Image processing starter kit

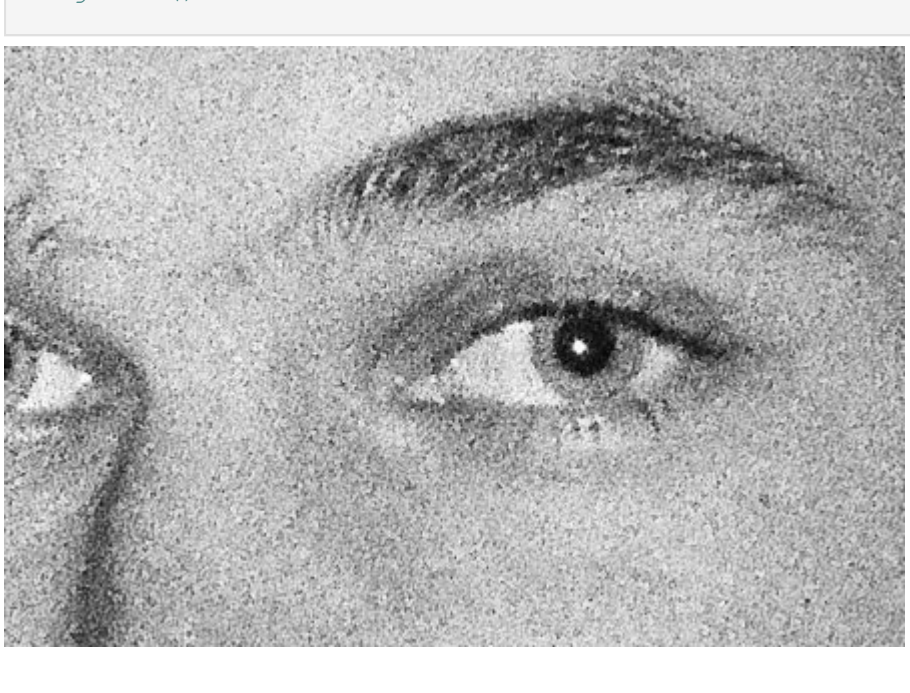
This is the starter kit for your images project. There are a number of image files we will use in this project so please download and unzip them. The files inside the zip look like this:

Make sure the unzipped image files are in the same directory as your `images.ipynb` file and that you are storing all files in the root of your repository. Do not create any subdirectories in your repository. (If you double-click on a zip file it tends to create a subdirectory so move the files afterwards). Only add the notebook file to the repository, not the image files.

View

In [35]:
```
######## START ##################
```

In [36]:
```
# open 'eye.png', convert to grayscale, flip, and display
from PIL import Image
import numpy as np

img = Image.open('eye.png')
img = img.convert("L") # grayscale
display(img)  # same as display(img)
#img.show()
```

