Trabajo: Eliminación de artefactos impulsivos en una imagen

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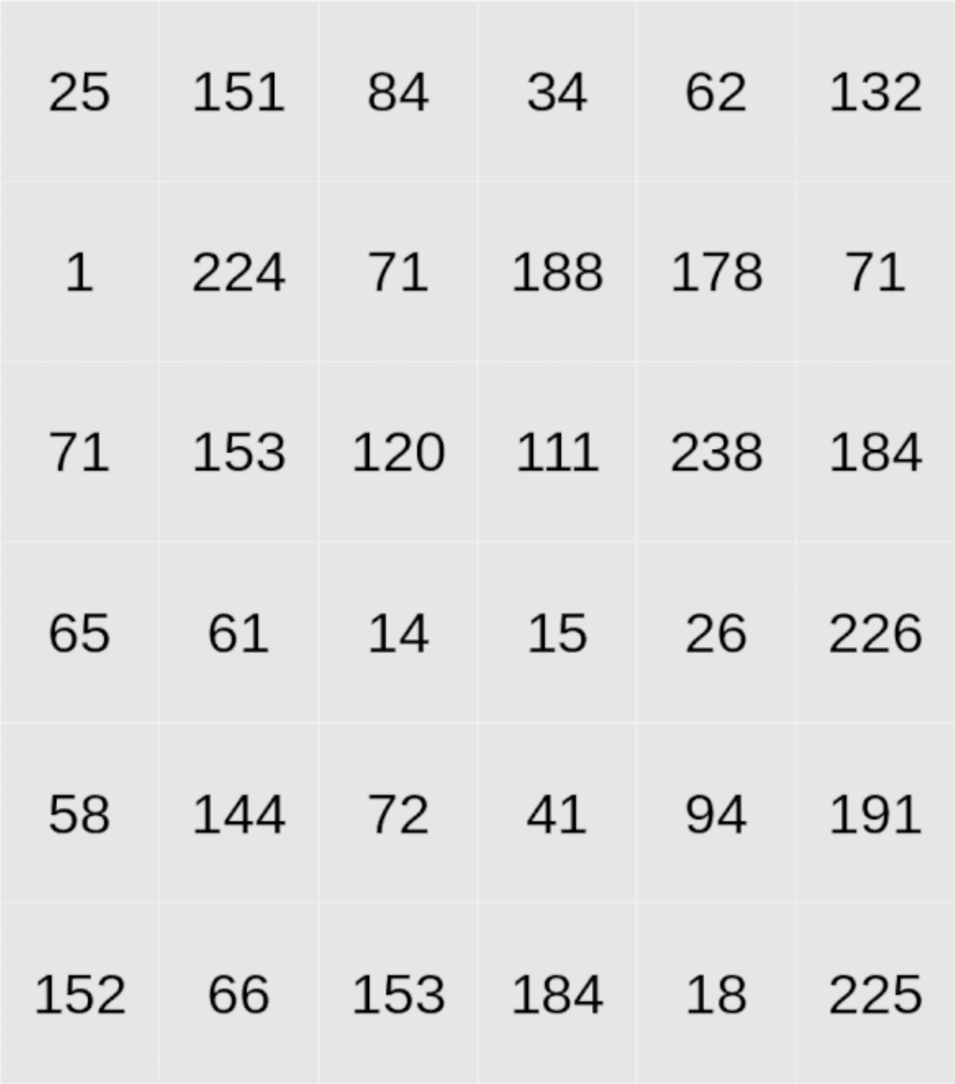


25	151	84	34	62	132
1	224	71	188	178	71
71	153	120	111	238	184
65	61	14	15	26	226
58	144	72	41	94	191
152	66	153	184	18	225

Median Filter

Source https://commons.wikimedia.org/wiki/File:Median_filter_2D.gif

In [1]:

```
# Import libraries
import numpy as np
import sklearn as sk
import skimage as ski
import matplotlib.pyplot as plt
import random
%matplotlib inline
print(f'numpy v.{np.__version__}\
\nsklearn v.{sk.__version__}\
\nskimage v.{ski.__version__}')
```

```
numpy v.1.18.1
sklearn v.0.22.1
skimage v.0.16.2
```

In [2]:

```
# Load a img
img = ski.data.astronaut()
```

In [3]:

