231501008

EXP NO: 04
DATE: 25-07-2025

Low pass and High pass filtering mechanisms

Aim: To Implement the various low pass and high pass filtering mechanisms.

Algorithm:

1. Read and convert image to grayscale.
2. Apply low pass (Gaussian/average) filter using cv2.GaussianBlur() or cv2.blur().
3. Apply high pass filter using Laplacian or Sobel operator.
4. Combine results to observe smoothing vs sharpening effects.
5. Display filtered images.
6. Save outputs.

Code:

```
import cv2
import numpy as np
from PIL import Image
import matplotlib.pyplot as plt

# Read image using PIL and convert to OpenCV format
try:
    img_pil = Image.open('/content/drive/MyDrive/input.jpg')
    img = cv2.cvtColor(np.array(img_pil), cv2.COLOR_RGB2BGR)
    gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
except Exception as e:
    print(f"Error reading image: {e}")
    img = None
    gray = None

if gray is not None:
```

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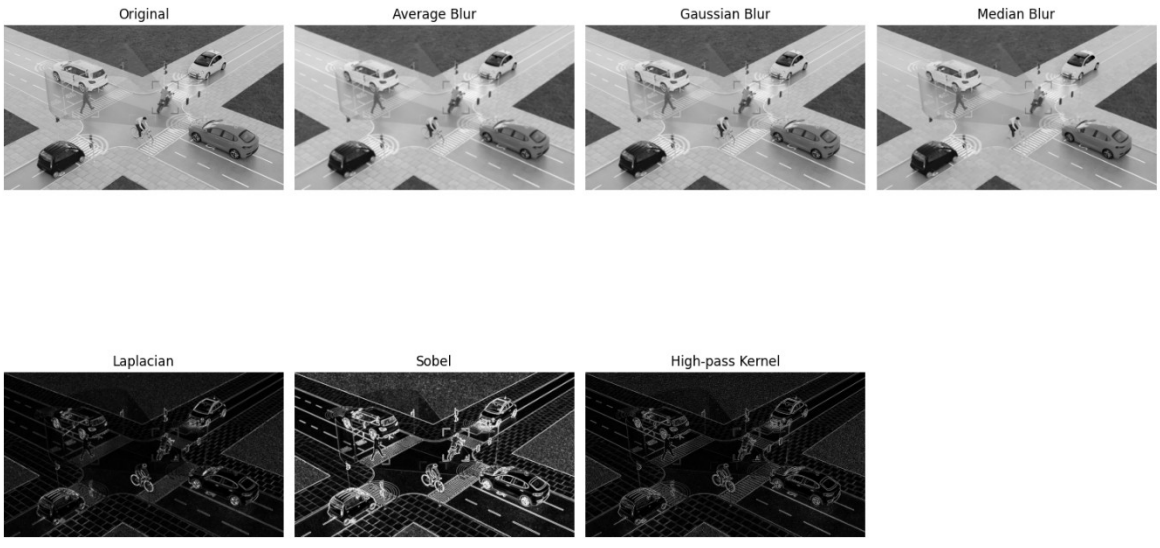
```
# --- Low Pass Filters ---
avg_blur = cv2.blur(gray, (5,5))              # Average filter
gauss_blur = cv2.GaussianBlur(gray, (5,5), 0)    # Gaussian filter
median_blur = cv2.medianBlur(gray, 5)          # Median filter

# --- High Pass Filters ---
laplacian = cv2.Laplacian(gray, cv2.CV_64F)
laplacian = cv2.convertScaleAbs(laplacian)

sobelx = cv2.Sobel(gray, cv2.CV_64F, 1, 0, ksize=3)
sobely = cv2.Sobel(gray, cv2.CV_64F, 0, 1, ksize=3)
sobel = cv2.convertScaleAbs(cv2.magnitude(sobelx, sobely))

# High-pass kernel filter
kernel = np.array([[-1,-1,-1],
                   [-1, 8,-1],
                   [-1,-1,-1]])
highpass = cv2.filter2D(gray, -1, kernel)

# Display results using matplotlib
images = {
    "Original": gray,
    "Average Blur": avg_blur,
    "Gaussian Blur": gauss_blur,
    "Median Blur": median_blur,
    "Laplacian": laplacian,
    "Sobel": sobel,
    "High-pass Kernel": highpass
```

```
    }


    plt.figure(figsize=(15, 10))
    for i, (title, img) in enumerate(images.items()):
        plt.subplot(2, 4, i + 1)
        plt.imshow(img, cmap='gray')
        plt.title(title)
        plt.axis('off')
    plt.tight_layout()
    plt.show()

else:
    print("Could not process the image.")
```

Output:



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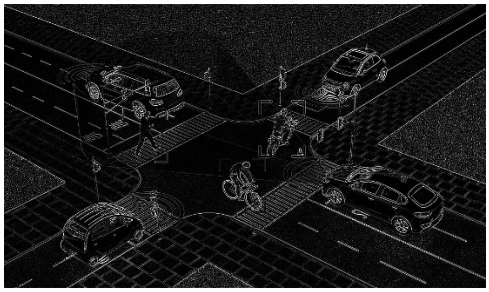
Code:

```
from google.colab.patches import cv2_imshow

import cv2

import numpy as np

from PIL import Image


# Read image using PIL and convert to OpenCV format

try:

  img_pil = Image.open('/content/drive/MyDrive/input.jpg') # Replace with an existing image file

  img = cv2.cvtColor(np.array(img_pil), cv2.COLOR_RGB2BGR)

  gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

except Exception as e:

  print(f"Error reading image: {e}")

  img = None

  gray = None


if gray is not None:

  # --- Low Pass Filters ---

  avg_blur = cv2.blur(gray, (5,5))              # Average filter

  gauss_blur = cv2.GaussianBlur(gray, (5,5), 0)   # Gaussian filter

  median_blur = cv2.medianBlur(gray, 5)          # Median filter


  # --- High Pass Filters ---

  laplacian = cv2.Laplacian(gray, cv2.CV_64F)

  laplacian = cv2.convertScaleAbs(laplacian)


  sobelx = cv2.Sobel(gray, cv2.CV_64F, 1, 0, ksize=3)

  sobely = cv2.Sobel(gray, cv2.CV_64F, 0, 1, ksize=3)
```

```
sobel = cv2.convertScaleAbs(cv2.magnitude(sobelx, sobely))

# High-pass kernel filter
kernel = np.array([[-1,-1,-1],
                   [-1, 8,-1],
                   [-1,-1,-1]])
highpass = cv2.filter2D(gray, -1, kernel)

# Display results using cv2_imshow
cv2_imshow(gray)
cv2_imshow(avg_blur)
cv2_imshow(gauss_blur)
cv2_imshow(median_blur)
cv2_imshow(laplacian)
cv2_imshow(sobel)
cv2_imshow(highpass)

# The waitKey and destroyAllWindows are not needed when using cv2_imshow
# cv2.waitKey(0)
# cv2.destroyAllWindows()

# Save results
cv2.imwrite("avg_blur.jpg", avg_blur)
cv2.imwrite("gauss_blur.jpg", gauss_blur)
cv2.imwrite("median_blur.jpg", median_blur)
cv2.imwrite("laplacian.jpg", laplacian)
cv2.imwrite("sobel.jpg", sobel)
cv2.imwrite("highpass.jpg", highpass)
```

```
else:
    print("Could not process the image.")
```

Output:



Result: Thus, the various low pass and high pass filtering mechanisms was successfully implemented.