



Feline: Fast, Elliptical Lines for Anisotropic Texture Mapping

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Outline

- ◆ What should texture mapping really do?
- ◆ Previous work
- ◆ Our work: Simple Feline
- ◆ Image gallery
- ◆ Conclusions



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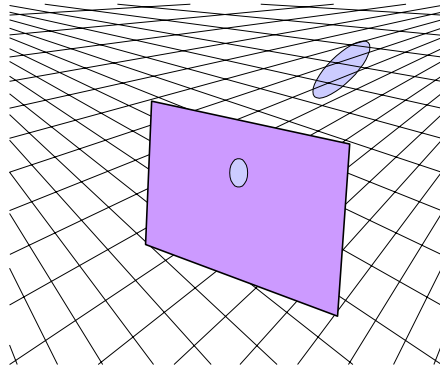


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An Intuitive Diagram of Texture Mapping (stolen from Landsdale)



- ◆ Pixel filter is a window with variable transparency
- ◆ Filter weight at a point is degree of transparency
- ◆ A circular window views an elliptical texture area
- ◆ Adjacent filters overlap

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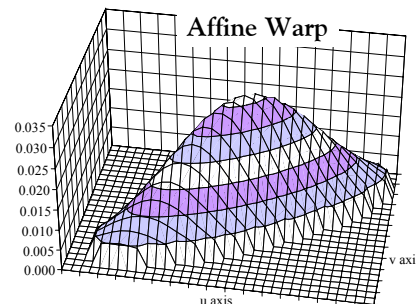
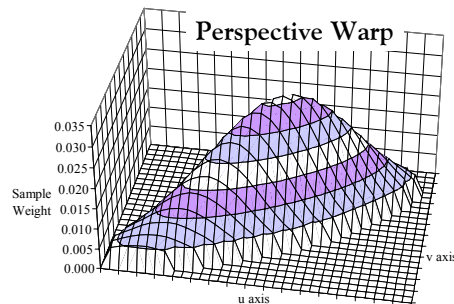
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Heckbert & Greene's Elliptical Weighted Average (EWA)

- ◆ Assume perspective distortion is constant near pixel (99.9% true)
- ◆ Back mapping to screen space is a biquadratic



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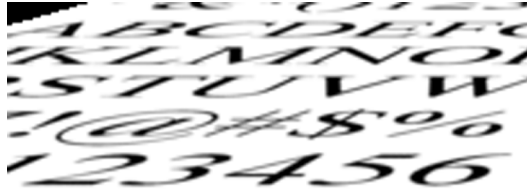


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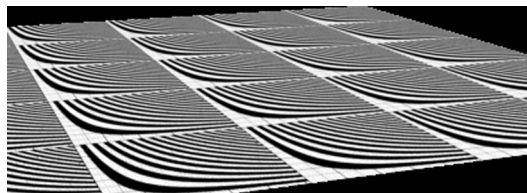
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EWA Texturing Examples



Nice definition to text without jaggies



Few & faint Moiré artifacts

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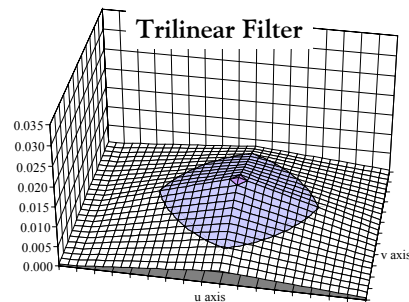
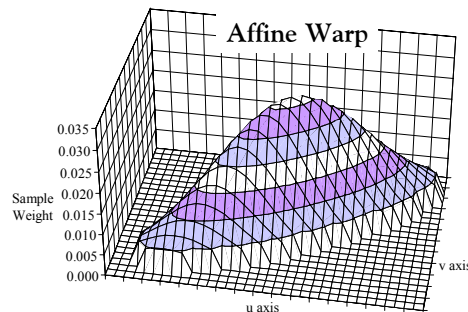
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Lance Williams' Mip-mapping with Trilinear Filtering

- ◆ Trilinear filter has (very) roughly circular contour lines, with a square footprint



