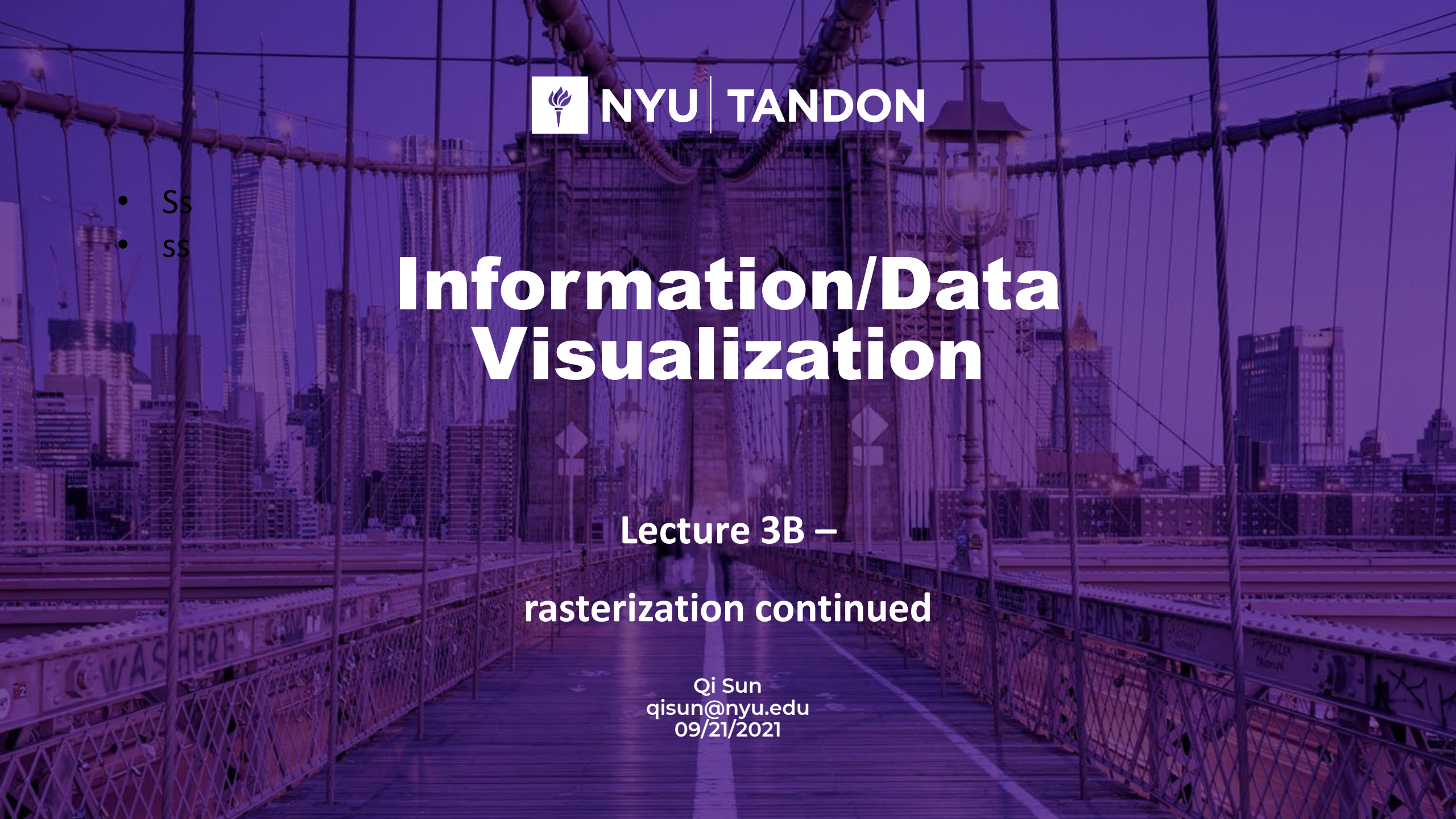

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- Ss
- ss

Information/Data Visualization

Lecture 3B –

rasterization continued