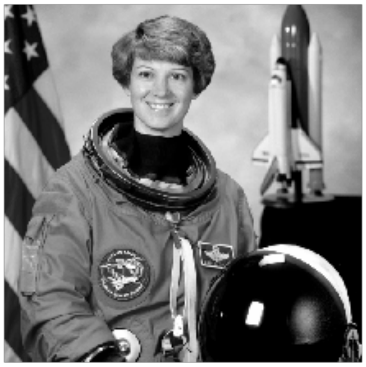
```
#Show img
plt.axis('off')
plt.imshow(img);
print(f'Img shape {img.shape}')
```

```
Img shape (512, 512, 3)
```

In [4]:

```
# Convert Color to gray (rgb2gray)
grays_img = ski.color.rgb2gray(img)
plt.axis('off')
plt.imshow(grays_img, cmap=plt.cm.gray);
print(f'Img shape {grays_img.shape}')
```

```
Img shape (512, 512)
```



1. Crear una función que modele la adición, de forma aleatoria, de artefactos impulsivos. El resultado deberá apreciarse en la visualización de la imagen, que deberá estar afectada por ruido de tipo «sal y pimienta». Como se ha visto en la asignatura, estos artefactos toman valores de intensidad máximos o mínimos, y afectan, aleatoriamente, a los píxeles de la imagen. La función a implementar debe aceptar la imagen original y devolver la imagen afectada por el ruido. Además, sería deseable que aceptara un argumento adicional para indicar el porcentaje de píxeles que se verán afectados por estos artefactos.

In [5]:

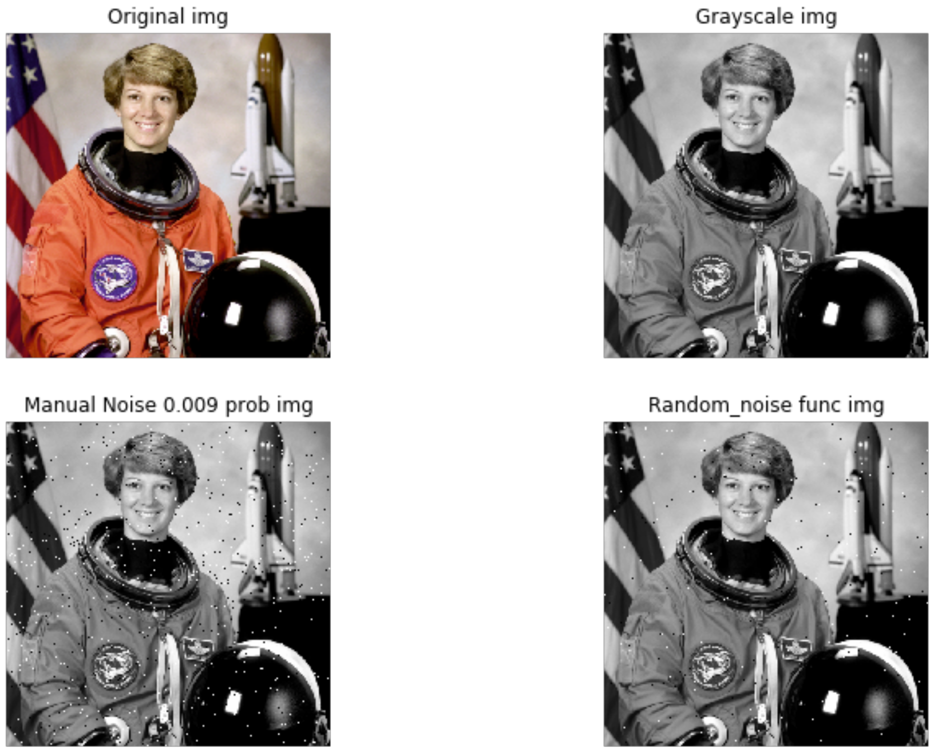
```python
# Build a function for add noise(salt & pepper) to a img
def salt_pepper_noise(img, prob=None):
    """Add salt and pepper noise to a image
input:
img: image in 1D or Grayscale image
prob: Probability of noise float in range [0.01,0.09]
output:
return image with noise
"""
    output = np.zeros(img.shape, np.float32)
    if prob is None:
        prob = random.random() * 0.01
    thres = 1 - prob
    for i in range(img.shape[0]):
        for j in range(img.shape[1]):
            rdn = random.random()
            if rdn < prob:
                output[i][j] = 0
            elif rdn > thres:
                output[i][j] = 1
            else:
                output[i][j] = img[i][j]
    return output
```

