

Comment

實驗結果顯示，**平均濾波 (Average Filter)** 相較於 **中值濾波 (Median Filter)**，對影像的模糊化效果更為顯著。當 **核大小 (n)** 增加時，濾波範圍擴大，使得影像變得更加模糊。這是因為平均濾波對影像中的所有像素取均值，會平滑掉邊緣與細節資訊，導致整體畫面變得柔和。

相對而言，中值濾波雖然也能減少雜訊，但其機制是選取局部區域內的中值，因此能夠較好地保留影像的邊緣與細節，特別適用於去除 Salt-and-Pepper Noise。

此外，在**未銳化遮罩 (Unsharp Masking)** 的實驗中，增大銳化係數 (**k**) 會使得細節增強效果更加明顯。這是因為 **k** 會影響增強邊緣的強度，當 **k** 值較大時，原圖與模糊影像的差異被放大，從而強化邊緣與紋理細節，使影像看起來更加銳利。

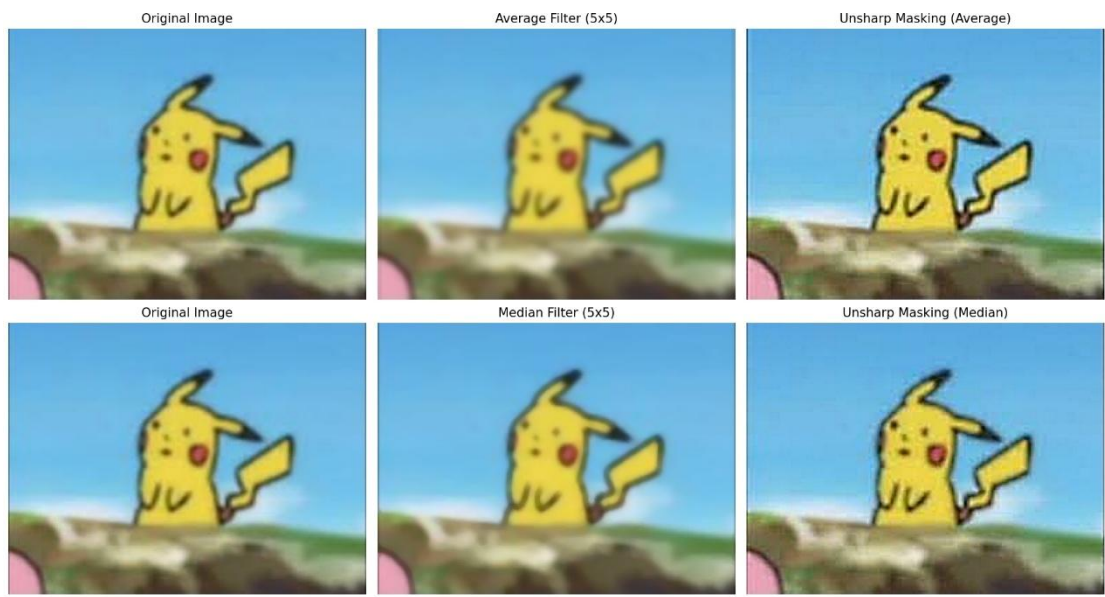
總結來說，**核大小 (n)** 控制模糊程度，**銳化係數 (k)** 影響細節增強強度，在影像處理中需根據不同應用場景調整這些參數，以達到最佳的影像處理效果。