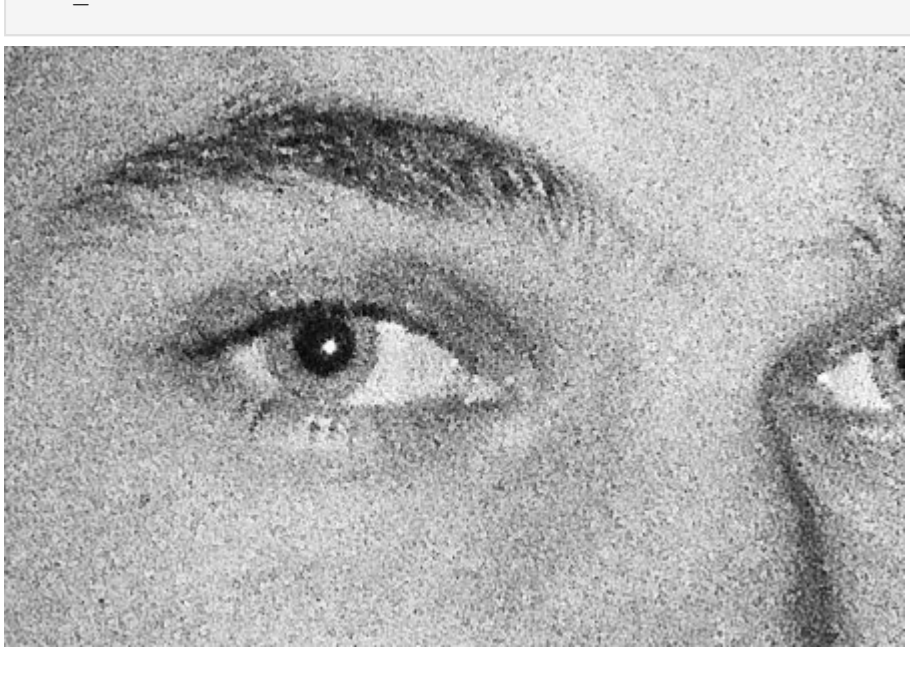


Flip

In [37]:
```
# define function flip()
def flip(img):
    width, height = img.size
    imgduplicate = img.copy()
    m_1 = img.load()
    m_2 = imgduplicate.load()
    for x in range(width):
        for y in range(height):
            m_2[x,y]=m_1[width-x-1,y]
            #m_2=m_2
    return   imgduplicate
```

In [38]:
```
new_arr=flip(img)
type(new_arr)
new_arr.save("flipped_image.png")
new_arr
```

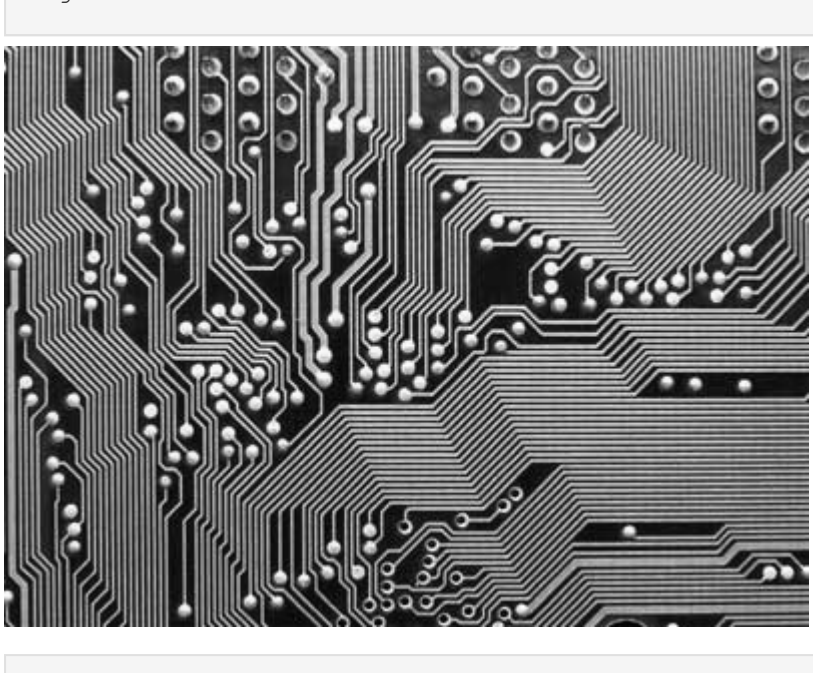
Out[38]:



Blur

In [39]:
```
# define getpixel, region3x3, avg, and blur functions

img = Image.open('pcb.png')
img = img.convert("L") # make greyscale if not already (luminance)
img
```

Out[39]:



In [40]:
```
def blur(img):
    width, height = img.size
    imgduplicate = img.copy()
    pixels=imgduplicate.load()
    for x in range(width):
        for y in range(height):
            r=region3x3(img,x,y)
            pixels[x,y]=avg(r)
    return imgduplicate
```

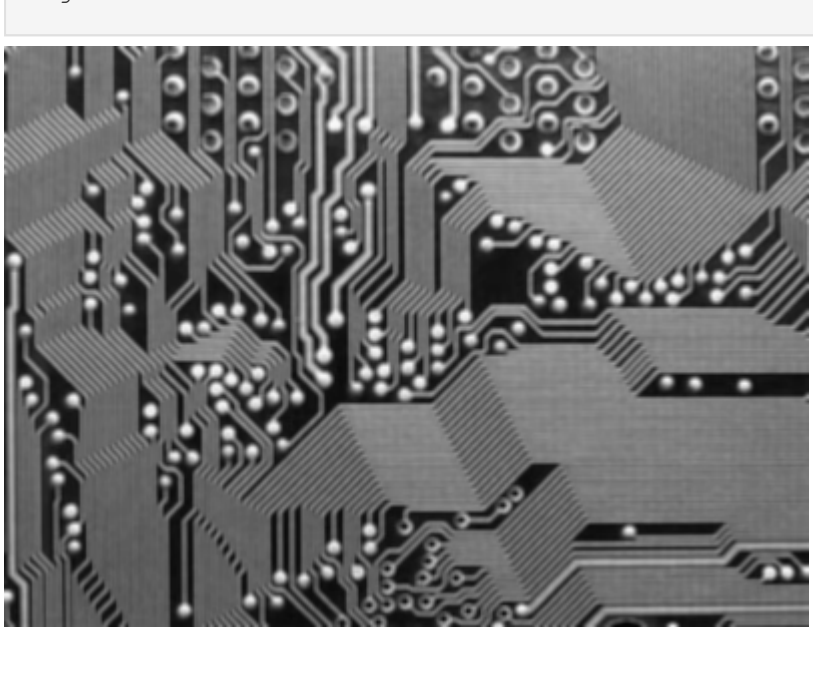
In [41]:
```
def avg(data):
    return int(sum(data)/len(data))
```

