

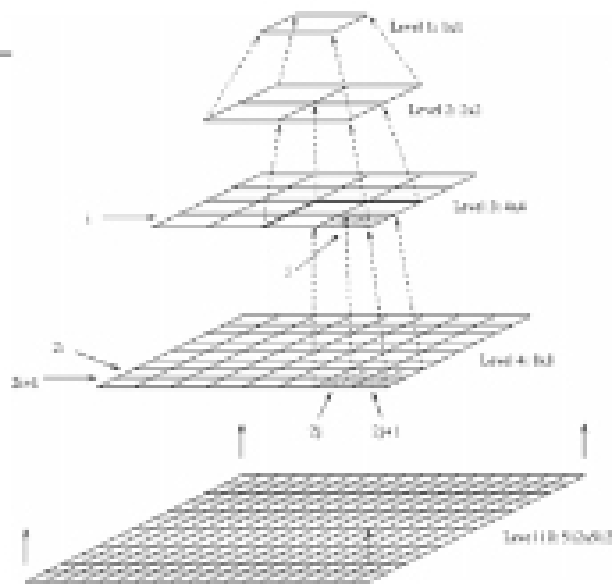
Pyramids

Lecture-5

Pyramids

- Very useful for representing images.
- Pyramid is built by using multiple copies of image.
- Each level in the pyramid is 1/4 of the size of previous level.
- The lowest level is of the highest resolution.
- The highest level is of the lowest resolution.

Pyramid



Gaussian Pyramids

$$g_i(i, j) = \sum_{m=-2}^2 \sum_{n=-2}^2 w(m, n) g_{i-1}(2i+m, 2j+n)$$

$$g_i = REDUCE[g_{i-1}]$$

Expand (1D)

$$g_{l,n}(i) = \sum_{p=-2}^2 \hat{w}(p) g_{l,n-1}\left(\frac{i-p}{2}\right)$$

$$g_{l,n}(4) = \hat{w}(-2)g_{l,n-1}\left(\frac{4-2}{2}\right) + \hat{w}(-1)g_{l,n-1}\left(\frac{4-1}{2}\right) +$$

$$\hat{w}(0)g_{l,n-1}\left(\frac{4}{2}\right) + \hat{w}(1)g_{l,n-1}\left(\frac{4+1}{2}\right) + \hat{w}(2)g_{l,n-1}\left(\frac{4+2}{2}\right)$$

$$g_{l,n}(4) = \hat{w}(-2)g_{l,n-1}(1) + \hat{w}(0)g_{l,n-1}(2) + \hat{w}(2)g_{l,n-1}(3)$$

Expand (1D)

$$g_{l,n}(i) = \sum_{p=-2}^2 \hat{w}(p) g_{l,n-1}\left(\frac{i-p}{2}\right)$$

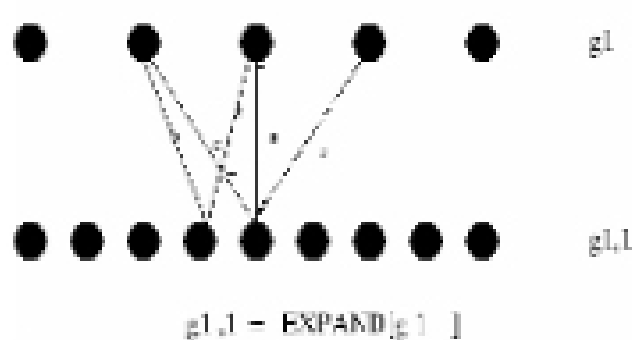
$$g_{l,n}(3) = \hat{w}(-2)g_{l,n-1}\left(\frac{3-2}{2}\right) + \hat{w}(-1)g_{l,n-1}\left(\frac{3-1}{2}\right) +$$

$$\hat{w}(0)g_{l,n-1}\left(\frac{3}{2}\right) + \hat{w}(1)g_{l,n-1}\left(\frac{3+1}{2}\right) + \hat{w}(2)g_{l,n-1}\left(\frac{3+2}{2}\right)$$

$$g_{l,n}(3) = \hat{w}(-1)g_{l,n-1}(1) + \hat{w}(1)g_{l,n-1}(2)$$

Expand

Gaussian Pyramid



Convolution Mask

$$[w(-2), w(-1), w(0), w(1), w(2)]$$