1. Median Filter

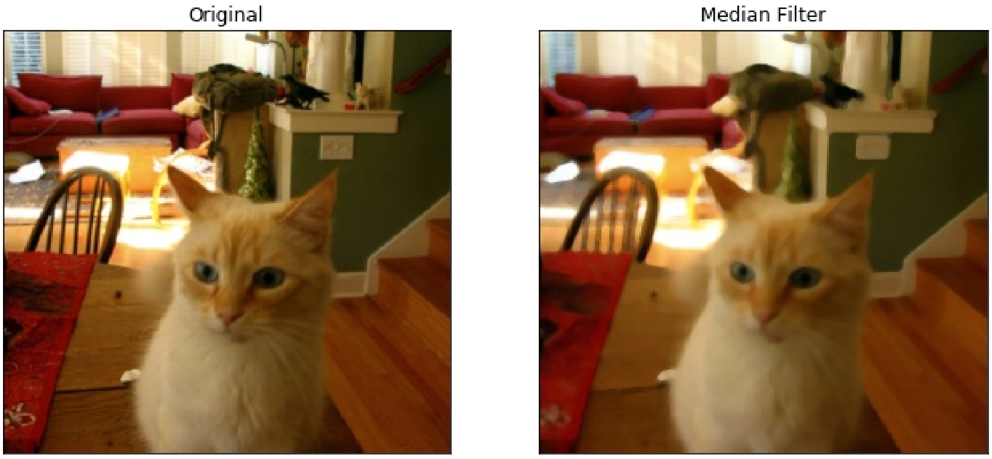
In [1]:

```
import numpy as np
import cv2
from matplotlib import pyplot as plt
# from PIL import Image, ImageFilter

NOISE_IMG_PATH = 'img_train/noise/'
```

1.1 Gaussian Noise

In [2]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/gaussian_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



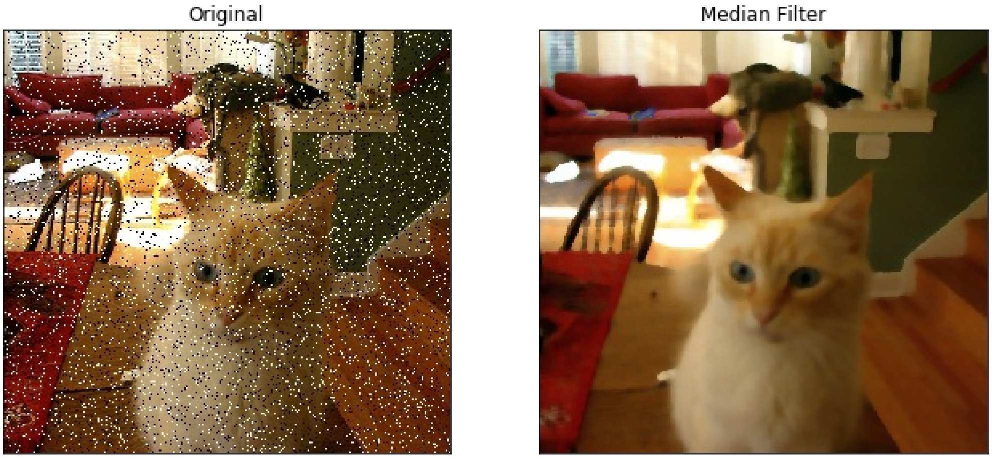
In [3]:

```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```

1.2 Salt-Pepper Noise

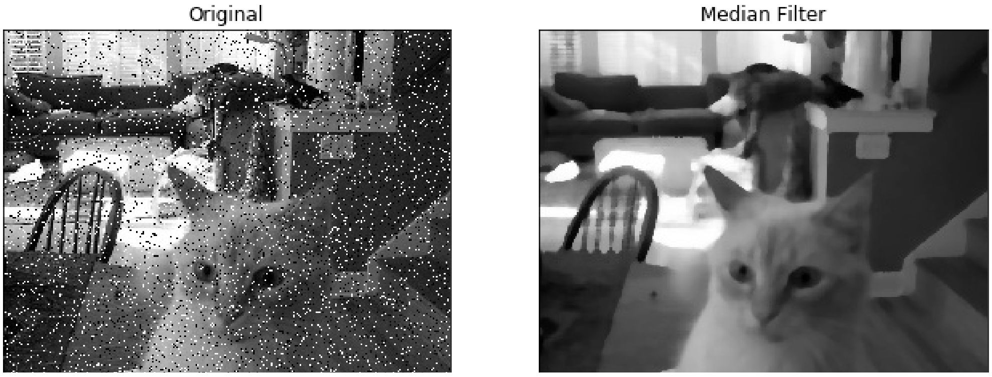
In [4]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/salt-pepper_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



In [5]:

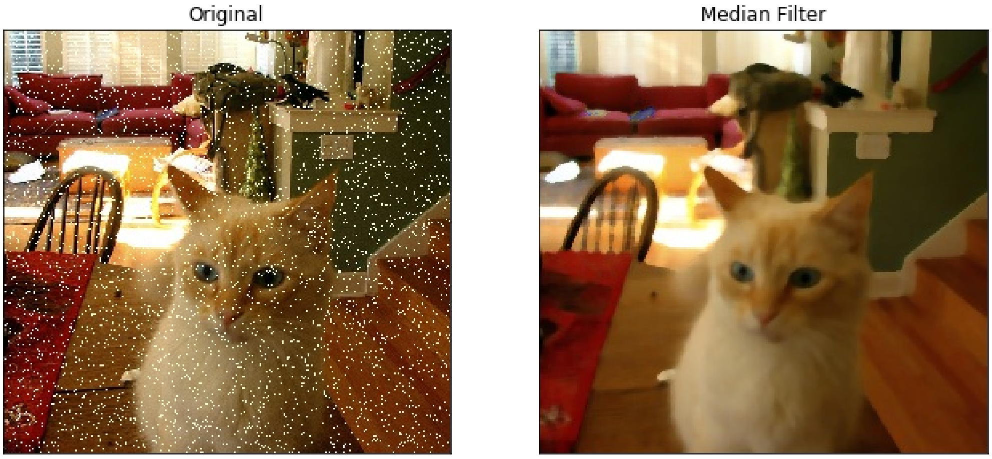
```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



