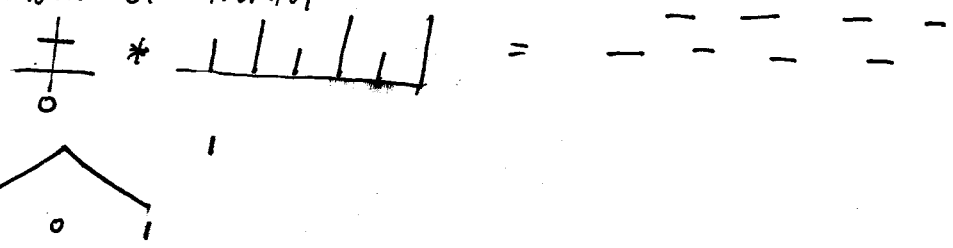
Image Re Sampling

Reconstruction
Sampling
Re-Sampling

① Re-Construction
Which one ? . . . . .
① device-oriented (splat) - overlap
② connect the dots
piecewise constant
linear
splines - overlap / support
③ as smooth as possible

Math:
Samples = Spike Chain → Convolution
Sliding window of kernel



How to compute @ pos X

Why this way?
What kernel?

Sampling Theory

How to make reconstruction unambiguous?

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Consider only sine waves

0 $2\pi t$ 1 $2\pi t$ 2 $2\pi t$

Any will pass through these points
- need to restrict to < 1

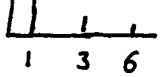
Intuition: "smooth" signals can't turn around too often between samples
(less than 1 min/max per period)

NOTE: if you have more than 2 samples per period the lowest frequency is unique
- aliases with multiples of freq

FOURIER Theory

Represent any signal as sum of sin waves
- Not quite, some complications

$f(t)$ $\sin 1\ 2\pi t + \frac{1}{2} \sin 3\ 2\pi t + \frac{1}{7} \sin 6\ 2\pi t$

$F(w) =$ 

High Frequencies $\cong$ abrupt changes
- need to use high frequencies to make sharp changes

Sampling Theorem (Nyquist Shannon)

IF Signal is Band Limited (~~no~~ HF $\neq \omega$)
you know the highest frequency in it
AND you sample @ $> 2\omega$

THEN: you can <u>exactly</u> reconstruct

IDEAL RECONSTRUCTION

determine the 1 signal that fits samples
(that doesn't exceed the band limit)

make spike chain (lots of HF)
low-pass filter (remove HF)

Filtering is convolution