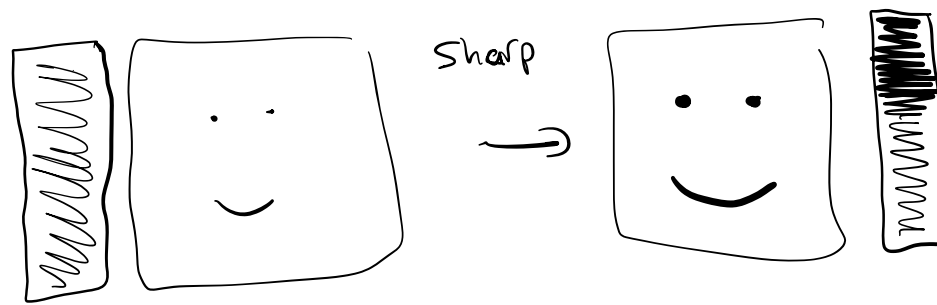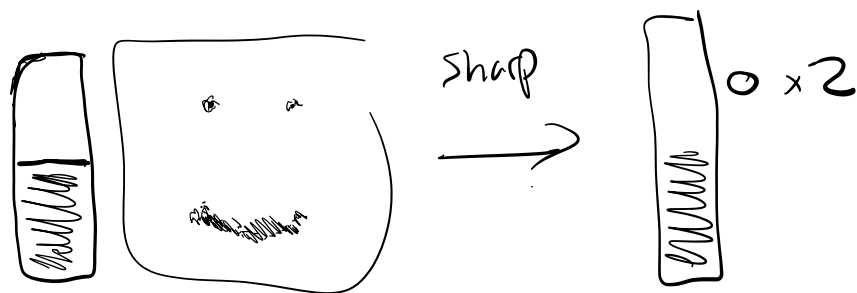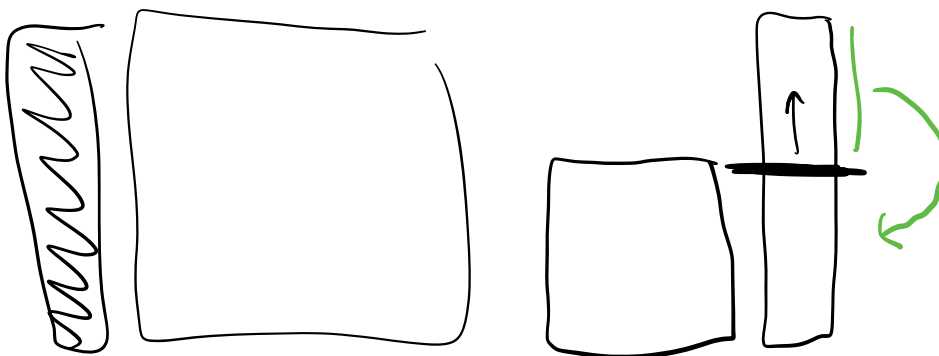# Lecture 3B/4 - Frequency, Sampling, Pyramids
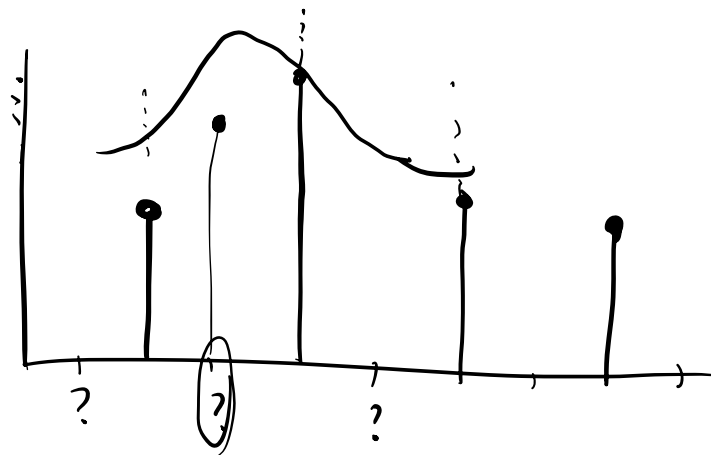


Sharp

blur

Sharp

0 × 2

---

## Downsampling Frequencyometer

# Upsampling Frequensometer



?   ?   ?