1.3 Salt Noise

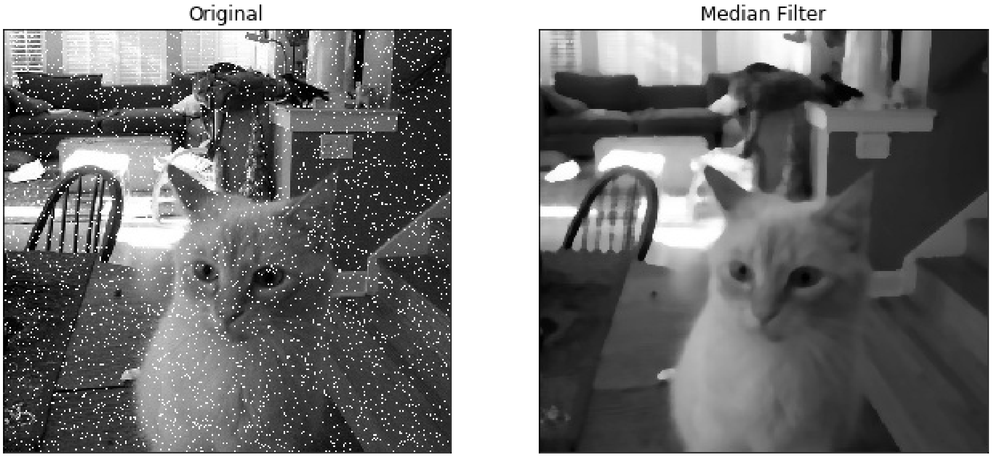
In [6]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/salt_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```


Original
Median Filter

In [7]:

