

# Images

Continuous phenomenon  $f(x,y)$

set of measurements (grid)  $\rightarrow$  storage as an array

reconstruction (in display)

sampling

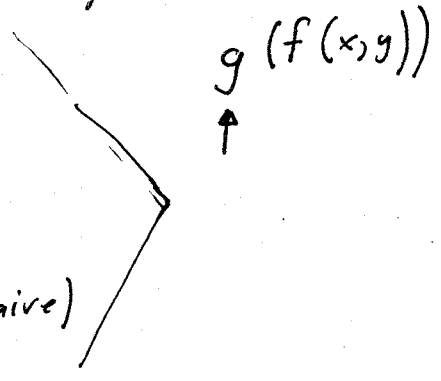
re-sampling (change the set of samples)

other operations

Windowing operations (crop, treat rectangle as image)

Point Operations - 1 image vs. multiple images

- brightness / contrast
- levels curves
- histogram equalization
- color operations / color twists
- desaturation, color 2 gray (naive)



Multi-image  $g(f_1(x,y), f_2(x,y))$   
same  $x,y$  (or window)

Cross-dissolve

$\alpha$  channel (still per pixel)

over  $\alpha f_1(x,y) + (1-\alpha) f_2(x,y)$

$\alpha = f_1(x,y)$

other operations -

mashing, vnder, atop, ...

feathering, cloning, ...

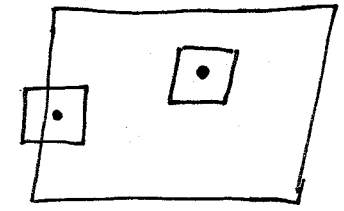
# Area Operations

$f(x,y)$  = function of the neighborhood around  $X,Y$

Size / shape of neighborhood (often square, odd size)

What if neighborhood exceeds border?  $x \pm k, y \pm k$

- Zero (or constant)
- clamp (border)
- wrap
- mirror



examples :

max, min

average

weighted average

} discrete = sum  
 } continuous = integral

note : weights are an image (size of neighborhood)

1D version w/ signals

average =  $[\frac{1}{3} \ \frac{1}{3} \ \frac{1}{3}]$

← zero centering

Convolution  $\hat{=}$  sliding weighted average  
 flip signal around (doesn't matter if symmetric)

Dealing w/ edges

- infinite zeros  $\Rightarrow$  signal "grows"
- border handling