In [42]:
```
def region3x3(img,x,y):
    me = getpixel(img, x, y)
    N=getpixel(img, x, y - 1)
    S=getpixel(img, x, y + 1)
    W=getpixel(img, x-1, y)
    E=getpixel(img, x+1, y)
    SE=getpixel(img, x+1, y + 1)
    NW=getpixel(img, x-1, y - 1)
    NE=getpixel(img, x+1, y - 1)
    SW=getpixel(img, x-1, y + 1)

    return [me,N, S, E, W, NW, NE, SE, SW]
```

In [43]:
```
def getpixel(img,x,y):
    width, height = img.size
    pixel_matrix=img.load()
    if x<0:
        x=0
    if x>=width:
        x=width-1
    if y<0:
        y=0
    if y>=height:
        y=height-1
    return pixel_matrix[x,y]
```

In [44]:
```
img = blur(img)
img
```

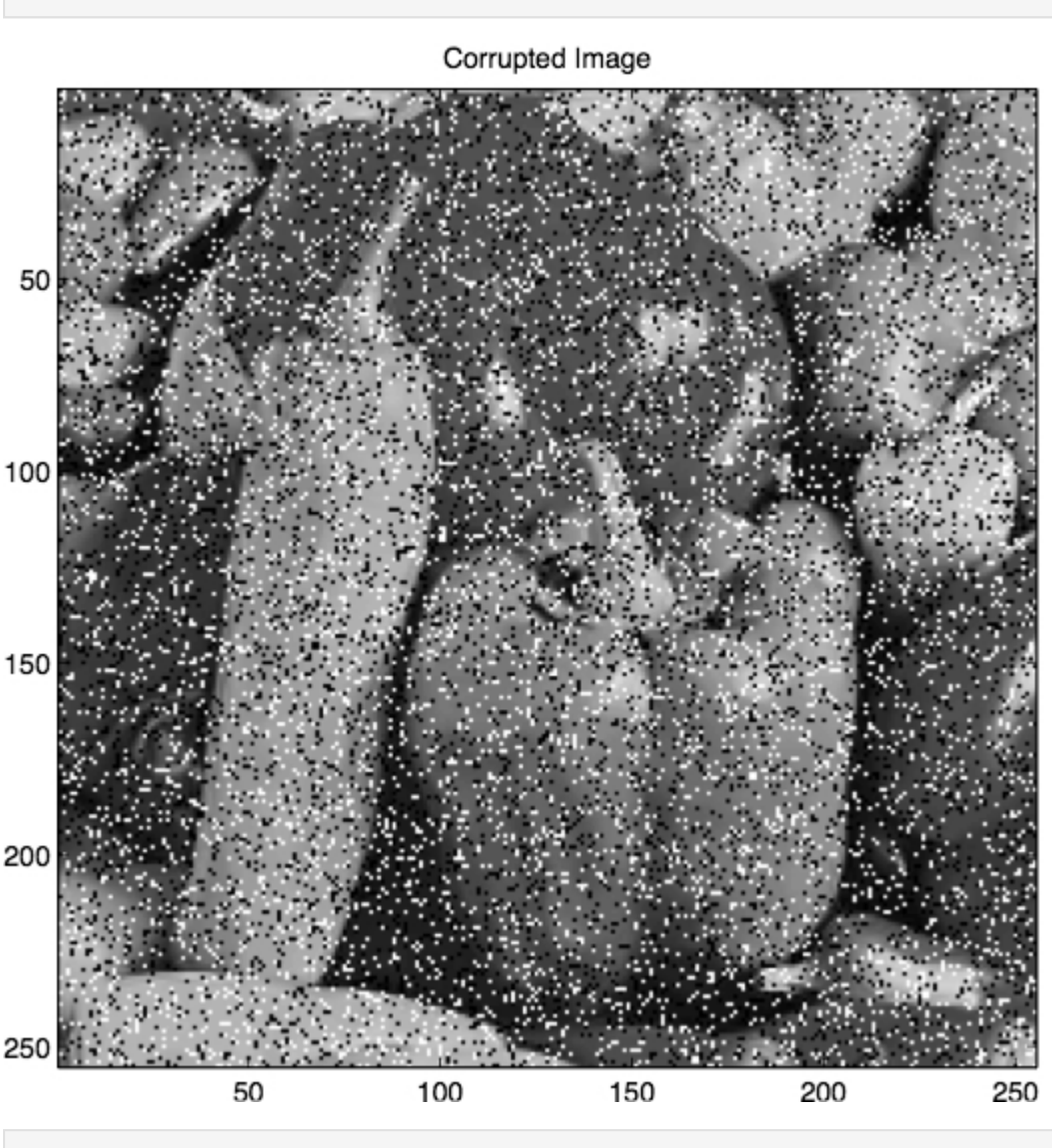
Out[44]:



Denoise

In [45]:
```
img = Image.open('Veggies_noise.jpg')
img = img.convert("L") # make greyscale if not already (luminance)
img
```

Out[45]:



In [46]:
```
# define median and denoise functions
```

In [47]:
```
def denoise(img):
    width, height = img.size
    imgduplicate = img.copy()
    pixels=imgduplicate.load()
    for x in range(width):
        for y in range(height):
            r=region3x3(img,x,y)
            pixels[x,y]=median(r)
    return imgduplicate
```

In [48]:
```
def median(data):
    sort_data=sorted(data)
    index=round(len(sort_data)/2)
    return int(sort_data[index])
```

In [49]:
```
def region3x3(img,x,y):
    me = getpixel(img, x, y)
    N=getpixel(img, x, y - 1)
    S=getpixel(img, x, y + 1)
    W=getpixel(img, x-1, y)
    E=getpixel(img, x+1, y)
    SE=getpixel(img, x+1, y + 1)
    NW=getpixel(img, x-1, y - 1)
    NE=getpixel(img, x+1, y - 1)
    SW=getpixel(img, x-1, y + 1)

    return [me,N, S, E, W, NW, NE, SE, SW]
```

In [50]:
```
def getpixel(img,x,y):
    width, height = img.size
    pixel_matrix=img.load()
    if x<0:
        x=0
    if x>=width:
        x=width-1
    if y<0:
        y=0
    if y>=height:
        y=height-1
    return pixel_matrix[x,y]
```

In [51]:
```
# denoise 3 times and display
```

In [52]:
```
for i in range(3):
    img = denoise(img)
display(img)
```

In [53]:
```
# show 'guesswho.png'
img = Image.open('guesswho.png')
img = img.convert("L") # make greyscale if not already (luminance)
img
```

Out[53]:

In [54]:
```
# denoise 3 times then display
for i in range(3):
    img = denoise(img)
display(img)
```