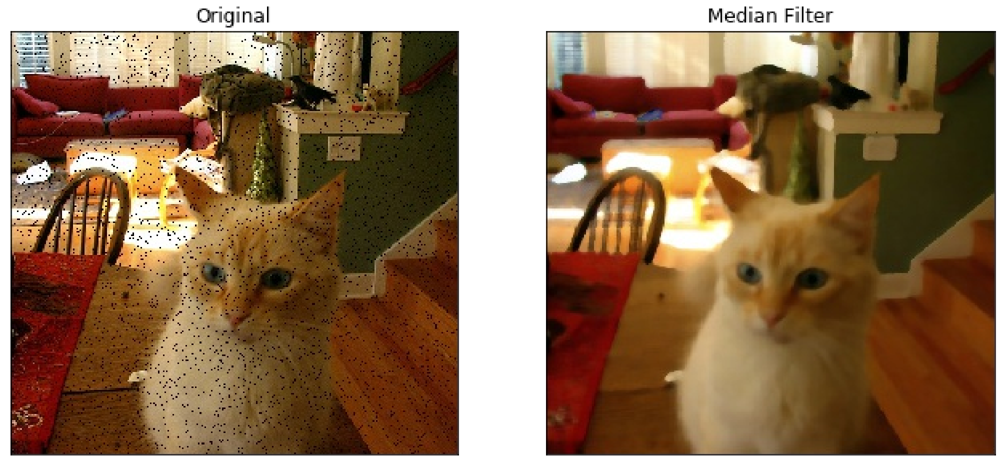
```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```


Original
Median Filter

1.4 Pepper Noise

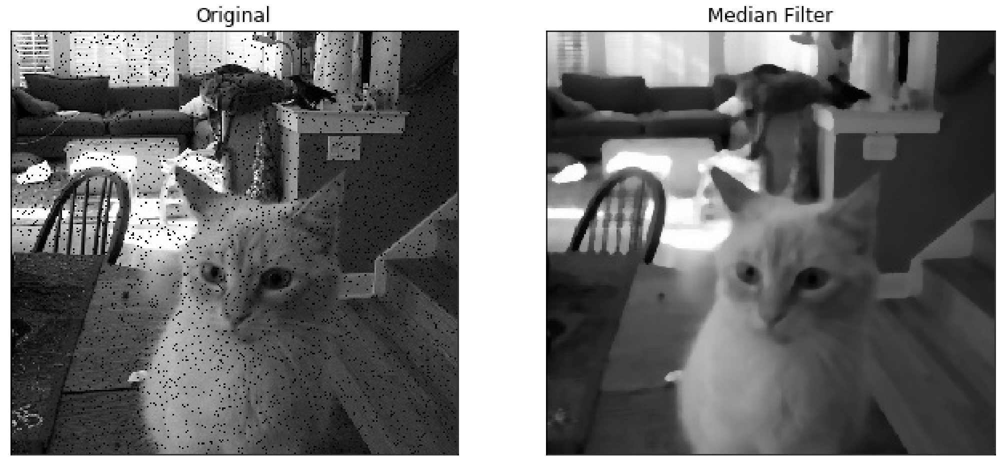
In [8]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/pepper_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



In [9]:

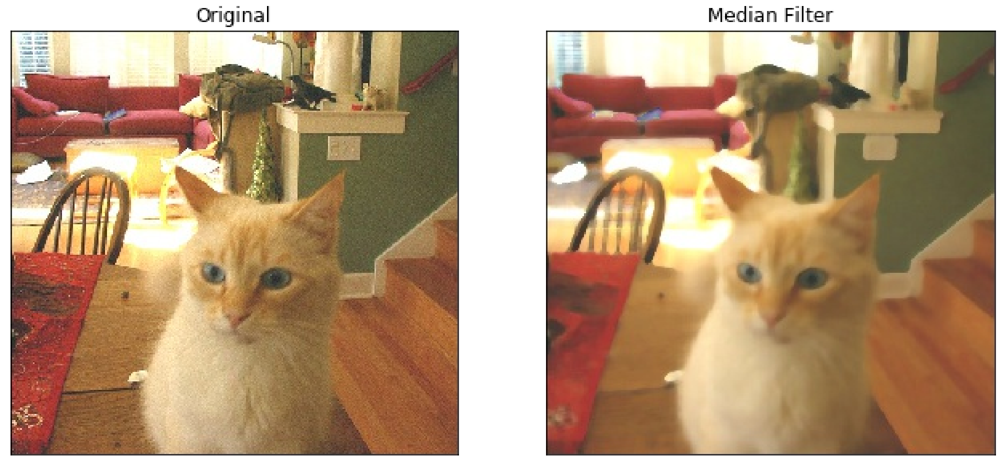
```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



