PRACTICAL – 4

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Aim: Program to filter an image using averaging low pass filter in spatial domain and median filter in Python

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Theory:

Spatial Filtering technique is used directly on pixels of an image. Mask is usually considered to be added in size so that it has a specific center pixel. This mask is moved on the image such that the center of the mask traverses all image pixels. In this article, we are going to cover the following topics –

- To write a program in Python to implement spatial domain averaging filter and to observe its blurring effect on the image without using inbuilt functions
- To write a program in Python to implement spatial domain median filter to remove salt and pepper noise without using inbuilt functions

- Neighborhood processing in spatial domain: Here, to modify one pixel, we consider values of the immediate neighboring pixels also. For this purpose, 3X3, 5X5, or 7X7 neighborhood mask can be considered. An example of a 3X3 mask is shown below.

f(x-1, y-1) f(x-1, y) f(x-1, y+1)

f(x, y-1) f(x, y) f(x, y+1)

f(x+1, y-1) f(x+1, y) f(x+1, y+1)

- **Low Pass filtering:** It is also known as the smoothing filter. It removes the high-frequency content from the image. It is also used to blur an image. A low pass averaging filter mask is as shown.

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- **High Pass Filtering:** It eliminates low-frequency regions while retaining or enhancing the high-frequency components. A high pass filtering mask is as shown.

-1/9 -1/9 -1/9

-1/9 8/9 -1/9

-1/9 -1/9 -1/9

- **Median Filtering:** It is also known as nonlinear filtering. It is used to eliminate salt and pepper noise. Here the pixel value is replaced by the median value of the neighboring pixel.

  - Image filters can be used to reduce the amount of noise in an image and to enhance the edges in an image. There are two types of noise that can be present in an image: speckle noise and salt-and-pepper noise. Speck noise is the noise that occurs during image acquisition while salt-and-pepper noise (which refers to sparsely occurring white and black pixels) is caused by sudden disturbances in an image signal. Enhancing the edges of an image can help a model detect the features of an image.

  - An image pre-processing step can improve the accuracy of machine learning models. Pre-processed images can hep a basic model achieve high accuracy when compared to a more complex model trained on images that were not pre-processed. For Python, the Open-CV and PIL packages allow you to apply several digital filters. Applying a digital filter involves taking the convolution of an image with a kernel (a small matrix). A kernal is an $n \times n$ square matrix were n is an odd number. The kernel depends on the digital filter.

Requirements:

- Open CV
- numpy

Output:

Blurred Image

Conclusion:

In this practical we have studied to filter an image using averaging low pass filter in spatial domain and median filter in Python.