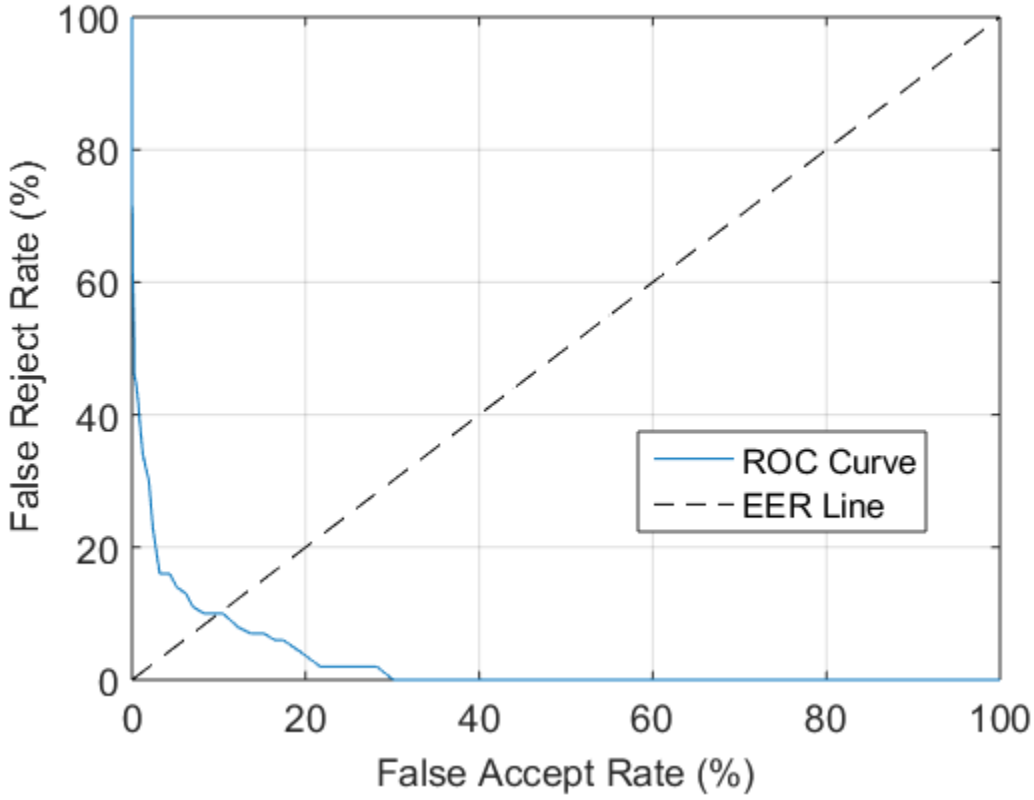

100
80
60
40
20
0
False Reject Rate (%)
0
20
40
60
80
100
False Accept Rate (%)
ROC Curve
EER Line


Image #1
Image #2
Image #3
Image #4
Image #5


Genuine Distribution
Impostor Distribution
30
25
20
15
10
5
0
0
100
200
300
400
500
600
700
800
900
1000