1.5 Poisson Noise

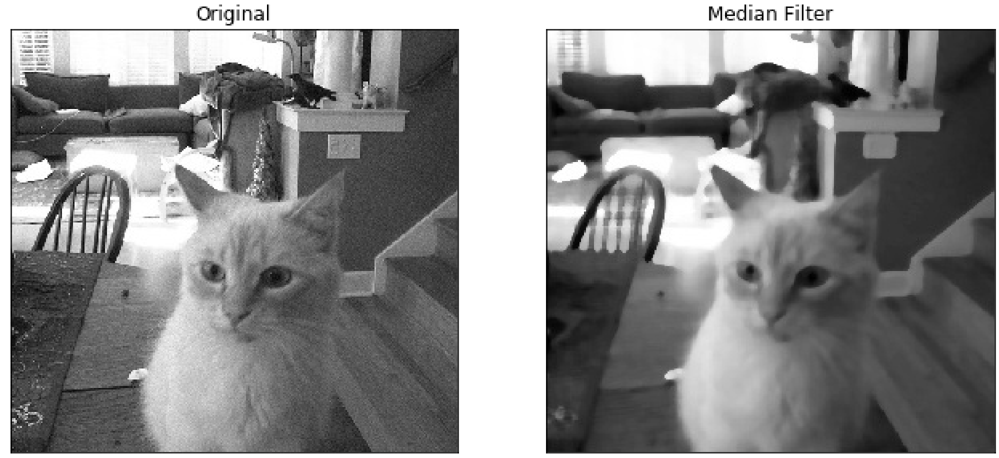
In [10]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/poisson_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



In [11]:

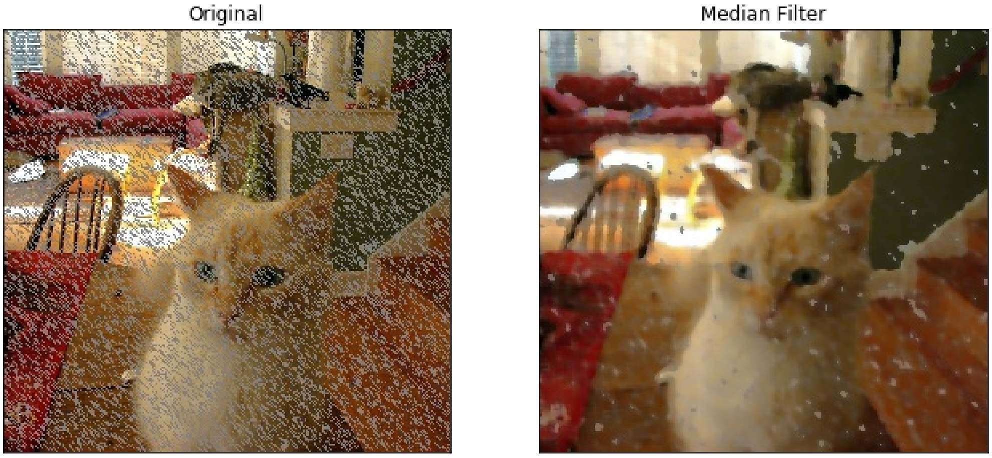
```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



1.3 Speckle Noise

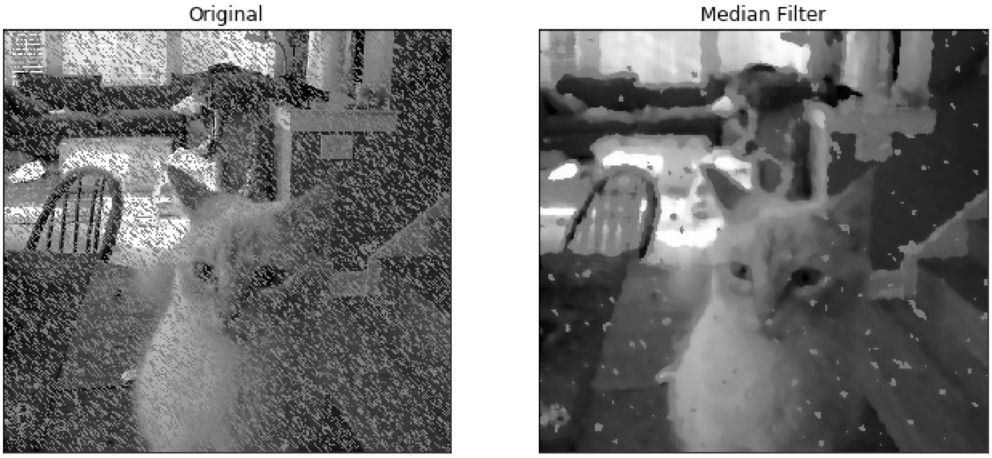
In [12]:

```
%matplotlib inline
image = cv2.imread(NOISE_IMG_PATH + 'kocenglucu/speckle_kocenglucu.jpg') # reads the image
image = cv2.cvtColor(image, cv2.COLOR_BGR2HSV) # convert to HSV
figure_size = 9 # the dimension of the x and y axis of the kernal.
new_image = cv2.medianBlur(image, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_HSV2RGB)),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(cv2.cvtColor(new_image, cv2.COLOR_HSV2RGB)),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



In [13]:

```
# The image will first be converted to grayscale
image2 = cv2.cvtColor(image, cv2.COLOR_HSV2BGR)
image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
figure_size = 9
new_image = cv2.medianBlur(image2, figure_size)
plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Median Filter')
plt.xticks([]), plt.yticks([])
plt.show()
```



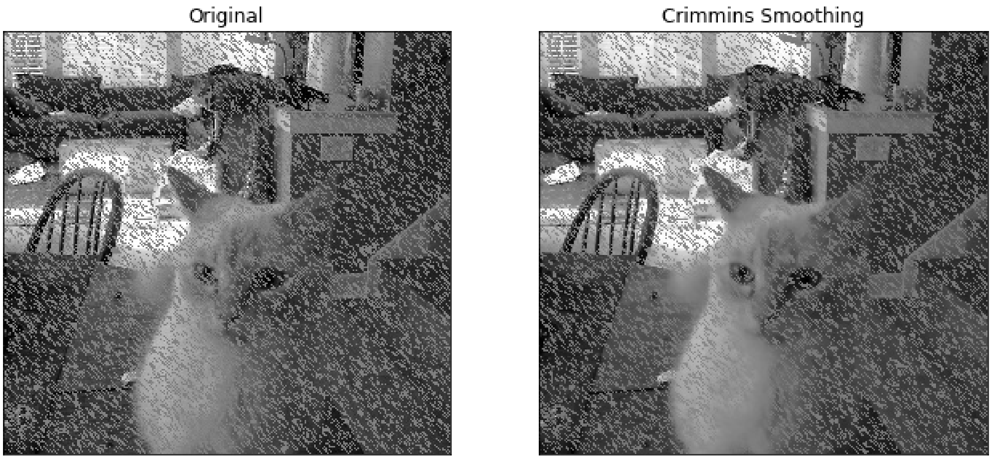
Crimmins Speckle Removal Filter

In [14]:

```
def crimmins(data):
    new_image = data.copy()
    nrow = len(data)
    ncol = len(data[0])

    # Dark pixel adjustment

    # First Step
    # N-S
    for i in range(1, nrow):
        for j in range(ncol):
            if data[i-1,j] >= (data[i,j] + 2):
                new_image[i,j] += 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(ncol-1):
            if data[i,j+1] >= (data[i,j] + 2):
                new_image[i,j] += 1
    data = new_image
    # NW-SE
    for i in range(1, nrow):
        for j in range(1, ncol):
            if data[i-1,j-1] >= (data[i,j] + 2):
                new_image[i,j] += 1
    data = new_image
    #NE-SW
    for i in range(1, nrow):
        for j in range(ncol-1):
            if data[i-1,j+1] >= (data[i,j] + 2):
                new_image[i,j] += 1
    data = new_image
    # Second Step
    # N-S
    for i in range(1, nrow-1):
        for j in range(ncol):
            if (data[i-1,j] > data[i,j]) and (data[i,j] <= data[i+1,j]):
                new_image[i,j] += 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1, ncol-1):
            if (data[i,j+1] > data[i,j]) and (data[i,j] <= data[i,j-1]):
                new_image[i,j] += 1
    data = new_image
    # NW-SE
    for i in range(1, nrow-1):
        for j in range(1, ncol-1):
            if (data[i-1,j-1] > data[i,j]) and (data[i,j] <= data[i+1,j+1]):
                new_image[i,j] += 1
    data = new_image
    # NE-SW
    for i in range(1, nrow-1):
        for j in range(1, ncol-1):
            if (data[i-1,j+1] > data[i,j]) and (data[i,j] <= data[i+1,j-1]):
                new_image[i,j] += 1
    data = new_image
    #Third Step
    # N-S
    for i in range(1, nrow-1):
        for j in range(ncol):
            if (data[i+1,j] > data[i,j]) and (data[i,j] <= data[i-1,j]):
                new_image[i,j] += 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1, ncol-1):
            if (data[i,j-1] > data[i,j]) and (data[i,j] <= data[i,j+1]):
                new_image[i,j] += 1
    data = new_image
    # NW-SE
    for i in range(1, nrow-1):
        for j in range(1, ncol-1):
            if (data[i+1,j+1] > data[i,j]) and (data[i,j] <= data[i-1,j-1]):
                new_image[i,j] += 1
    data = new_image
    # NE-SW
    for i in range(1, nrow-1):
        for j in range(1, ncol-1):
            if (data[i+1,j-1] > data[i,j]) and (data[i,j] <= data[i-1,j+1]):
                new_image[i,j] += 1
    data = new_image
    # Fourth Step
    # N-S
    for i in range(nrow-1):
        for j in range(ncol):
            if (data[i+1,j] >= (data[i,j]+2)):
                new_image[i,j] += 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1,ncol):
            if (data[i,j-1] >= (data[i,j]+2)):
