

DIP ASSIGNMENT - 4

Question-1

Denoising with Bilateral and Gaussian Filters

- **Original Noisy Image:** Grainy noise reduces detail and edge clarity.
- **Bilateral Filtered Image:** Smooths noise in flat areas while preserving edges, providing a clearer image with better detail than Gaussian smoothing.
- **Gaussian Blurred Image:** Reduces noise but blurs edges slightly, leading to a softer appearance compared to the bilateral filter.

Laplace Filtering on Different Images

- **Laplacian on Noisy Image:** Enhances edges but amplifies noise, resulting in a grainy edge map.
- **Laplacian on Bilateral Filtered Image:** Produces sharp edges with minimal noise, showing effective edge preservation after denoising.
- **Laplacian on Gaussian Blurred Image:** Shows clear but softer edges, as the Gaussian blur slightly reduces edge sharpness.

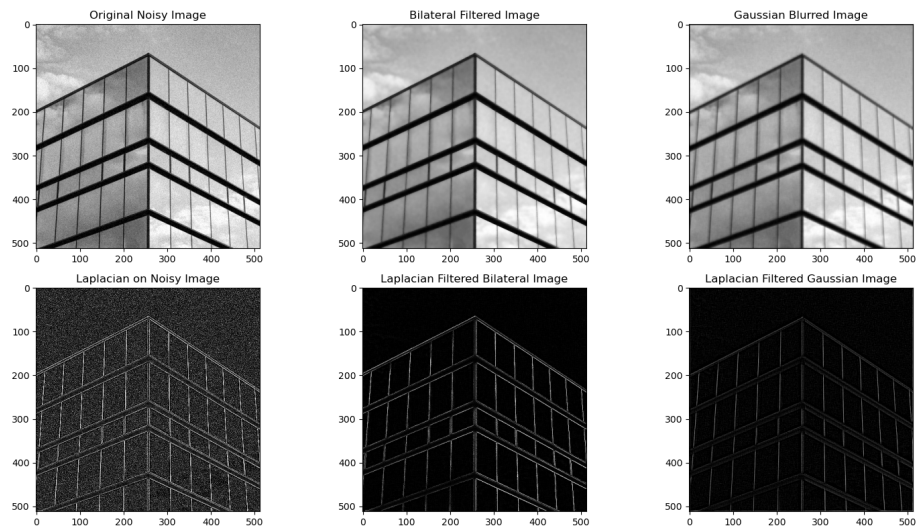


Figure 1: output image under different filter

Question-2

- **Single Circle Detection:** The Hough Transform accurately detects a single circle when the radius is known, producing sharp accumulator peaks. Minor radius deviations are tolerated, though peak clarity may reduce as the radius differs.
- **Hough Transform with Noise:** Noise introduces extra peaks in the accumulator, making it harder to differentiate true circles. Detection is possible if peaks remain distinct, but accuracy drops with higher noise levels.
- **Variable Radii Detection:** Detection accuracy decreases if the circle radius varies from the expected value. Peak sharpness weakens, especially with large radius differences, highlighting the need for multiple radius checks.
- **Detection with Partial Occlusion:** Partially occluded circles still produce accumulator peaks, though weaker and less defined. Greater occlusion reduces edge points, weakening accumulator response and reliability.
- **Impact of Edge Detectors:** The Hough Transform performs best with clean edges. Poor-quality edges, like those from noisy detectors, create cluttered accumulators, reducing detection accuracy.

Effect of Threshold and Noise

- **Threshold:** High thresholds reduce noise but risk missing finer edges; low thresholds capture more details but may introduce noise, cluttering the Hough accumulator.
- **Noise:** Noise creates extra peaks in the accumulator, making it difficult to distinguish true circles and reducing detection accuracy.