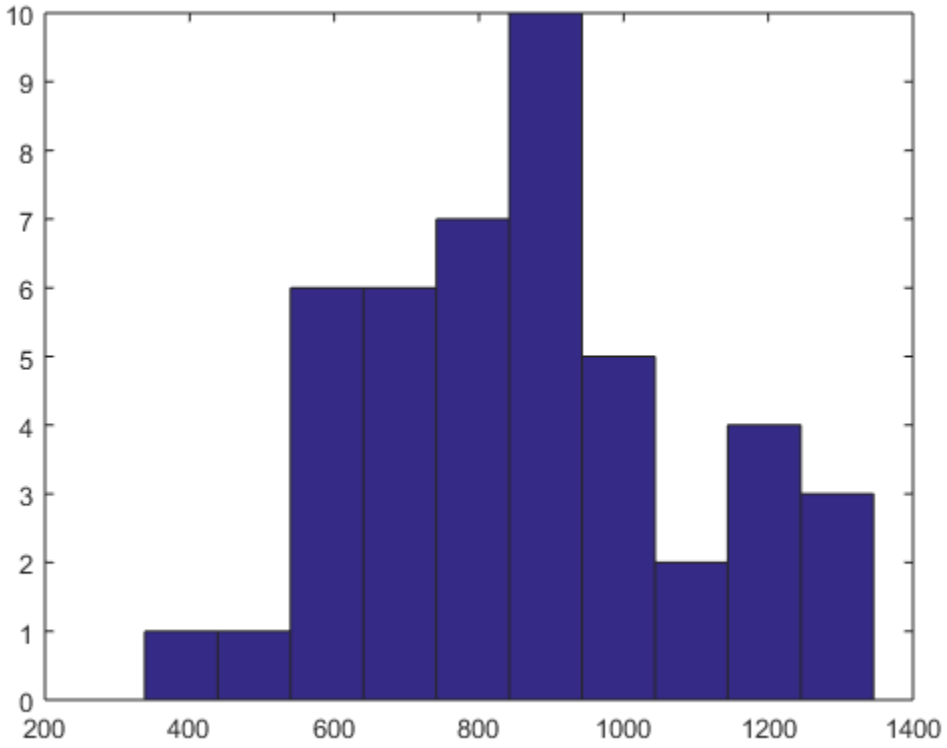

False Reject Rate (%)
False Accept Rate (%)
ROC Curve
EER Line
100
80
60
40
20
0
0
20
40
60
80
100

My Images

```
disp('Running my Face Images');
files2 = dir('My_Face_Pictures/*.jpg');
all_my_images = cell(1,10);
count = 1;
figure;

for i = 1:length(files2)
    filename =  ['My_Face_Pictures/' files2(i).name];
    file2 = imread(filename);

    subplot(2,5,i);
    imshow(file2,[]);
    title(['My Face #' num2str(i)]);
    all_my_images{i} = reshape(file2,900,1);
end
all_my_images = cell2mat(all_my_images);

disp('Processing My face in 3.....2.....1.... GO !!!!!...');
face(10,25,5,5, covariance, all_my_images, sumImage,'m');
disp('End of processing my faces yaaaaa!');
```

```
Running my Face Images
Processing My face in 3.....2.....1.... GO !!!!!...
End of processing my faces yaaaaa!
```


Image #1
Image #2
Image #3
Image #4
Image #5
Image #6
Image #7
Image #8
Image #9
Image #10
Image #11
Image #12
Image #13
Image #14
Image #15
Image #16
Image #17
Image #18
Image #19
Image #20
Image #21
Image #22
Image #23
Image #24
Image #25


10
9
8
7
6
5
4
3
2
1
0
200
400
600
800
1000
1200
1400

```
function [] = face( total, num, px, py, covariance, all_images,
 sumImage,type)
%UNTITLED2 Summary of this function goes here
%   Detailed explanation goes here

[V,D] = eigs(covariance,num);
figure;
% Comuting the 25 eigen faces and displaying them

for i = 1:num
    subplot(px,py,i);
    imshow(reshape(V(:,i),30,30),[]);
    title(['Image #' num2str(i)]);
end

E = V';
% Getting the eigen-coefficients for all the images in the database
 set
for i = 1:total
    W(:,i) = E*(double(all_images(:,i))-sumImage(:,1));
end

genCount = 1;
impCount = 1;
scoCount = 1;
for i= 1:total
    for j = i+1:total
        temp = sqrt(sum((W(:,i)-W(:,j)).^2));
        scores(i,j) = temp;
        score_dis(scoCount,1) = temp;
        scoCount = scoCount + 1;
        if type=='n'
            if idivide(i-1,int32(5)) == idivide (j-1,int32(5))
                gen(genCount) = temp;
                genCount = genCount + 1;
            else
                imp(impCount) = temp;
                impCount = impCount + 1;
            end
        end
    end
end

if type=='n'
    drawROC(gen',imp','d');

elseif type=='m'
    figure;
    hist(score_dis);
end

end
```

```
Error using face (line 5)
Not enough input arguments.
```

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