**Implemented Filters/Algorithms:**

**For the Spatial Domain filters:**

**• Smoothing Spatial filters (used for noise reduction):**

**Adaptive filter (median, min, or max).:**

The algorithm used in the code that you provided to apply an adaptive median filter to an image is a simple median filter algorithm. A median filter is a type of non-linear filter that is used to remove noise from an image by replacing each pixel with the median value of the pixel and its neighbors.

**Averaging filter:**

The algorithm used in the code that you provided to apply an averaging filter to an image is a simple convolution-based filtering algorithm. In this algorithm, a filter kernel (also known as a mask) is convolved over the image, and the filtered value for each pixel is computed by multiplying the pixel values in the neighborhood around the pixel by the weights in the filter kernel, and summing the products.

**Median filter:**

The algorithm used in the code that you provided to apply a median filter to an image is a simple sorting-based filtering algorithm. In this algorithm, a filter kernel (also known as a mask) is convolved over the image, and the filtered value for each pixel is computed by sorting the pixel values in the neighborhood around the pixel and selecting the median value.

**Gaussian filter:**

The algorithm used in the code that you provided to apply a Gaussian filter to an image is a convolution-based filtering algorithm. Convolution is a mathematical operation that involves multiplying two functions together and integrating the result over a given domain. In image processing, convolution is used to apply a filter (also known as a kernel) to an image by sliding the kernel over the image and computing the dot product between the kernel and the image pixels at each position.

**• Sharpening Spatial filters:**

**Laplacian Operator:**

The algorithm used in the provided code is the Laplacian filter algorithm. This algorithm is used for edge detection in image processing. It works by convolving the input image with a Laplacian kernel, which is a 2D filter that is used to detect edges in images

**Unsharp Masking and Highboost Filtering:**

The algorithm used in this code is unsharp masking. Unsharp masking is a sharpening technique used in image processing to enhance the contrast of an image by subtracting a blurred version of the image from the original image. This technique is often used to sharpen edges and fine details in images, making them more distinct and easier to see

**Roberts Cross-Gradient Operators:**

The Roberts edge detection algorithm is used in the given code snippet. It is a gradient-based edge detection technique that uses two 2x2 convolution kernels (called Roberts cross-gradient operators) to detect edges in an image

**Sobel Operators**:

The Sobel filter is an edge detection algorithm used in image processing. It works by convolving the input image with two kernels

**• Noise filters:**

**Uniform noise:**

The algorithm used in the uniform\_noise function is the algorithm for adding uniform noise to an image. This algorithm involves generating an array of random noise values with the same shape as the image, adding the noise to the image, and then clipping the values of the noisy image to the range [0, 255].

**Gaussian noise:**

simply adds Gaussian noise to an image by generating an array of random noise values with a specified mean and standard deviation, and adding this noise to the original image. The values of the resulting noisy image are then clipped to the range [0, 255]\

**Impulse noise (salt and pepper):**

The algorithm used in the code that you provided to add salt-and-pepper noise to an image is a simple random sampling algorithm. The algorithm randomly selects a certain number of pixels in the image and colors them either white or black, depending on the type of noise being added.

**For the Transform /Frequency Domain filters:**

**Histogram equalization:**

The algorithm used in the Histo\_equalization function is histogram equalization, which is a method for adjusting the contrast of an image by stretching the intensity values of the image to cover the full intensity range.

**Histogram specification:**

The algorithm used in the Histo\_specification function is called histogram matching. It is a process of adjusting the intensity values of an image so that its histogram matches a specified histogram.

**Nearest neighbor interpolation:**

The algorithm being used here is the nearest neighbor interpolation method for image resizing. In this method, each pixel in the output image is set to the value of the closest pixel in the input image.

**Bilinear interpolation:**

In the Interpolation\_Bilinear function, the algorithm for image resizing using bilinear interpolation is implemented.

The algorithm works by iterating over each pixel in the output image and calculating the corresponding pixel in the input image using bilinear interpolation.