

Linear Filters

- General process:
 - Form new image whose pixels are a weighted sum of original pixel values, using the same set of weights at each point.
- Properties
 - Output is a linear function of the input
 - Output is a shift-invariant function of the input (i.e. shift the input image two pixels to the left, the output is shifted two pixels to the left)
- Example: smoothing by averaging
 - form the average of pixels in a neighbourhood
- Example: smoothing with a Gaussian
 - form a weighted average of pixels in a neighbourhood
- Example: finding a derivative
 - form a weighted average of pixels in a neighbourhood

Convolution

- Represent these weights as an image, H
- H is usually called the **kernel**
- Operation is called **convolution**
 - it's associative
- Result is:

$$R_{ij} = \sum_{u,v} H_{i-u, j-v} F_{uv}$$

Example: Smoothing by Averaging