Qi Sun
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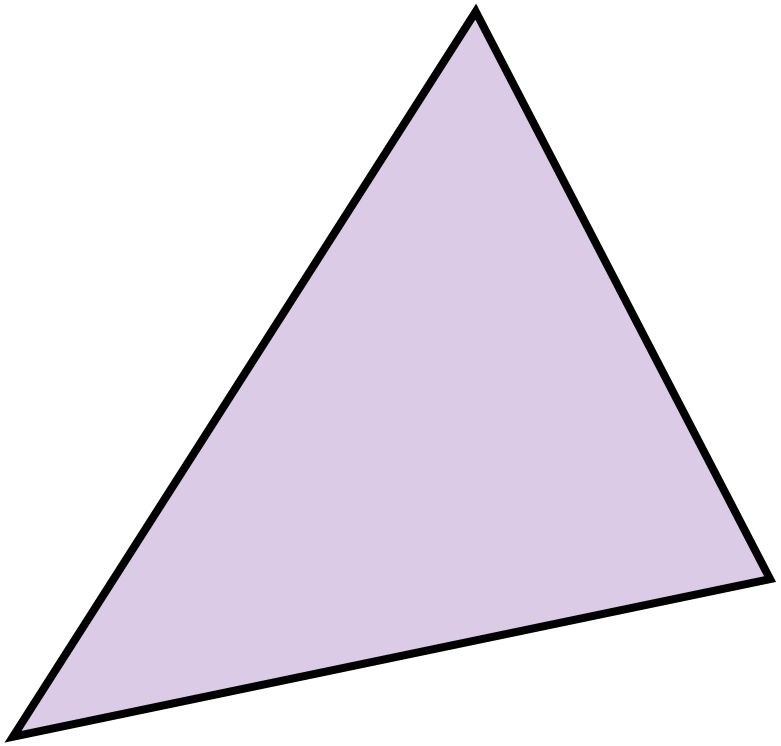
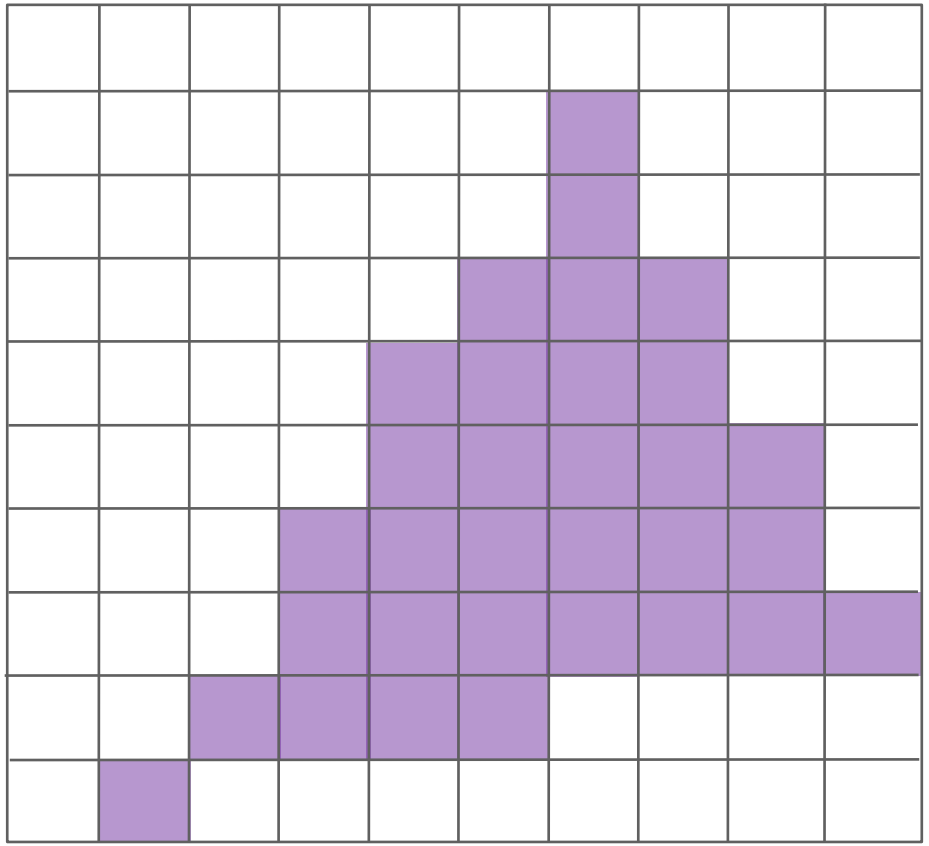
09/21/2021