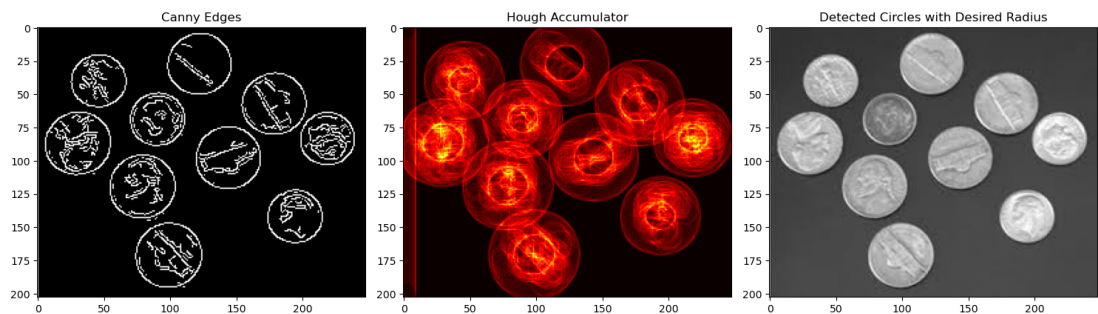


Figure 2: Hough Transform for coins image

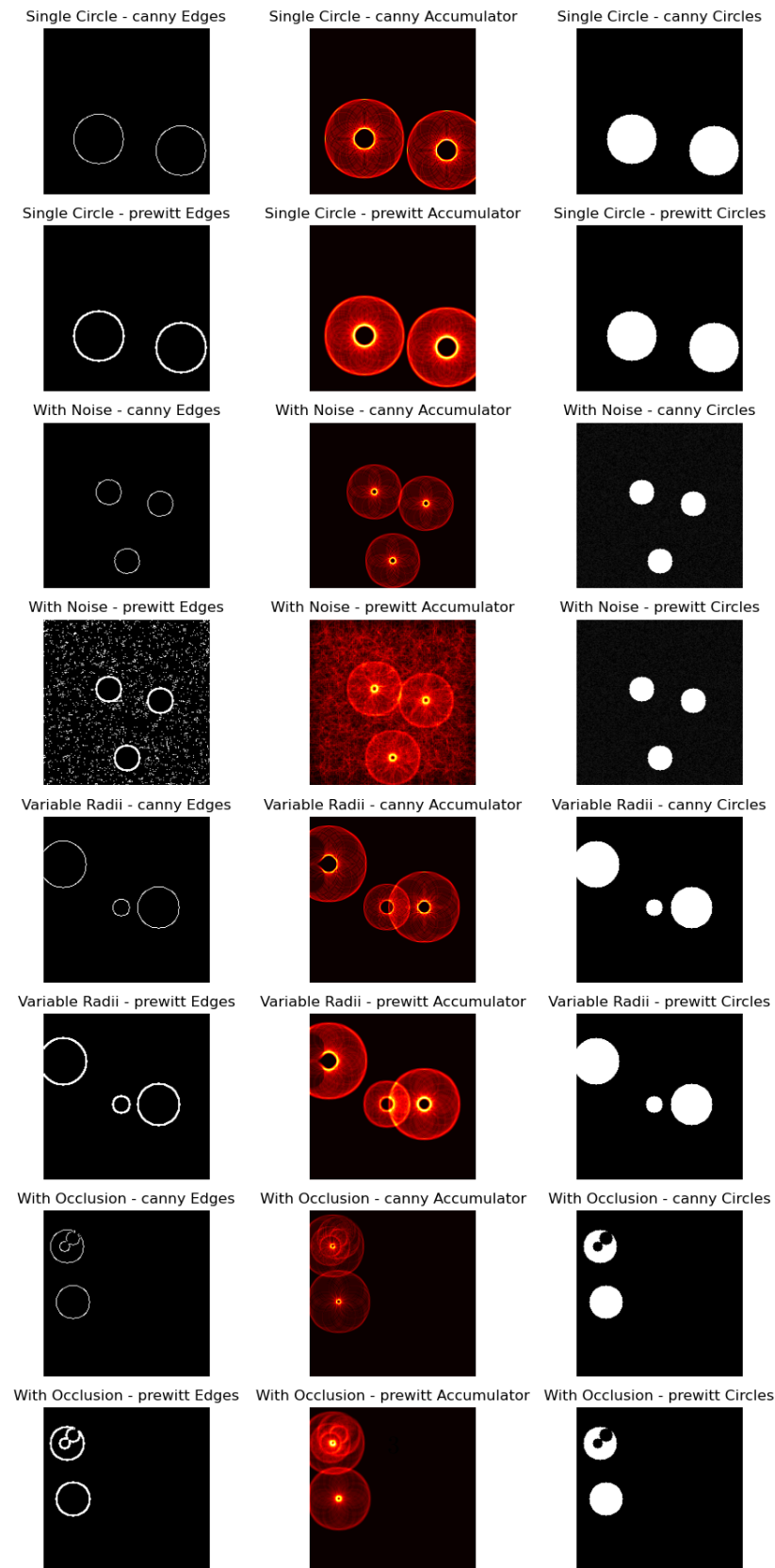


Figure 3: Hough Transform circles Under different scenario