```
[a fs]=audioread("C:\Users\pooja\Desktop\Cryptography\sig100.wav")
```

a = 650000×2
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0234   -0.0156
   -0.0264   -0.0156
      ⋮
      ⋮

fs = 360

```
a
```

a = 650000×2
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0283   -0.0127
   -0.0234   -0.0156
   -0.0264   -0.0156
      ⋮
      ⋮

```
count(string(a<0),string(1))
```

ans = 650000×2
     0   0
     0   0
     0   0
     0   0
     0   0
     0   0
     0   0
     0   0
     0   0
     0   0
     ⋮
     ⋮

```
t=(0:length(a)-1)/fs
```

t = 1×650000
10³ ×

       0   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 ⋯

```
%plotting the original waveform

%JPEG and %PNG images have pixels with values that range from 0-1
a=abs(a)
```

a = 650000×2
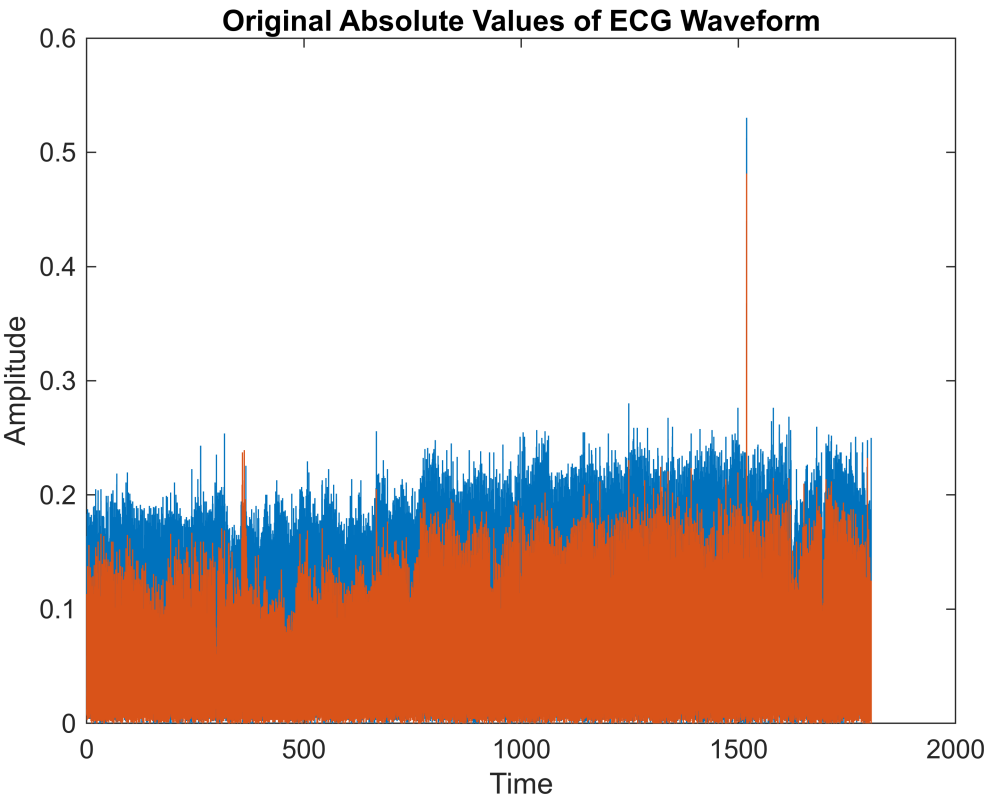```

```
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0283    0.0127
0.0234    0.0156
0.0264    0.0156
  .
  .
  .
```

```
plot(t,a)
title("Original Absolute Values of ECG Waveform")
xlabel("Time")
ylabel("Amplitude")
```



```
count(string(a<0),string(1))
```

```
ans = 650000×2
     0    0
     0    0
     0    0
     0    0
     0    0
     0    0
     0    0
     0    0
```

```
        0     0
        0     0
        :
        :
```

```
%reshaping the matrix into a column matrix and then into a square matrix
a_column=reshape(a,[],1)
```

```
a_column = 1300000×1
    0.0283
    0.0283
    0.0283
    0.0283
    0.0283
    0.0283
    0.0283
    0.0283
    0.0234
    0.0264
      :
      :
```

```
a_row=a_column'
```

```
a_row = 1×1300000
    0.0283    0.0283    0.0283    0.0283    0.0283    0.0283    0.0283    0.0283 ···
```

```
a_square=reshape(a_row,[1300,1000])
```

```
a_square = 1300×1000
    0.0283    0.0791    0.0684    0.0693    0.0576    0.0664    0.0576    0.0898 ···
    0.0283    0.0791    0.0703    0.0684    0.0586    0.0693    0.0566    0.0869
    0.0283    0.0781    0.0742    0.0684    0.0547    0.0703    0.0557    0.0889
    0.0283    0.0771    0.0723    0.0684    0.0547    0.0703    0.0557    0.0850
    0.0283    0.0771    0.0674    0.0703    0.0537    0.0693    0.0596    0.0869
    0.0283    0.0791    0.0674    0.0703    0.0566    0.0674    0.0596    0.0879
    0.0283    0.0820    0.0684    0.0703    0.0586    0.0674    0.0576    0.0898
    0.0283    0.0811    0.0693    0.0684    0.0596    0.0703    0.0566    0.0908
    0.0234    0.0781    0.0713    0.0693    0.0557    0.0723    0.0576    0.0898
    0.0264    0.0771    0.0703    0.0713    0.0557    0.0732    0.0576    0.0889
      :
      :
```

```
%writing the wave files into a jpg files
imwrite(a_square,'C:\Users\pooja\Desktop\Cryptography\wave.jpg')
imwrite(a_square,'C:\Users\pooja\Desktop\Cryptography\wave_png.png')



%reading the image files and decryption
a_jpg=imread('C:\Users\pooja\Desktop\Cryptography\wave.jpg')
```

```
a_jpg = 1300×1000 uint8 matrix
    6    20    20    14    16    16    15    21    15    18    27    10    21    18    25    12 ···
    6    20    20    14    16    16    15    21    15    18    26     9    19    15    24    14
    6    20    20    14    16    16    15    21    16    18    26     8    16    12    23    18
    6    20    20    14    16    16    15    21    16    18    25     8    15     9    22    20
    6    20    20    14    16    16    15    21    17    16    24    10    18    11    22    19
```

```
   6   20   20   14   16   16   15   21   18   15   23   14   25   14   21   15
   6   20   20   14   16   16   15   21   19   13   22   17   32   20   21   11
   6   20   20   14   16   16   15   21   19   12   22   20   37   23   20    8
   3   22   16   20   11   20   12   24   19   12   26   20   30   23   26    5
   4   22   16   20   11   20   12   24   19   12   24   16   23   18   25    9
   :
   :
```