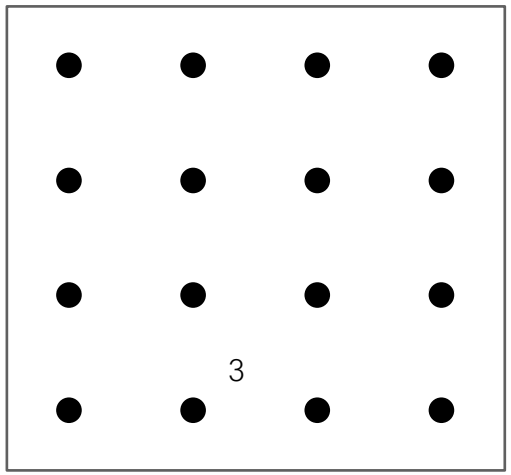
Super-Sampling and Anti-Aliasing





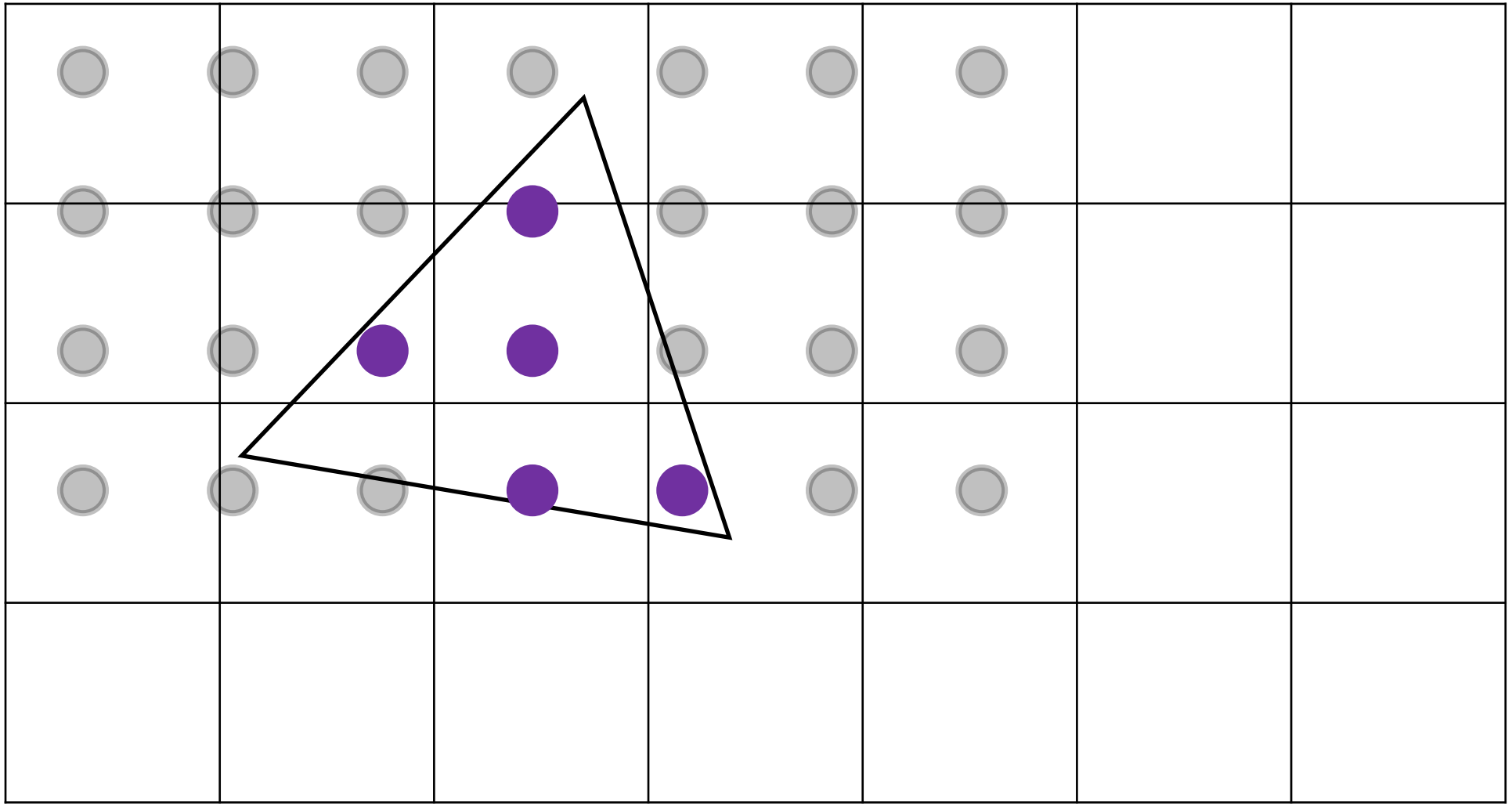
Supersampling

We can approximate the effect of the 1-pixel box filter by sampling multiple locations within a pixel and averaging their values:



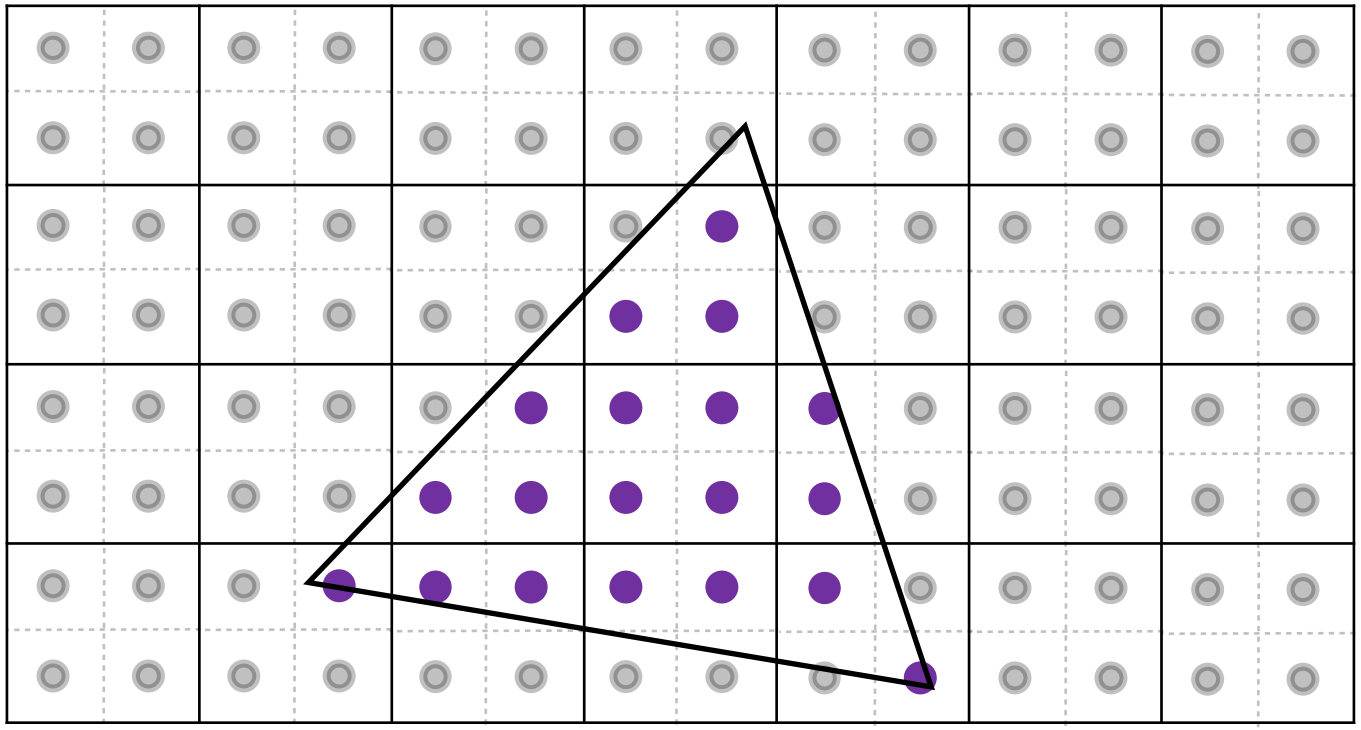
4x4 supersampling

Point Sampling: One Sample Per Pixel



