Filtering Images

Median Filter:

Returns the median value of the pixels in a neighbourhood.

Sharpening Filter:

```
$$ \begin{bmatrix} -1 & -1 & -1\\-1 & 4& -1 \\ -1 & -1 & -1\end{bmatrix}=\text{basic sharpen
```

Highlights edges and removes blurred parts of images. This is based on spatial differentiation, suppressing neighbouring pixels and increasing the weight of the current pixel.

Original Image - Smoothed Image = Detail

Original Image + Weight * Detail = Sharpened Image

The 2nd derivative is more useful for image sharpening or enhancement than the first derivative as it has a stronger response to fine detail.

Laplacian Filter:

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix} = \text{Laplacian sharpening filter}$$

$$\nabla^2 f = [f(x+1,y) + f(x-1,y) + f(x,y+1) + f(x,y-1)] - 4f(x,y)$$

Filtering is used to achieve:

- Enhancement
- Smoothing
- Template mathcing
- Feature Extraction
- Analysiszx