In [6]:

```python
# Build a function for add noise to a img
def add_noise(img, noise=None):
    """Add random noise
input:
img: 1d or 3d imagen
noise: float in range [0,1]
output:
return image with noise"""
    if noise is None:
        noise = random.random()*0.01
    return ski.util.random_noise(img, mode='s&p', amount=noise)
```

In [7]:

```
# Grid of img and transformations
plt.figure(figsize=(12,8))
# Original
plt.subplot(2,2,1)
plt.axis('off')
plt.title("Original img")
plt.imshow(img, cmap=plt.cm.gray)
# Gray
plt.subplot(2,2,2)
plt.axis('off')
plt.title("Grayscale img")
plt.imshow(grays_img, cmap=plt.cm.gray)
# Random Noise 1
plt.subplot(2,2,3)
plt.axis('off')
plt.title("Manual Noise 0.009 prob img")
plt.imshow(salt_pepper_noise(grays_img,0.009), cmap=plt.cm.gray)
# Random Noise 2
plt.subplot(2,2,4)
plt.axis('off')
plt.title("Random_noise func img")
plt.imshow(add_noise(grays_img), cmap=plt.cm.gray);
```



A partir de la imagen ruidosa, buscaremos eliminar los artefactos impulsivos para el posterior tratamiento de la imagen. Para ello, se deberá aplicar un filtro adecuado para este tipo de ruido

In [8]:

```
# Import methods for denoise
from skimage.restoration import (denoise_tv_chambolle, denoise_bilateral,
                                 denoise_wavelet, estimate_sigma)
```

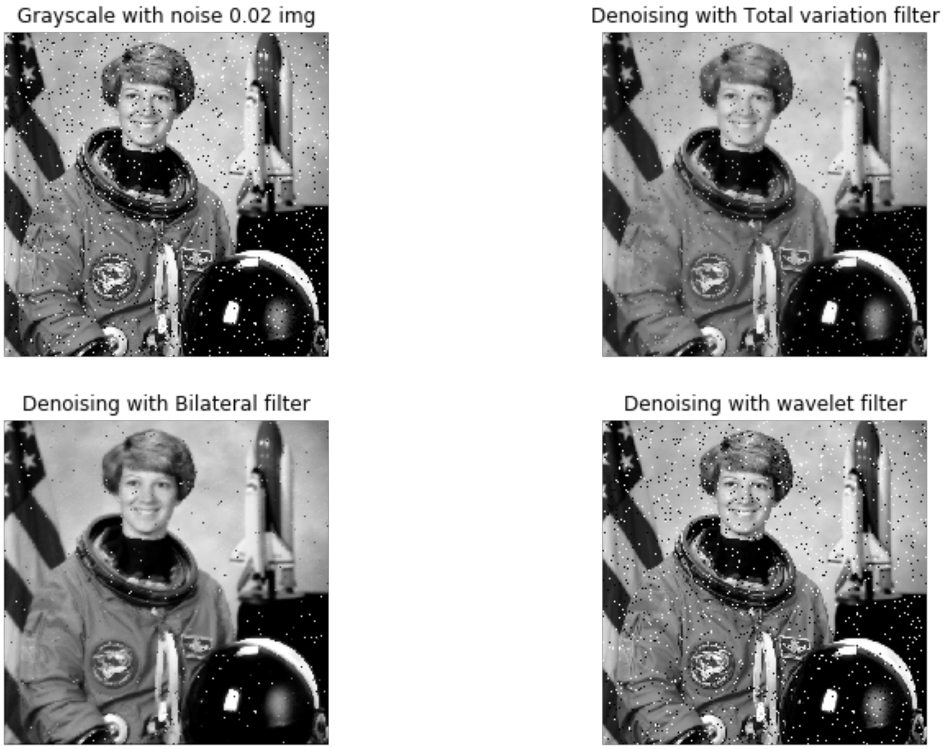
In [9]:

```
# Estimate the average noise standard deviation.
# Note : With multichannel in True is for rgb img
noise = 0.02
noisy_gray_img = salt_pepper_noise(grays_img, noise)
sigma_est = estimate_sigma(noisy_gray_img, multichannel=False, average_sigmas=True)
print(f'Real noise rate {noise} and estimated Gaussian noise {sigma_est:.3f} \
      \nMaybe gaussian is no the best because s&p is diff to gaussian method')
```

```
Real noise rate 0.02 and estimated Gaussian noise 0.019
Maybe gaussian is no the best because s&p is diff to gaussian method
```