Photos

Origin



$N = 5, k = 1.5$



$N = 5, k = 3.0$



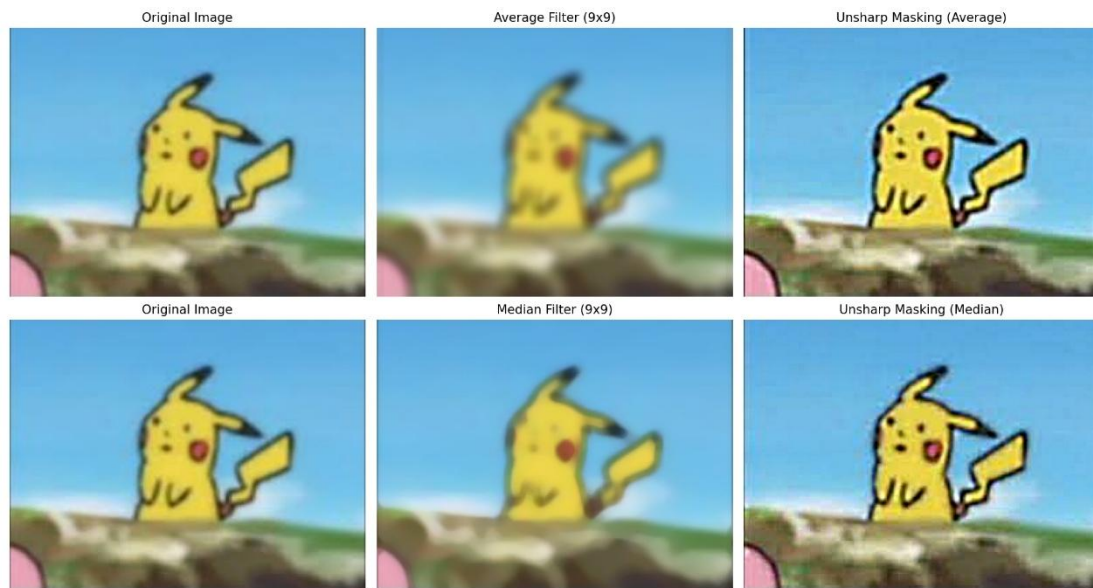
$N = 7, k = 1.5$



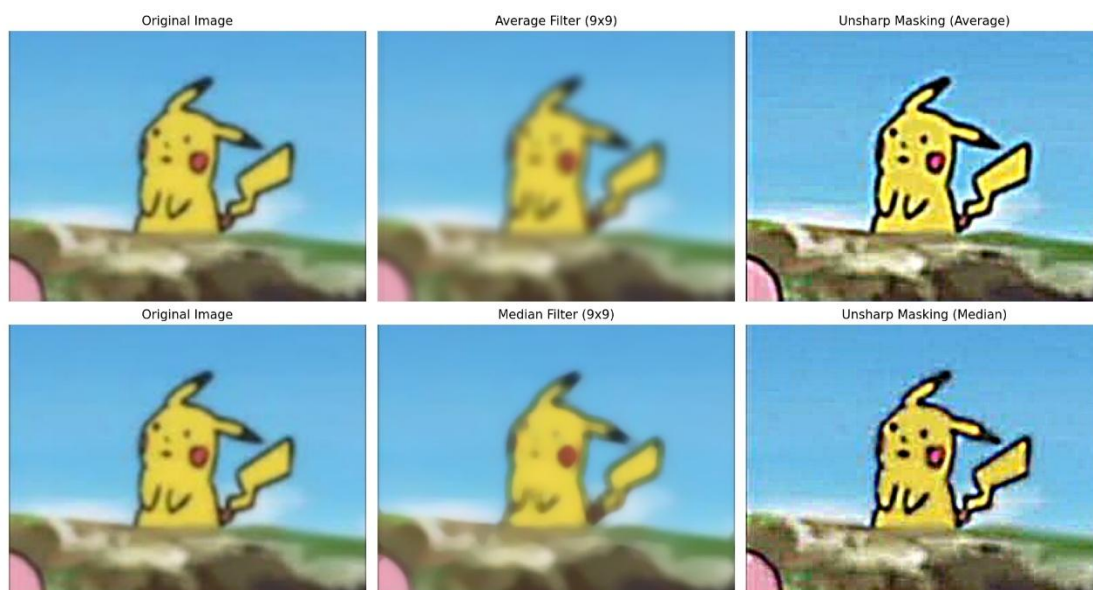
$N = 7, k = 3.0$



$N = 9, k = 1.5$



$N = 9, k = 3.0$



Program

```
import cv2
```

```
import numpy as np
```

```
import matplotlib.pyplot as plt
```



```
image = cv2.imread('images.jpg', cv2.IMREAD_COLOR)
```

```
n = 5
```

```
# (a) 應用平均濾波器
```

```
average_filter_image = cv2.blur(image, (n, n))
```

```
# (b) 應用媒體濾波器
```

```
median_filter_image = cv2.medianBlur(image, n)
```

```
image_int16 = image.astype(np.int16)
```

```
average_filter_image_int16 = average_filter_image.astype(np.int16)
```

```
median_filter_image_int16 = median_filter_image.astype(np.int16)
```

```
average_image = cv2.subtract(image_int16, average_filter_image_int16)
```

```
median_image = cv2.subtract(image_int16, median_filter_image_int16)
```

```
k = 3.0
```

```
sharpened_average_image = np.clip(image_int16 + k * average_image, 0,  
255).astype(np.uint8)
```

```
sharpened_median_image = np.clip(image_int16 + k * median_image, 0,  
255).astype(np.uint8)
```

```
plt.figure(figsize=(15, 12))
```

```
plt.subplot(2, 3, 1)
```

```
plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
```

```
plt.title("Original Image")
```

```
plt.axis('off')
```

```
plt.subplot(2, 3, 2)
```

```
plt.imshow(cv2.cvtColor(average_filter_image, cv2.COLOR_BGR2RGB))
```

```
plt.title(f"Average Filter ({n}x{n})")
```

```
plt.axis('off')
```

```
plt.subplot(2, 3, 3)
```

```
plt.imshow(cv2.cvtColor(sharpened_average_image, cv2.COLOR_BGR2RGB))
```

```
plt.title(f"Unsharp Masking (Average)")
```

```
plt.axis('off')
```

```
plt.subplot(2, 3, 4)
```

```
plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB))
```

```
plt.title("Original Image")
```

```
plt.axis('off')
```

```
plt.subplot(2, 3, 5)
```

```
plt.imshow(cv2.cvtColor(median_filter_image, cv2.COLOR_BGR2RGB))
```

```
plt.title(f"Median Filter ({n}x{n})")
```

```
plt.axis('off')
```

```
plt.subplot(2, 3, 6)
```

```
plt.imshow(cv2.cvtColor(sharpened_median_image, cv2.COLOR_BGR2RGB))
```

```
plt.title("Unsharp Masking (Median)")
```

```
plt.axis('off')
```

```
plt.tight_layout()
```

```
plt.show()
```