1) Box filtering:

A linear filtering technique that replaces each pixel with the average of its neighbouring pixels using an uniform kernel.

Application:

1) Used in image processing for blurring and noise reduction.
2) Preprocessing for tasks where edge preservation is not critical.
3) Downsampling image while preserving overall intensity.

Outcome:

1) Blurs the image, making fine details less visible.
2) Weak at preserving edges, loss of details in high frequency regions.
3) May introduce boxy artifacts in textured regions.
4) Computationally efficient but less effective than gaussian filtering.

2) Gaussian filtering:

A linear filter using a kernel with weights following a gaussian distribution, prioritising central pixels.

Application:

1) Advanced noise reduction
2) Preprocessing for edge detection (eg. Canny edge detector)
3) Common in medical imaging, object detection and computer vision applications.
4) Utilized in gaussian pyramid construction for multiscale image processing.

Outcome:

1) Provides natural blur effect that minimizes artifacts.
2) Reduces high frequency noise without significant loss of structural details.
3) computationally expensive than box filtering but produces better results.

3) Median filtering:

A non linear filter replacing each pixel with the median of its neighbourhood.

Applications:

1) Removing salt and pepper noise in images.
2) Ideal for edge sensitive applications
3) Common in fingerprint recognition, medical image denoising and object detection.

Outcome:

1) Effectively eliminates impulse noise while preserving sharp edges.
2) Less effective for gaussian noise or subtle textures.
3) Effectively removes outlier noise while preserving edges and fine details.
4) can introduce unwanted patterns or distortions in heavily textured images.

4) Unsharp Masking:

A sharpening technique that subtracts a blurred version of the image from the original to enhance edges.

Applications:

1) Enhances local contrast and sharpness, making details more prominent used in digital photography/art.
2) Used in document scanning and OCR to improve text clarity.
3) Applied in medical imaging and satellite imagery to highlight critical details.

Outcomes:

1) Increases edge contrast and sharpness.
2) Overuse leads to halo artifacts around edges.
3) Often combined with adaptive sharpening techniques to minimize distortion.

5) High Boost filtering:

A generalized sharpening method amplifying high frequency components by adding a scaled version of the unsharp mask to the original image.

Applications:

1) Boosting contrast in low contrast images.
2) Forensic image analysis to reveal hidden patterns
3) Enhancing fine details in satellite/astronomical imagery.

Outcome:

1) Amplifies high frequency components, making edges and textures stand out.
2) Can introduce artifacts and noise if boost factor is too high.
3) Produces stronger sharpening and contrast than unsharp masking.