In [10]:

```
# Grid of methods for denoise Statistical
plt.figure(figsize=(12,8))
# Noise Gray
plt.subplot(2,2,1)
plt.axis('off')
plt.title(f"Grayscale with noise {noise} img")
plt.imshow(noisy_gray_img, cmap=plt.cm.gray)
# Total variation filter
plt.subplot(2,2,2)
plt.axis('off')
plt.title("Denoising with Total variation filter")
plt.imshow(denoise_tv_chambolle(noisy_gray_img), cmap=plt.cm.gray)
# Bilateral filter
plt.subplot(2,2,3)
plt.axis('off')
plt.title("Denoising with Bilateral filter")
plt.imshow(denoise_bilateral(noisy_gray_img), cmap=plt.cm.gray)
# Wavelet denoising filter
plt.subplot(2,2,4)
plt.axis('off')
plt.title("Denoising with wavelet filter")
plt.imshow(denoise_wavelet(noisy_gray_img, rescale_sigma=False), cmap=plt.cm.gr
ay);
```



Grayscale with noise 0.02 img

Denoising with Total variation filter

Denoising with Bilateral filter

Denoising with wavelet filter

In [11]:

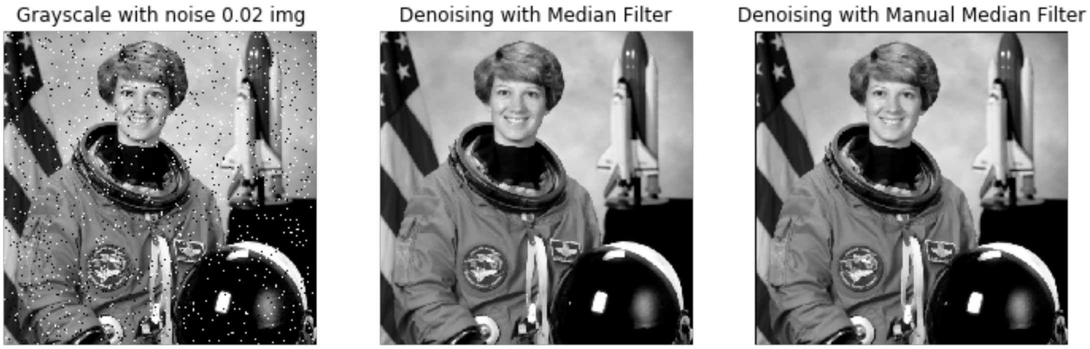
```
def manual_median_filter(img, offset=0, size_frame=3):
    """Apply Median filter
Input:
img: Imagen in 1D array like
offset: int near to 0
size_frame: int near to 3 is good
output:
return a image with filter applied"""
    # Add offset
    size = (img.shape[0]+offset*2, img.shape[1]+offset*2)
    fig = np.zeros(size, np.float32)
    for i in range(size[0]-size_frame):
        for j in range(size[1]-size_frame):
            mid_i = (i+(size_frame // 2)) + 1
            mid_j = (j+(size_frame // 2)) + 1
            tmp_list = img[i:i+size_frame,j:j+size_frame]
            fig[mid_i][mid_j] = np.median(tmp_list)

    return fig
```