Super-sampling: Step 1

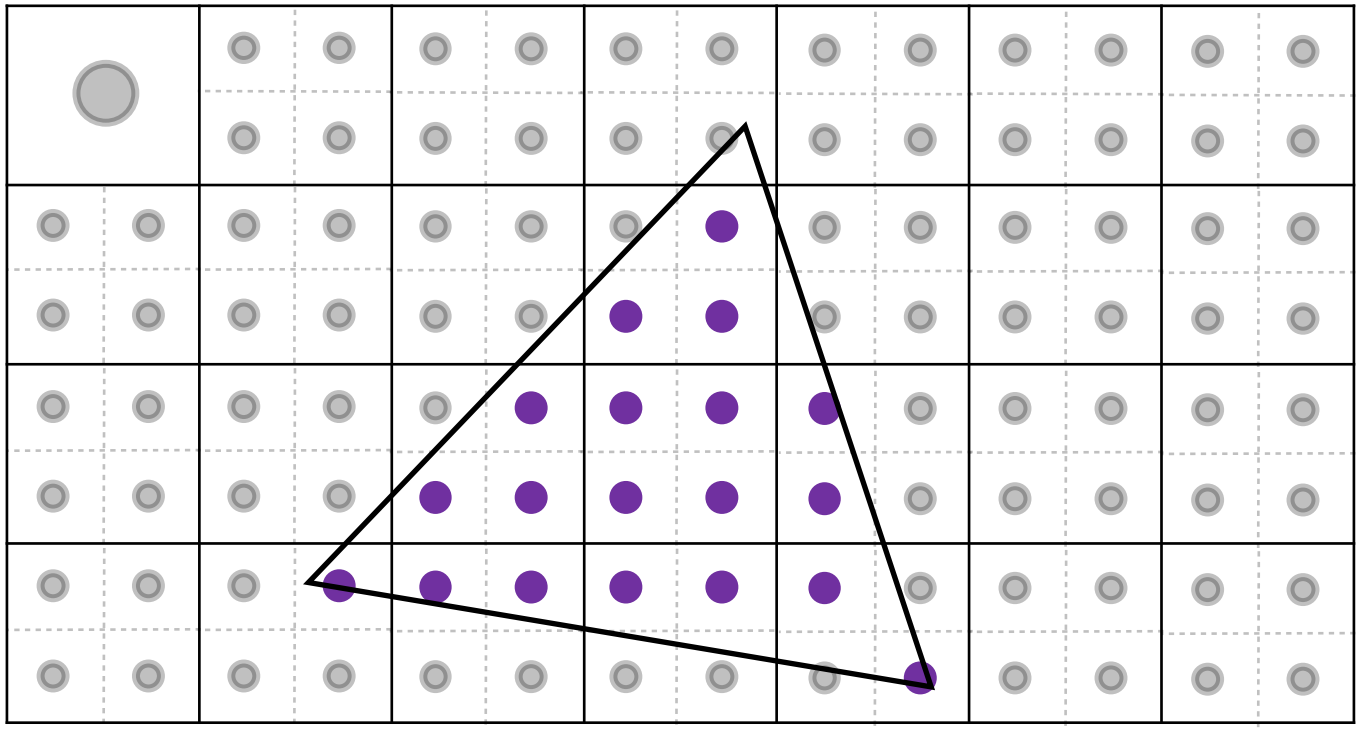
Take NxN samples in each pixel.