                new_image[i,j] += 1
    data = new_image
    # NW-SE
    for i in range(nrow-1):
        for j in range(ncol-1):
            if (data[i+1,j+1] >= (data[i,j]+2)):
                new_image[i,j] += 1
    data = new_image
    # NE-SW
    for i in range(nrow-1):
        for j in range(1,ncol):
            if (data[i+1,j-1] >= (data[i,j]+2)):
                new_image[i,j] += 1
    data = new_image

    # Light pixel adjustment

    # First Step
    # N-S
    for i in range(1,nrow):
        for j in range(ncol):
            if (data[i-1,j] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(ncol-1):
            if (data[i,j+1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # NW-SE
    for i in range(1,nrow):
        for j in range(1,ncol):
            if (data[i-1,j-1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # NE-SW
    for i in range(1,nrow):
        for j in range(ncol-1):
            if (data[i-1,j+1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # Second Step
    # N-S
    for i in range(1,nrow-1):
        for j in range(ncol):
            if (data[i-1,j] < data[i,j]) and (data[i,j] >= data[i+1,j]):
                new_image[i,j] -= 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1, ncol-1):
            if (data[i,j+1] < data[i,j]) and (data[i,j] >= data[i,j-1]):
                new_image[i,j] -= 1
    data = new_image
    # NW-SE
    for i in range(1,nrow-1):
        for j in range(1,ncol-1):
            if (data[i-1,j-1] < data[i,j]) and (data[i,j] >= data[i+1,j+1]):
                new_image[i,j] -= 1
    data = new_image
    # NE-SW
    for i in range(1,nrow-1):
        for j in range(1,ncol-1):
            if (data[i-1,j+1] < data[i,j]) and (data[i,j] >= data[i+1,j-1]):
                new_image[i,j] -= 1
    data = new_image
    # Third Step
    # N-S
    for i in range(1,nrow-1):
        for j in range(ncol):
            if (data[i+1,j] < data[i,j]) and (data[i,j] >= data[i-1,j]):
                new_image[i,j] -= 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1,ncol-1):
            if (data[i,j-1] < data[i,j]) and (data[i,j] >= data[i,j+1]):
                new_image[i,j] -= 1
    data = new_image
    # NW-SE
    for i in range(1,nrow-1):
        for j in range(1,ncol-1):
            if (data[i+1,j+1] < data[i,j]) and (data[i,j] >= data[i-1,j-1]):
                new_image[i,j] -= 1
    data = new_image
    # NE-SW
    for i in range(1,nrow-1):
        for j in range(1,ncol-1):
            if (data[i+1,j-1] < data[i,j]) and (data[i,j] >= data[i-1,j+1]):
                new_image[i,j] -= 1
    data = new_image
    # Fourth Step
    # N-S
    for i in range(nrow-1):
        for j in range(ncol):
            if (data[i+1,j] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # E-W
    for i in range(nrow):
        for j in range(1,ncol):
            if (data[i,j-1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # NW-SE
    for i in range(nrow-1):
        for j in range(ncol-1):
            if (data[i+1,j+1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    # NE-SW
    for i in range(nrow-1):
        for j in range(1,ncol):
            if (data[i+1,j-1] <= (data[i,j]-2)):
                new_image[i,j] -= 1
    data = new_image
    return new_image.copy()
```

In [15]:

```
new_image = crimmins(image2)

plt.figure(figsize=(11,6))
plt.subplot(121), plt.imshow(image2, cmap='gray'),plt.title('Original')
plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(new_image, cmap='gray'),plt.title('Crimmins Smoothing')
plt.xticks([]), plt.yticks([])
plt.show()
```



Original

Crimmins Smoothing

In [ ]:

```
```