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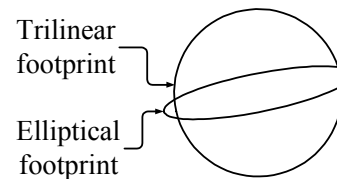
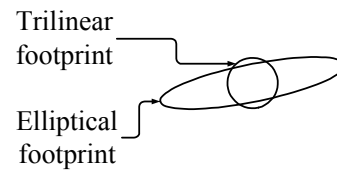
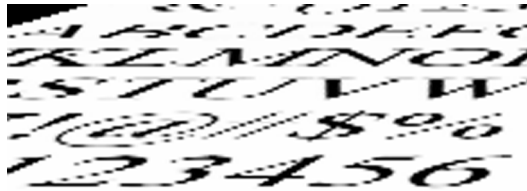


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Trilinear Texturing Examples



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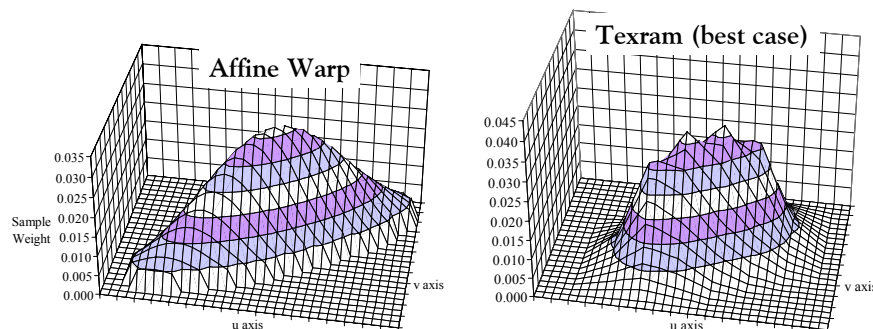
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Texram (Best Case)

- ◆ 2ⁿ trilinear probes along ellipse's "major axis"
- ◆ Resulting filter is too short and mesa-like at best...



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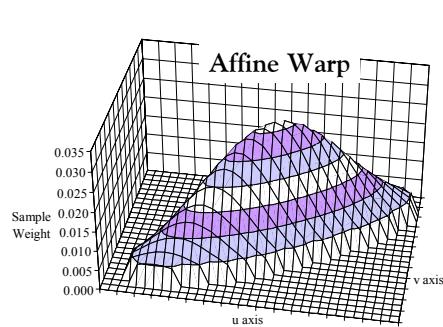
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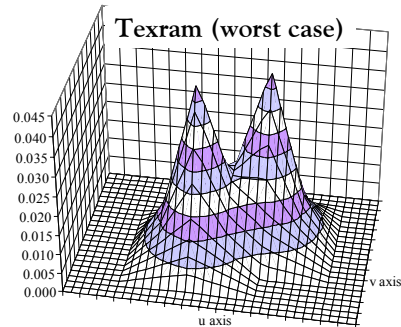
Texram (Worst Case)

◆ ... and jaggedly peaked at worst.



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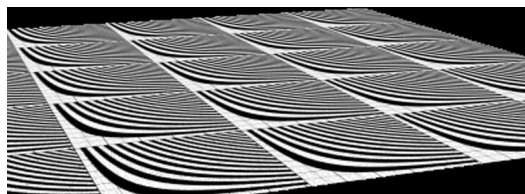
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Texram Texturing Examples



Sharp text but with
jaggies (aliasing)



Lots of swimming
Moiré artifacts

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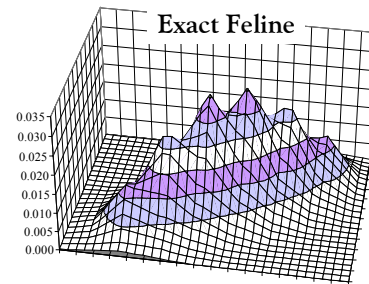
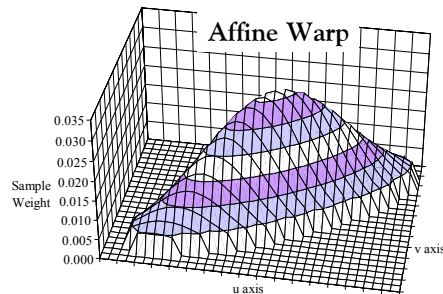
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Exact Feline: Use Ellipse Parameters

- ◆ n probes, Gaussian weighted, on major axis of ellipse
- ◆ Important Texram problems fixed
- ◆ But expensive setup comparable to EWA!