?   ?   ?
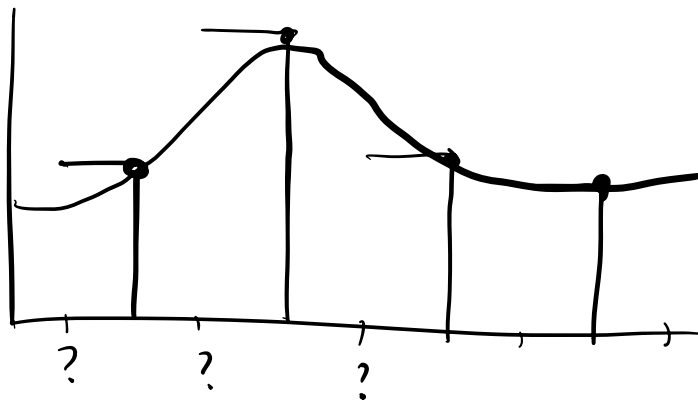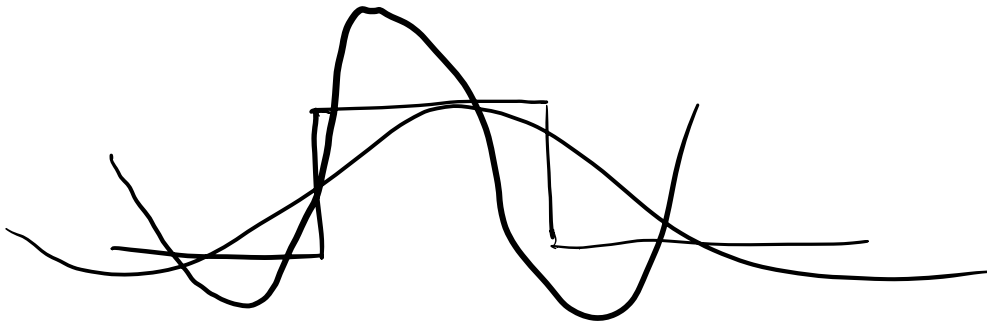
# Local Uniqueness
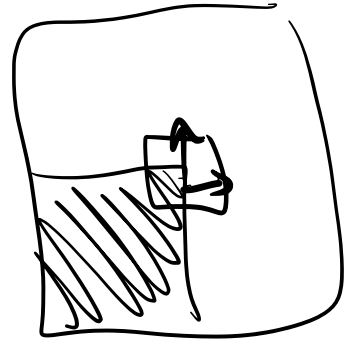


$$I_x = \frac{\partial I}{\partial x}$$

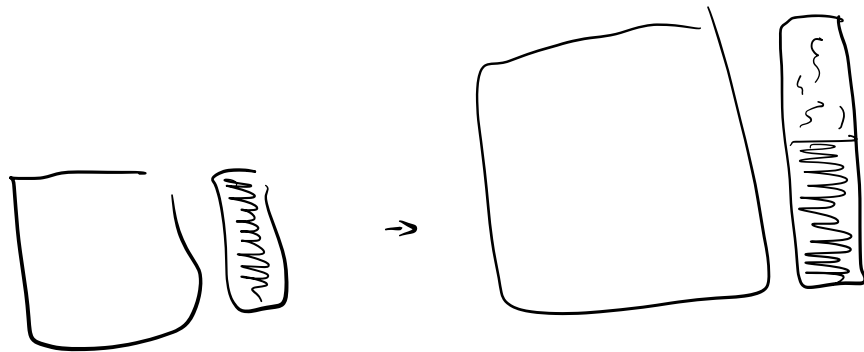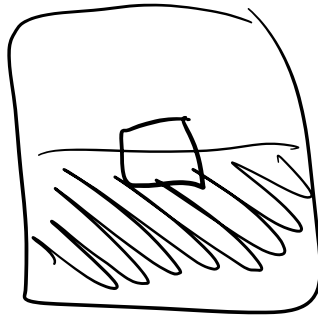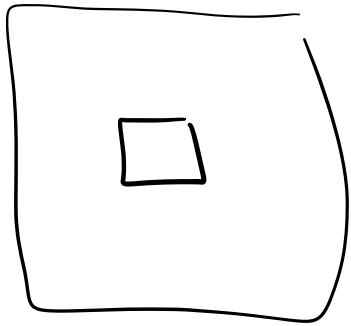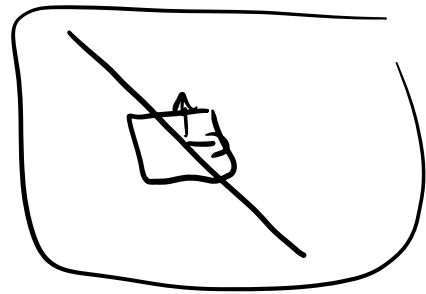$$I_y = \frac{\partial I}{\partial y}$$



"error"

$$E(u,v) = \sum_{x,y \in W} \left[ I(x+u, y+v) - I(x,y) \right]^2$$

$$f(x) = f(a) + f'(a)(x-a) + f''(a)(x-a)^2$$

$$f(x) \approx f(a) + f'(a)(x-a)$$

$$\boxed{I(x+u, y+v)} \approx I(x,y) + \frac{\partial I}{\partial x} u + \frac{\partial I}{\partial y} v$$

$$I(x,y) + I_x u + I_y v$$

Plug in:

$$E(u,v) = \sum_{x,y \in W} \left[ I(x,y) + I_x u + I_y v - I(x,y) \right]^2$$

$$E(u,v) = \sum_{x,y \in W} \left[ I_x u + I_y v \right]^2$$