a_jpg_double=im2double(a_jpg)

```
a_jpg_double = 1300×1000
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824···
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0235   0.0784   0.0784   0.0549   0.0627   0.0627   0.0588   0.0824
   0.0118   0.0863   0.0627   0.0784   0.0431   0.0784   0.0471   0.0941
   0.0157   0.0863   0.0627   0.0784   0.0431   0.0784   0.0471   0.0941
   :
   :
```

a_png=imread('C:\Users\pooja\Desktop\Cryptography\wave_png.png')

```
a_png = 1300×1000 uint8 matrix
   7   20   17   18   15   17   15   23   19   17   24   16   22   17   20   17···
   7   20   18   17   15   18   14   22   18   17   23   17   16   17   21   16
   7   20   19   17   14   18   14   23   18   17   23   17    9   16   21   15
   7   20   18   17   14   18   14   22   18   17   23   17    0   16   21   16
   7   20   17   18   14   18   15   22   17   17   22   17   12   16   21   15
   7   20   17   18   14   17   15   22   17   17   23   16   25   17   20   15
   7   21   17   18   15   17   15   23   17   16   23   17   35   17   20   14
   7   21   18   17   15   18   14   23   17   14   24   17   39   17   20   14
   6   20   18   18   14   18   15   23   18   14   23   17   38   17   21   13
   7   20   18   18   14   19   15   23   17   14   22   17   28   17   22   13
   :
   :
```