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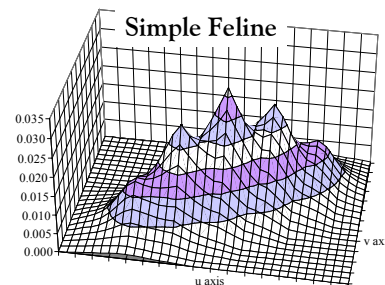
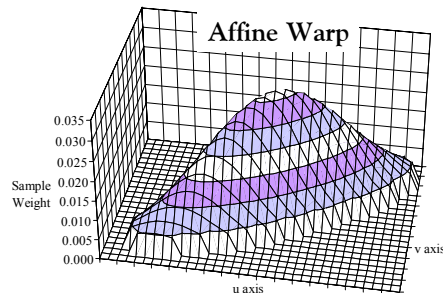
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Simple Feline: Approximate Ellipse

- ◆ Approximate ellipse axes for cheaper setup
- ◆ Slightly underestimates major radius, overestimates minor radius (resulting in fewer, fatter probes)



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Simple Feline: Reducing # of Probes

- ◆ Allow shortening of “major axis”
 - Extreme sensitivity, quickly causes aliasing
 - 3% decrease
- ◆ Allow widening probes
 - Causes blurring
 - Max of 16% (high-quality) or 31% (high-efficiency)
- ◆ Allow stretching distance between probes
 - Causes aliasing
 - Max of 15% (high-quality) or 36% (high-efficiency)



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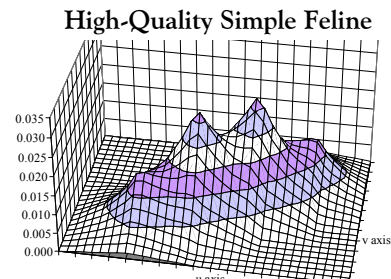
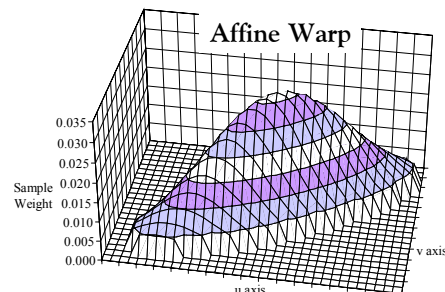
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Simple Feline: Modest Probe Reduction

- ◆ Actual blur stretch of 15.6% (maximum allowed)
- ◆ Actual aliasing stretch of 7.0%



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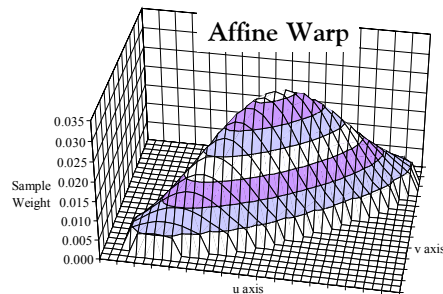
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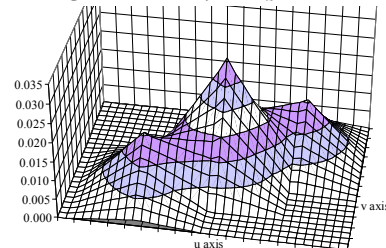


Simple Feline: “Texram Probe-Equivalent” Reduction

- ◆ Actual blur stretch of 31% (maximum allowed)
- ◆ Actual aliasing stretch of 26%



High-Efficiency Simple Feline



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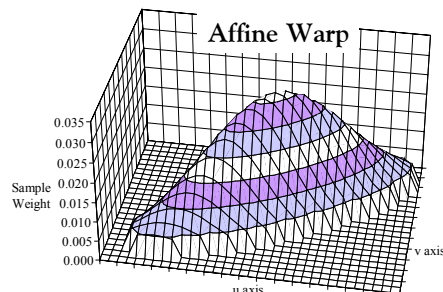
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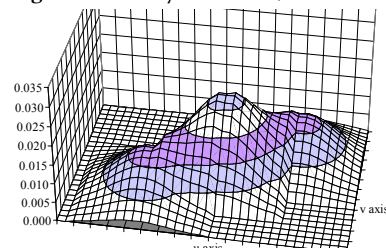