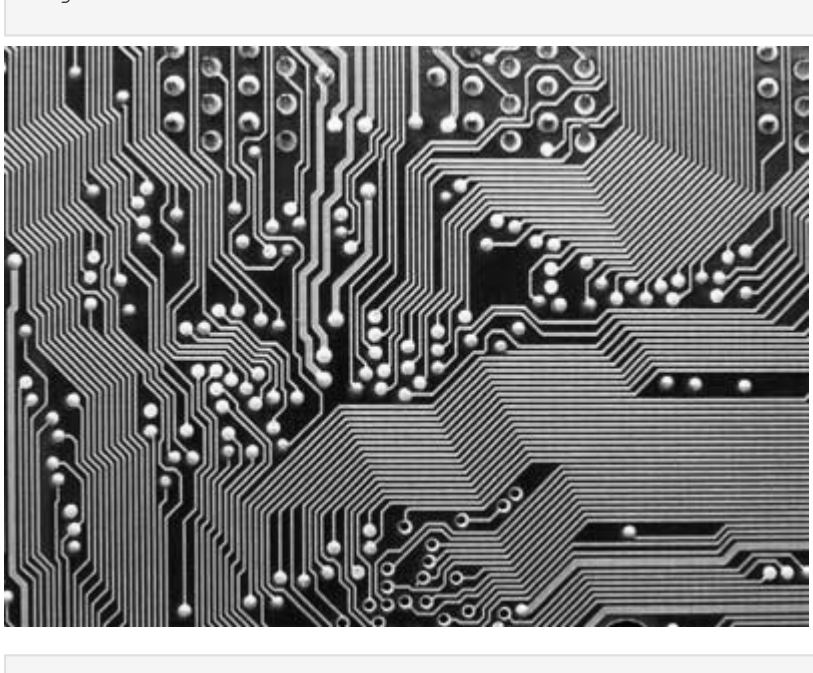
Generic filter

In [55]:
```
# define filter And open functions
def open(fname):
    img = Image.open(fname)
    img = img.convert("L")
    return img
```

Blur refactored

In [56]:
```
# Display 'pcb.png'
img = open('pcb.png')
img
```

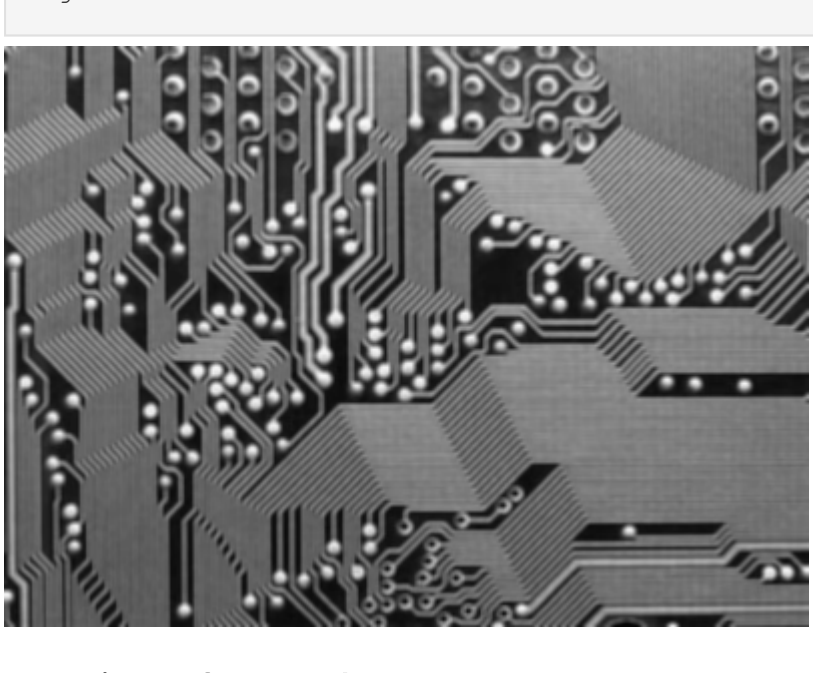
Out[56]:



In [57]:
```
def filter(img,f):
    width, height = img.size
    imgduplicate = img.copy()
    pixels=imgduplicate.load()
    for x in range(width):
        for y in range(height):
            r=region3x3(img,x,y)
            pixels[x,y]=f(r)
    return imgduplicate
```

In [58]:
```
# use filter to blur the image
img = filter(img, avg)
img
```

Out[58]:



Denoise refactored

In [59]:
```
img = open('guesswho.png')
img
```

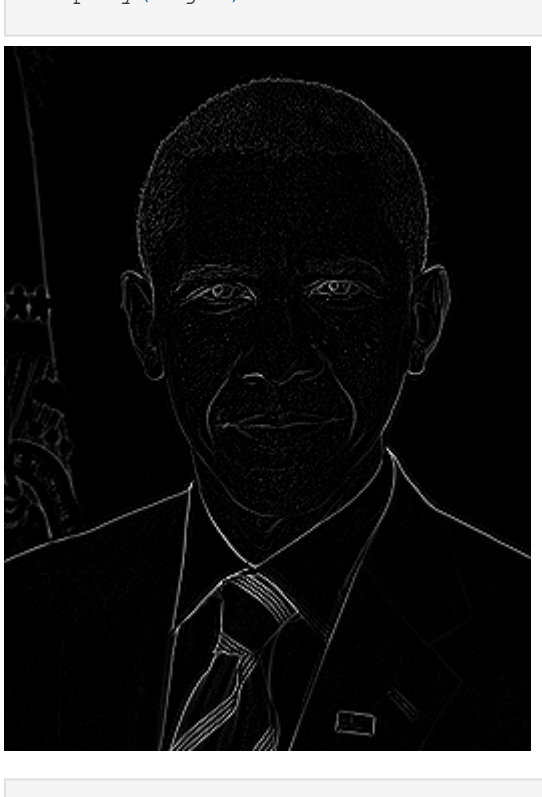
Out[59]:

In [60]:
```
# using filter function, denoise the image
img = filter(img, median)
img = filter(img, median)
img = filter(img, median)
display(img)
```

Edges

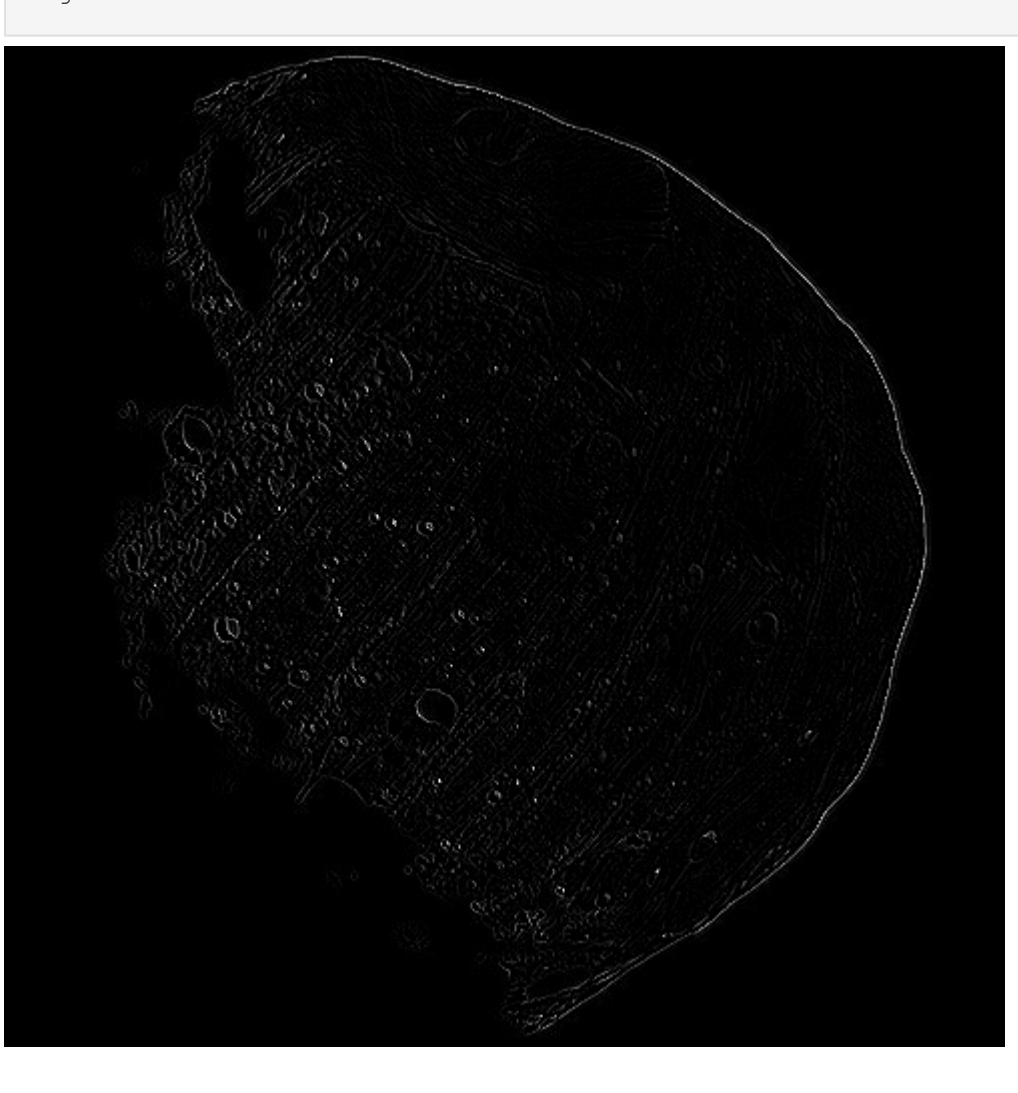
In [61]:
```
# define laplace function
def laplace(data):
    return ((data[1]+data[2]+data[3]+data[4])-(4*data[0]))
```

In [62]:
```
# Open 'obama.png' and show the edges
img = open('obama.png')

edges = filter(img, laplace)
display(edges)
```



