Linear Filters

Noise:
Salt & Pepper Noise: Random occurrences of black and white pixels
Impulse Noise: Random occurrences of white pixels
Gaussian Noise: Variations in intensity drawn from a Gaussian normal distribution
Filters:
Smoothing Filter: Values positive, $\sum F = 1$, amount of smoothing proportional to mask size, remove 'high-frequency'components; 'low-pass'filter
Correlation Filter(Cross-Correlation): Pixel is linear combination of surrounding pixels, G=H$\otimes$F.
Gaussian Filter: Linear, smoothing, σ=variance, kernel=size of mask
Sharpening Filter: Accentuates differences with local average, subtraction
Convolution: Flip the filter in both dimensions (bottom to top, right to left), then apply cross -correlation, G=H$\star$F, shift-invariant, superposition
Shift Invariant: Operator behaves the same everywhere; the value of the output depends on the pattern in the image neighborhood, not the position of the neighborhood
Superposition: The response to a sum of inputs is the sum of the responses to the individual inputs
Seperability: A 2D filter is separable if it can be written as the outer product of two 1D filters
Median Filter: Non-linear, no new pixel values, removes spikes, good for impulse + salt & pepper noise, edge preserving
Laplacian Filter: Hybrid images, Unit impulse - gaussian $\approx$ laplacian of gaussian

Edge Detection

Edge: rapid change in image intensity, extrema of the first derivative, zero-crossings of the second derivative