In [12]:

```
# Median filter
import skimage.filters as filters
from skimage.morphology import disk #this is for the size of the frame
# Grid of filters for denoise
plt.figure(figsize=(12,8))
# Noise Gray
plt.subplot(1,3,1)
plt.axis('off')
plt.title(f"Grayscale with noise {noise} img")
plt.imshow(noisy_gray_img, cmap=plt.cm.gray)
# Median filter
plt.subplot(1,3,2)
plt.axis('off')
plt.title("Denoising with Median Filter")
plt.imshow(filters.rank.median(noisy_gray_img), cmap=plt.cm.gray) # Frame of 3
pixels by default
# Manual Median filter
plt.subplot(1,3,3)
plt.axis('off')
plt.title("Denoising with Manual Median Filter")
plt.imshow(manual_median_filter(noisy_gray_img), cmap=plt.cm.gray);
```

```
/home/phoenix/anaconda3/lib/python3.7/site-packages/skimage/filters/rank/generi
c.py:119: UserWarning: Possible precision loss converting image of type float32
to uint8 as required by rank filters. Convert manually using skimage.util.img_a
s_ubyte to silence this warning.
  out_dtype)
```



Grayscale with noise 0.02 img

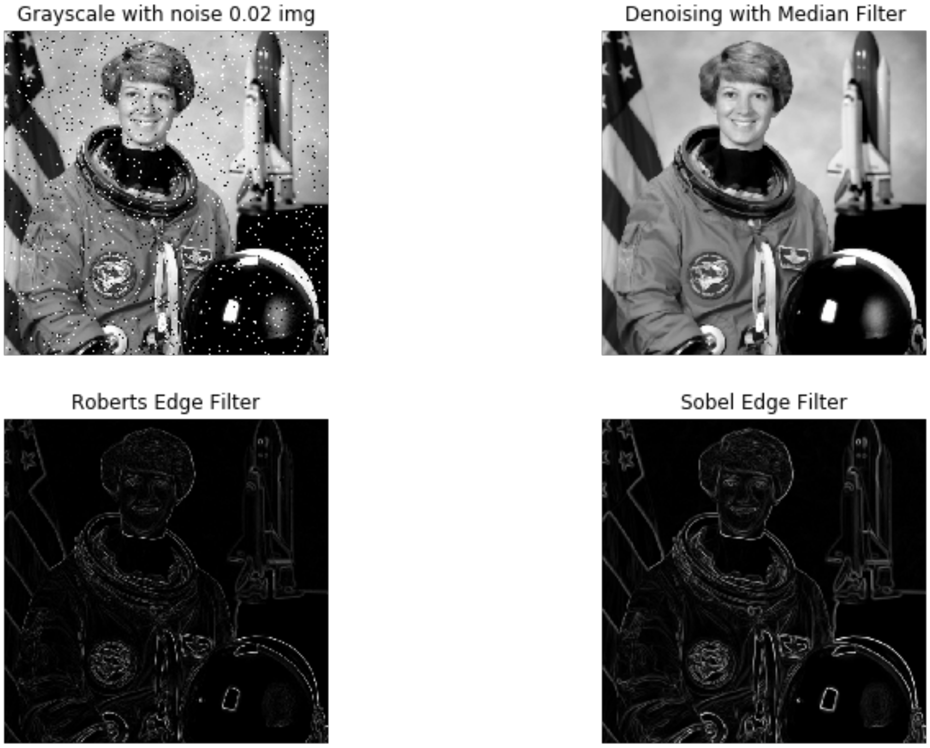
Denoising with Median Filter

Denoising with Manual Median Filter

Por último, a partir de la imagen obtenida en la etapa anterior, se busca identificar las siluetas de las estructuras en ella presentes. Para este fin, se debe identificar y razonar qué tipo de operador corresponde aplicar.

In [13]:

```
#Un filtro de borde es ideal(edges)
denoise_img = filters.rank.median(noisy_gray_img)
# Grid of edge filters
# Noise gray img
plt.figure(figsize=(12,8))
plt.subplot(2,2,1)
plt.axis('off')
plt.title(f"Grayscale with noise {noise} img")
plt.imshow(noisy_gray_img, cmap=plt.cm.gray)
# Median filter
plt.subplot(2,2,2)
plt.axis('off')
plt.title("Denoising with Median Filter")
plt.imshow(denoise_img, cmap=plt.cm.gray) # Frame of 3 pixels by default
# Roberts Edge filter
plt.subplot(2,2,3)
plt.axis('off')
plt.title("Roberts Edge Filter")
plt.imshow(filters.roberts(denoise_img), cmap=plt.cm.gray)
# Sobel Edge filter
plt.subplot(2,2,4)
plt.axis('off')
plt.title("Sobel Edge Filter")
plt.imshow(filters.sobel(denoise_img), cmap=plt.cm.gray);
```



End