

Homework 1

EE 604 - Image Processing
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1 Code

Below is the Python code used to generate the figure:

```
import numpy as np
import matplotlib.pyplot as plt

def create_img(r):

    mat = np.ones((4*r,4*r))

    ### creating the triangles using D-4 distance

    # (left triangle) center at (r,2r) and distance = r
    for i in range(4*r):
        for j in range(0,r):
            if abs(i-2*r)+abs(j-r)<r:
                mat[i,j]=0

    # (right triangle) center at (3r,2r) and distance = r
    for i in range(4*r):
        for j in range(3*r,4*r):
            if abs(i-2*r)+abs(j-3*r)<r:
                mat[i,j]=0

    ### creating the center square

    # complete square with side length 2r
    for i in range(r,3*r):
        for j in range(r,3*r):
            mat[i,j]=0

    # carving out a smaller square of side length r
    for i in range(3*r//2, 3*r//2+r):
        for j in range(3*r//2, 3*r//2+r):
            mat[i,j]=1
```

```

#### creating top and bottom hemi-circles using Euclidean distance

# top hemi-circle using center (2r,r) and distance = r
for i in range(0,r):
    for j in range(0,4*r):
        if (i-r)**2+(j-2*r)**2<=r**2:
            mat[i,j]=0

# bottom hemi-circle using center (2r,3r) and distance = r
for i in range(3*r,4*r):
    for j in range(0,4*r):
        if (i-3*r)**2+(j-2*r)**2<=r**2:
            mat[i,j]=0

#### Add a border of length r
final_mat = np.ones((6*r, 6*r))
final_mat[r:5*r, r:5*r] = mat

#### image plot
plt.imshow(final_mat, cmap='gray')
plt.savefig('img.png') # Save the figure as an image file
plt.show()

# Example usage:
create_img(1000)

```

2 Result

The figure generated using the above code for $r = 1000$ is shown below:

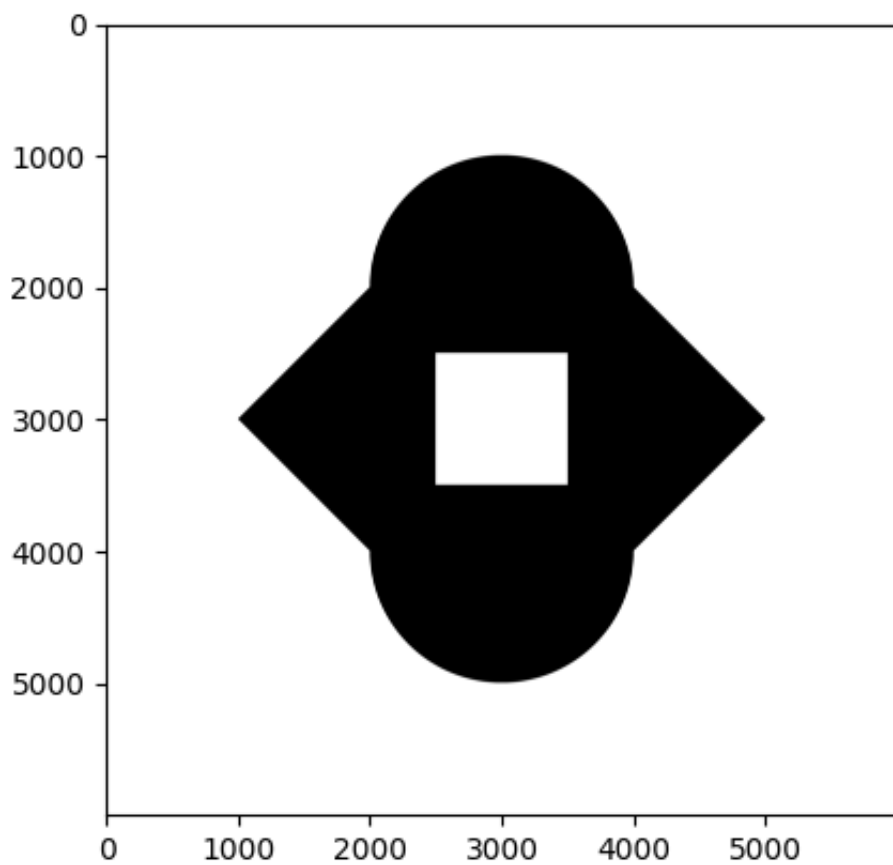


Figure 1: Figure for $r = 1000$.