In [63]:
```
# Show the edges for 'phobos2.jpg
img = open('phobos2.jpg')

edges = filter(img, laplace)
edges
```

Out[63]:



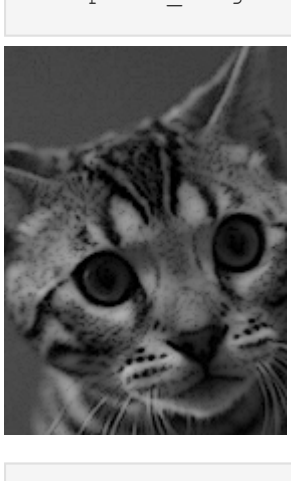
Sharpen

In [64]:
```
# define minus function
def minus(A,B):
    width, height = A.size
    imgduplicate = A.copy()
    pixels=imgduplicate.load()
    img_pix=A.load()
    edge_pix=B.load()
    for x in range(width):
        for y in range(height):
            pixels[x,y]=img_pix[x,y]-edge_pix[x,y]
    return imgduplicate
```

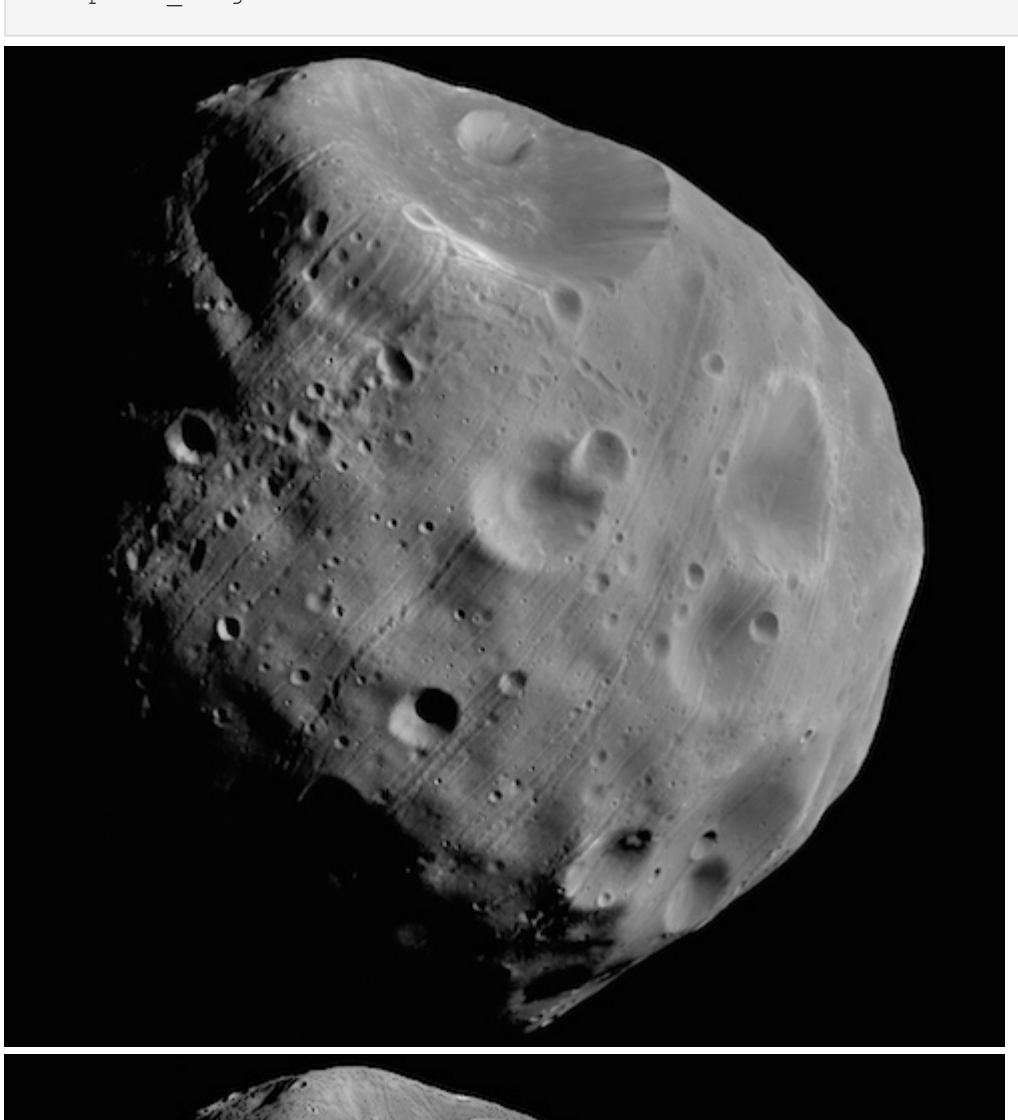
In [65]:
```
# display 'bonkers.png'
img = open('bonkers.png')
display(img)
```

