CMSC 435

Antialiasing
Aliasing

- Visual artifacts
  - jagged lines and edges
  - high frequencies appearing as low
  - small objects missed
  - texture distortions
  - strobing and popping
  - backward movement
No antialiasing
Rendering Process

- Two basic stages
  - sampling
  - reconstruction

- Assuming discrete sampling
Original scene

Luminosity signal
Sampling at pixel centers

Sampled signal
Rendered image

Luminosity signal
Prefiltering methods examine areas of color within a pixel.
Hello World

Hello World

A demonstration
No antialiasing
Prefiltering
Sampling Theory

- Shannon’s sampling theory (1D):
  - A band limited signal \( f(t) \) with cut off frequency \( w_F \) may be perfectly reconstructed from its samples \( f(nT_0) \) if \( 2\pi/T_0 \geq 2w_F \)
  - \( w_F == \) Nyquist limit

- Alternatively:
  - a signal can be reconstructed exactly from samples only if the highest frequency is less than half the sampling rate
Sampling Schemes

- Regular supersampling
- Jittered supersampling
- Adaptive supersampling
- Stochastic sampling
Taking 9 samples per pixel
Fig. 12c. Comb rendered with a regular grid, one sample per pixel.

Fig. 12d. Comb rendered with a jittered grid, one sample per pixel.
Reconstruction

- Reconstruction: recreate a continuous signal from a set of samples
- Tasks of reconstruction filter
  - remove extraneous replicas of signal spectrum
  - pass the original signal base unchanged
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Combines nine samples

Filters combine samples to find a pixel's color.
This filter computes a weighted average.

Samples  Pixels
No antialiasing
3x3 supersampling
3x3 unweighted filter
3x3 supersampling
5x5 weighted filter
3x3  jittered supersampling
5x5  weighted filter