Simple Feline: “Texram Probe-Equivalent” with Gaussian Probes

- ◆ Blur stretch of 36%
- ◆ Aliasing stretch of 31%
- ◆ Slightly blurrier, but many fewer aliasing artifacts



High-Efficiency Feline w/Gaussian



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Image Gallery: Text



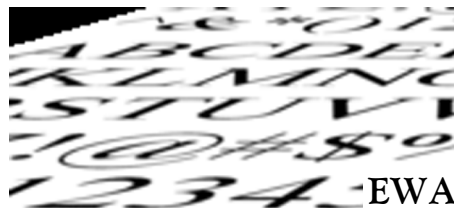
Trilinear



Texram



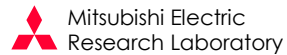
HQ Feline



EWA



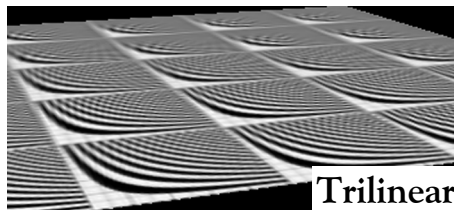
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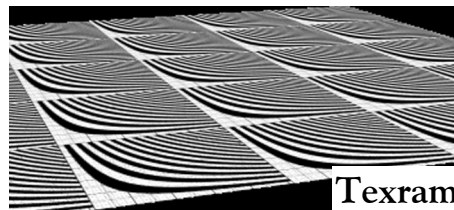
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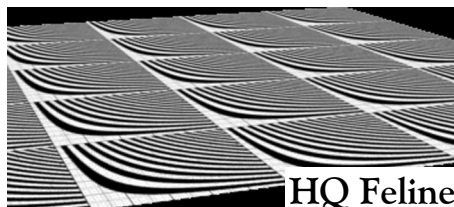
Image Gallery: Curves



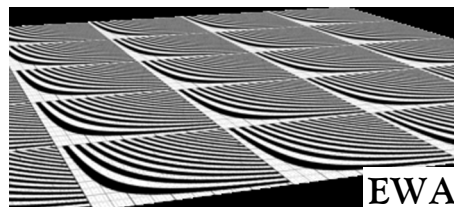
Trilinear



Texram



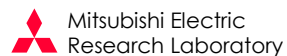
HQ Feline



EWA



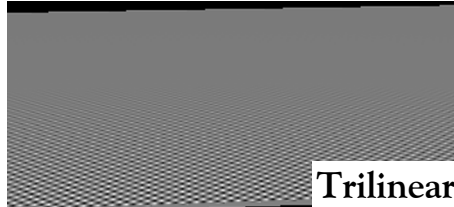
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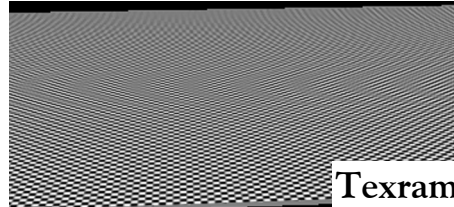
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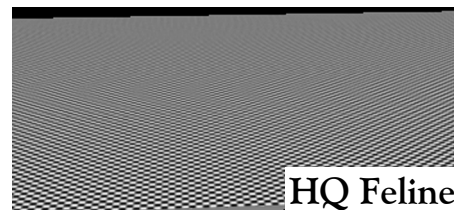
Image Gallery: Checkerboards



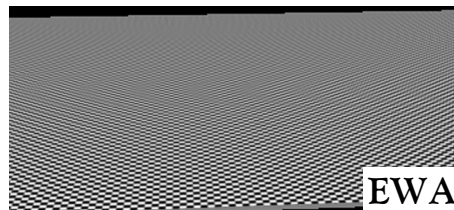
Trilinear



Texram



HQ Feline



EWA



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Conclusions

- ◆ Feline compared to EWA:
 - High-Quality Feline's visual quality is comparable, using half the cycles/pixel and much smaller setup logic
- ◆ Feline compared to Texram:
 - High-quality images far superior, using more cycles/pixel
 - High-efficiency images superior, using same cycles/pixel
- ◆ Feline requires a tiny fraction of the die of a PC or next-generation game console graphics accelerator



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