In [66]:
```
# sharpen that image and display it
sharpened_image=minus(img,filter(img, laplace))
sharpened_image
```

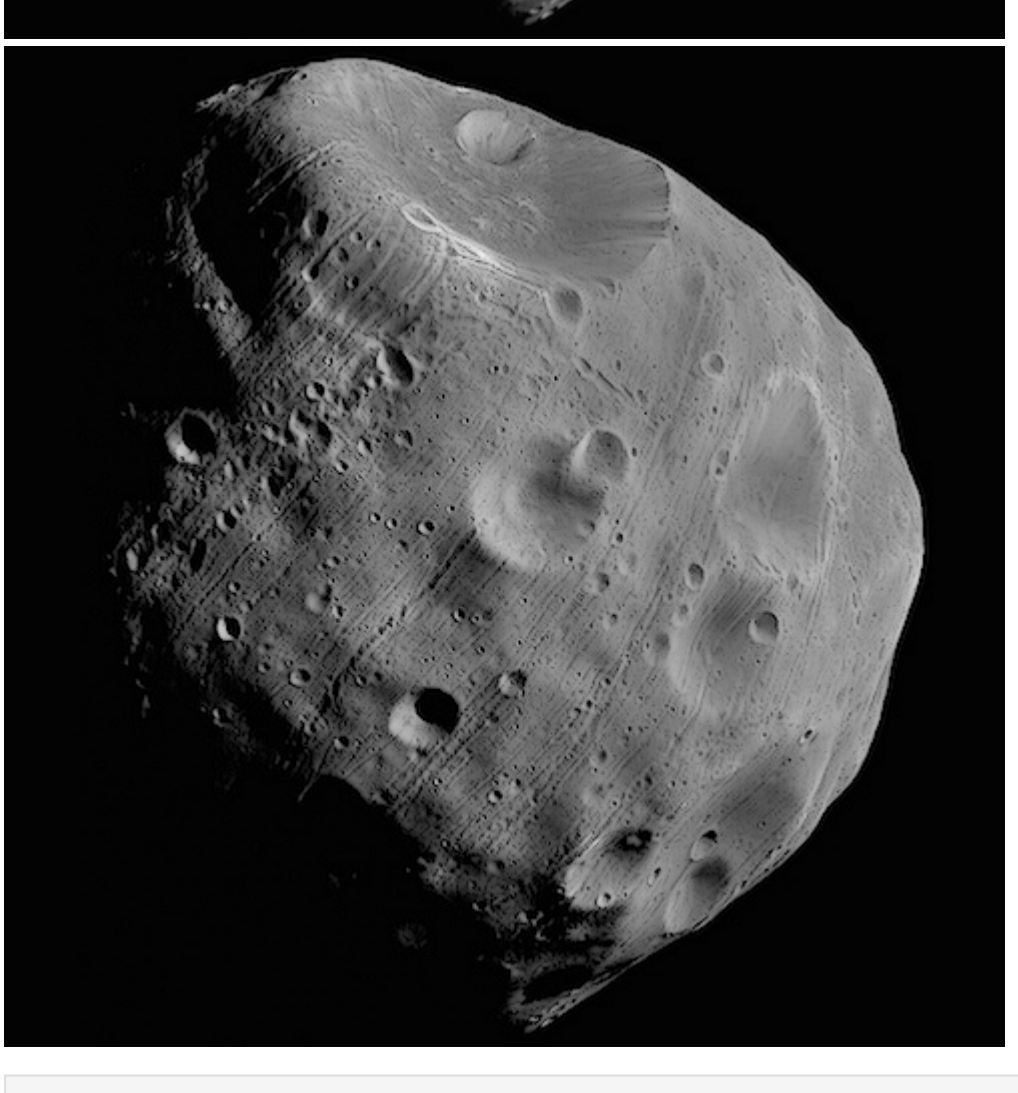
Out[66]:



In [67]:
```
img = open('phobos2.jpg')
display(img)

sharpened_image=minus(img,filter(img, laplace))
sharpened_image
```



Out[67]:



In [68]:
```
########## END  #################
```