a_png_double=im2double(a_png)

```
a_png_double = 1300×1000
   0.0275   0.0784   0.0667   0.0706   0.0588   0.0667   0.0588   0.0902···
   0.0275   0.0784   0.0706   0.0667   0.0588   0.0706   0.0549   0.0863
   0.0275   0.0784   0.0745   0.0667   0.0549   0.0706   0.0549   0.0902
   0.0275   0.0784   0.0706   0.0667   0.0549   0.0706   0.0549   0.0863
   0.0275   0.0784   0.0667   0.0706   0.0549   0.0706   0.0588   0.0863
   0.0275   0.0784   0.0667   0.0706   0.0549   0.0667   0.0588   0.0863
   0.0275   0.0824   0.0667   0.0706   0.0588   0.0667   0.0588   0.0902
   0.0275   0.0824   0.0706   0.0667   0.0588   0.0706   0.0549   0.0902
   0.0235   0.0784   0.0706   0.0706   0.0549   0.0706   0.0588   0.0902
   0.0275   0.0784   0.0706   0.0706   0.0549   0.0745   0.0588   0.0902
   :
   :
```

dec_jpg=reshape(a_jpg_double,[650000,2])

```
dec_jpg = 650000×2
   0.0235   0.0235
```

```
    0.0235    0.0196
    0.0235    0.0157
    0.0235    0.0118
    0.0235    0.0157
    0.0235    0.0235
    0.0235    0.0314
    0.0235    0.0353
    0.0118    0.0196
    0.0157    0.0196
      :
      :
```

```
dec_png=reshape(a_png_double,[650000,2])
```

```
dec_png = 650000×2
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0275    0.0118
    0.0235    0.0157
    0.0275    0.0157
      :
      :
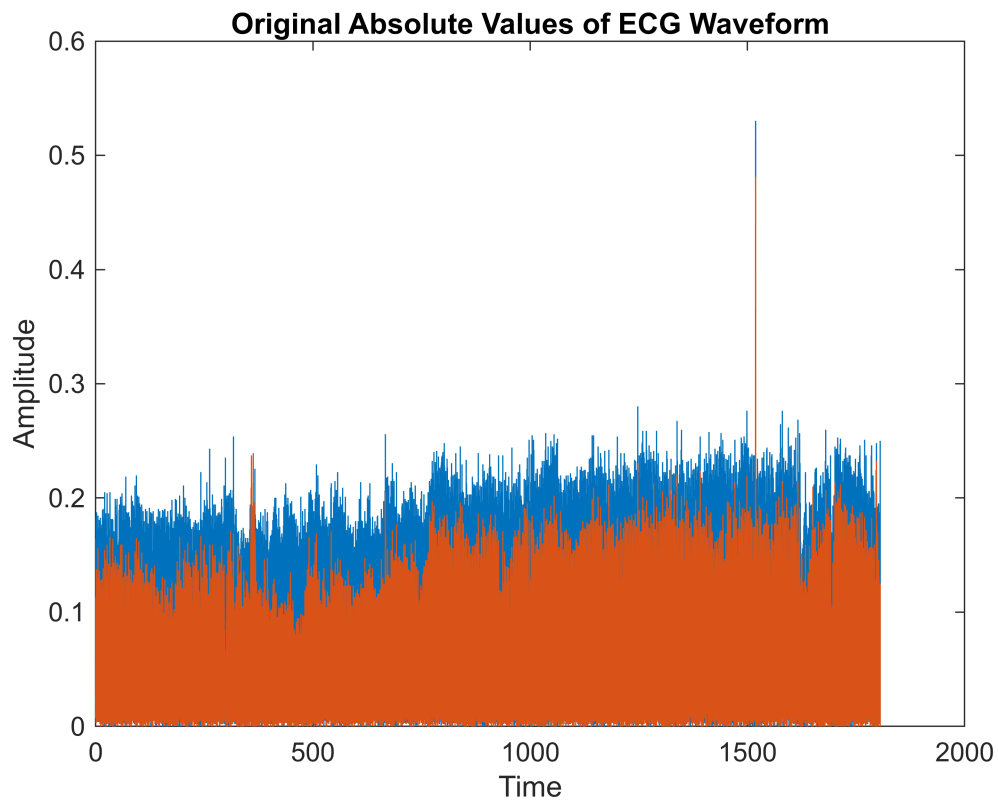```

