THESIS

1. Explain about HINR
2. Bilateral filter : spatial domain, range domain, filtering process and then output image.

The bilateral filter requires two key parameters:

a. **Spatial Domain Kernel**: This determines the spatial extent of the filter. It specifies how far the filter should consider neighboring pixels when computing the weighted average. Typically, it's defined as a 2D Gaussian function centered at the current pixel.

b. **Range Domain Kernel**: This controls the influence of pixel values in the filtering process. It specifies how similar the pixel values need to be to affect each other. It is also typically defined as a Gaussian function.

1. **Color Palette Generation:** Color palette generation refers to the process of creating a collection of distinct colors that can be used to represent an image or a set of colors for a particular purpose  
   **Grayscale Image Generation:** Grayscale image generation involves creating an image where each pixel is represented by a single intensity value, typically ranging from black (0) to white (255 in an 8-bit grayscale image). Unlike color images, which have multiple color channels (e.g., red, green, and blue), grayscale images contain only one channel, representing brightness or intensity

**Reversible Embedding:** Reversible embedding, often referred to as lossless data embedding or reversible data hiding, is a technique used to embed additional information or data into a carrier signal (such as an image or audio) in such a way that the original signal can be perfectly reconstructed without any loss of information.

**Grayscale-to-Color Reconstruction:** Grayscale-to-color reconstruction is the process of adding color information to a grayscale image to convert it into a full-color image. This is done by mapping grayscale intensity values to colors based on some predefined rules or color mapping techniques.

1. **Image quality metrics :** SSIM, MSE and PSNR.

In image processing, PSNR (Peak Signal-to-Noise Ratio), SSIM (Structural Similarity Index), and MSE (Mean Squared Error) are commonly used metrics to evaluate the quality and fidelity of images, especially when comparing an original or reference image to a processed or reconstructed image.

1. Histogram equalization for image enhancement and to enhance the brightness component of metal corrosion images.
2. Unsharp masking used for sharpening the quality of images.

9. Improved adaptive weighted mean filter

The Improved Adaptive Weight Mean (IAWM) filter is an image processing technique used for image denoising and enhancement. It is an improvement over the traditional Adaptive Weight Mean (AWM) filter and is designed to reduce noise while preserving edges and fine details in digital images.

Local neighbourhood selection, weight calculation, weight normalization, weighted mean calculation, output pixel update.

10. The trilateral filter is an extension of the bilateral filter, which is a popular image filtering technique used for noise reduction and edge preservation in images. Like the bilateral filter, the trilateral filter is particularly useful for preserving edges and fine details while smoothing the image to reduce noise. The main difference between the two filters is that the trilateral filter introduces an additional term for spatial proximity, making it more robust in scenarios where the bilateral filter might not work optimally.

spatial proximity typically relates to the distance or separation between pixels or elements in an image or data matrix.

The human eye is more sensitive to green, so it receives the highest weight (0.72), while red is weighted at 0.21, and blue is given the lowest weight at 0.07.

In summary, the weighted average method in the provided algorithm allows for a more nuanced and context-aware approach to noise removal. It adapts to the image's characteristics by assigning varying weights to neighboring pixels, which ultimately leads to improved noise reduction while preserving fine details and edges in the image. This adaptability is a significant advantage in the context of image denoising and impulse noise removal.

Instead of using a fixed 3x3 Gaussian kernel with predefined weights (1/16) to apply Gaussian blur to the image,

I can use to calculate the adaptive standard deviation for a local neighbourhood around each pixel and then compute kernel weights based on the local standard deviation for each pixel, allowing the filter to adapt to local noise levels and image content.

This method applies a more intelligent smoothing that preserves edges and details better in areas with less noise and applies stronger smoothing in noisier regions.