```
%comparison with the original file
a
```

```
a = 650000×2
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
    0.0283    0.0127
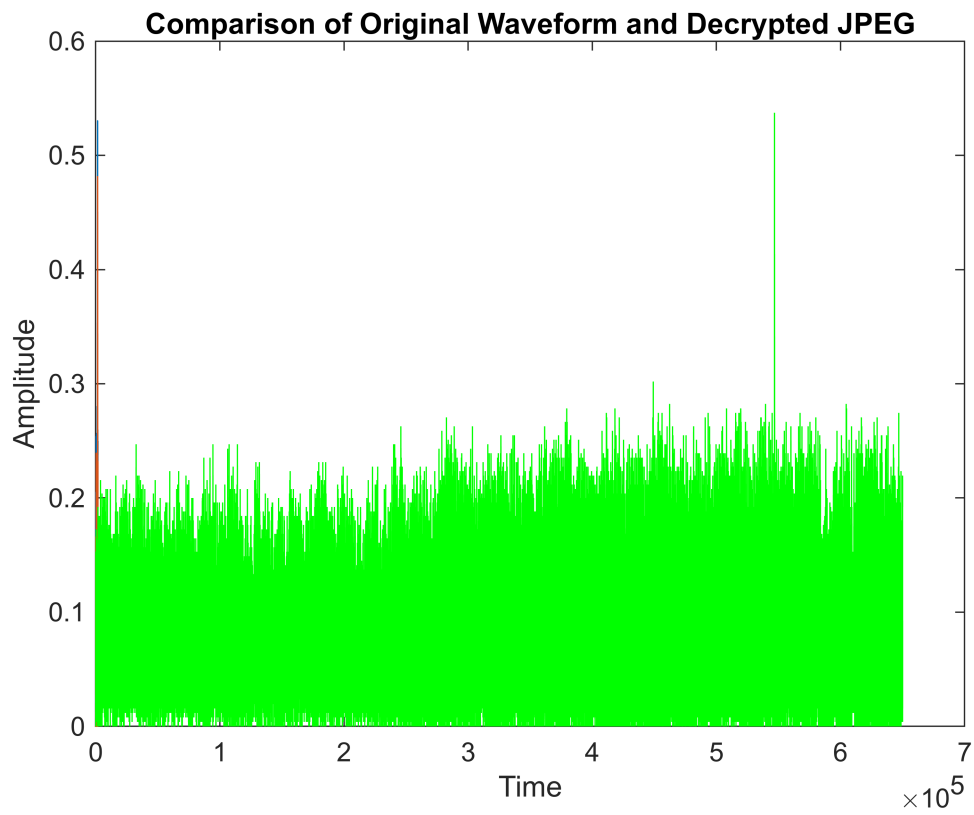    0.0234    0.0156
    0.0264    0.0156
      :
      :
```

```
plot(t,a)
title("Original Absolute Values of ECG Waveform")
xlabel("Time")
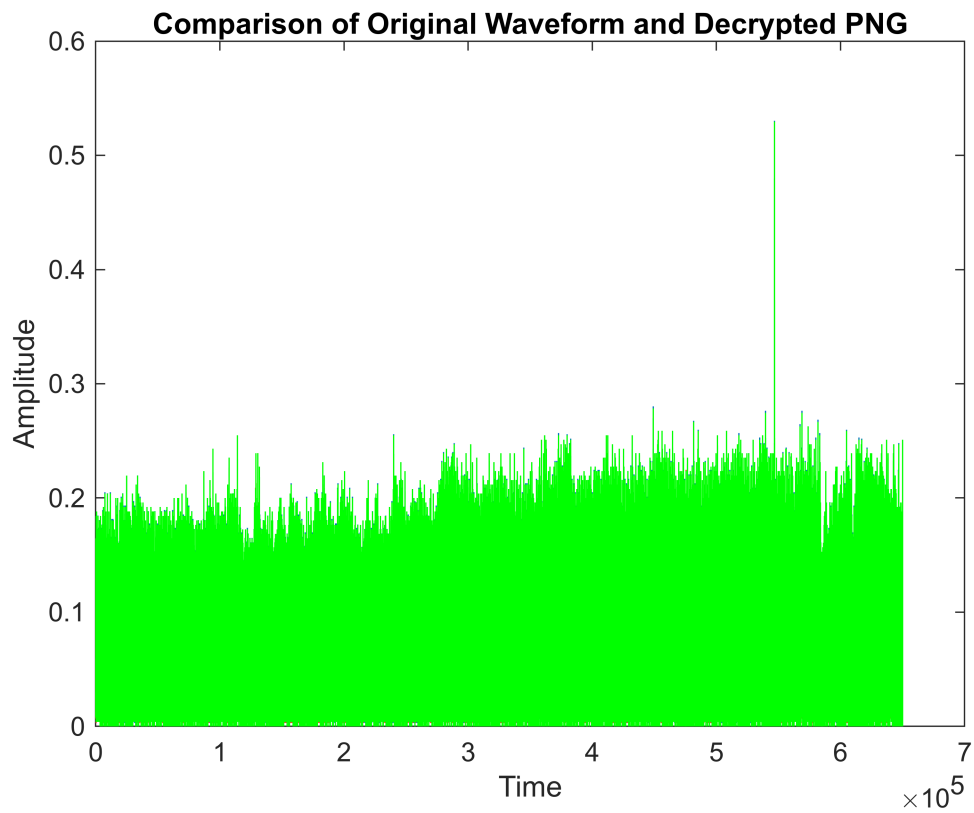ylabel("Amplitude")
```

Original Absolute Values of ECG Waveform

```
plot(t,a)
hold on
plot(dec_jpg,'g')
hold off
title("Comparison of Original Waveform and Decrypted JPEG")
xlabel("Time")
ylabel("Amplitude")
```

Comparison of Original Waveform and Decrypted JPEG

```
plot(a)
hold on
plot(dec_png,'g')
hold off
title("Comparison of Original Waveform and Decrypted PNG")
xlabel("Time")
ylabel("Amplitude")
```

Comparison of Original Waveform and Decrypted PNG

---

error_mat_jpg=a-dec_jpg

```
error_mat_jpg = 650000×2
    0.0048   -0.0108
    0.0048   -0.0069
    0.0048   -0.0030
    0.0048    0.0009
    0.0048   -0.0030
    0.0048   -0.0108
    0.0048   -0.0187
    0.0048   -0.0226
    0.0117   -0.0040
    0.0107   -0.0040
      ⋮
      ⋮
```

---

error_mat_png=a-dec_png

```
error_mat_png = 650000×2
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
    0.0009    0.0009
   -0.0001   -0.0001
   -0.0011   -0.0001
```

⋮

```matlab
%making all the values negative once again
dec_jpg=-dec_jpg
```

```
dec_jpg = 650000×2
   -0.0235   -0.0235
   -0.0235   -0.0196
   -0.0235   -0.0157
   -0.0235   -0.0118
   -0.0235   -0.0157
   -0.0235   -0.0235
   -0.0235   -0.0314
   -0.0235   -0.0353
   -0.0118   -0.0196
   -0.0157   -0.0196
      ⋮
```

```matlab
dec_png=-dec_png
```

```
dec_png = 650000×2
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0275   -0.0118
   -0.0235   -0.0157
   -0.0275   -0.0157
      ⋮
```