2x2 supersampling

Supersampling: Step 2

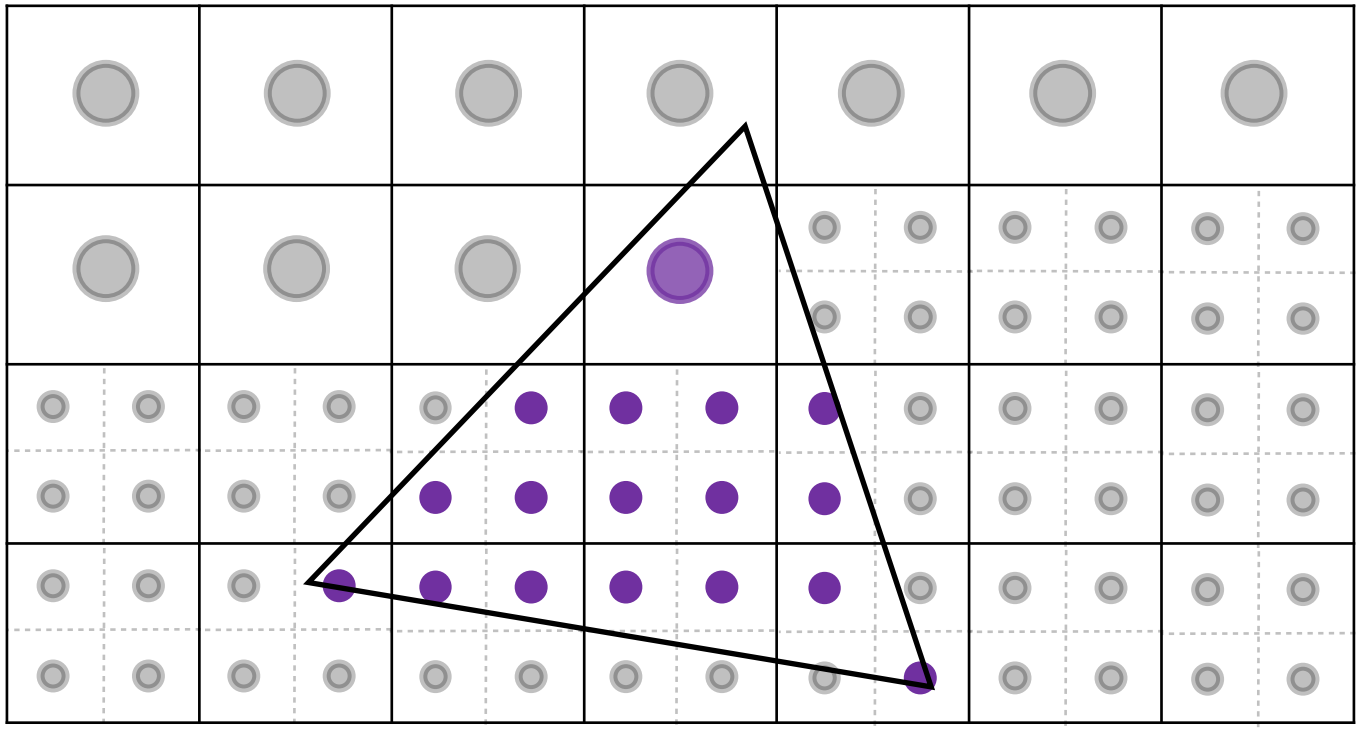
Average the NxN samples “inside” each pixel.



Averaging down

Supersampling: Step 2

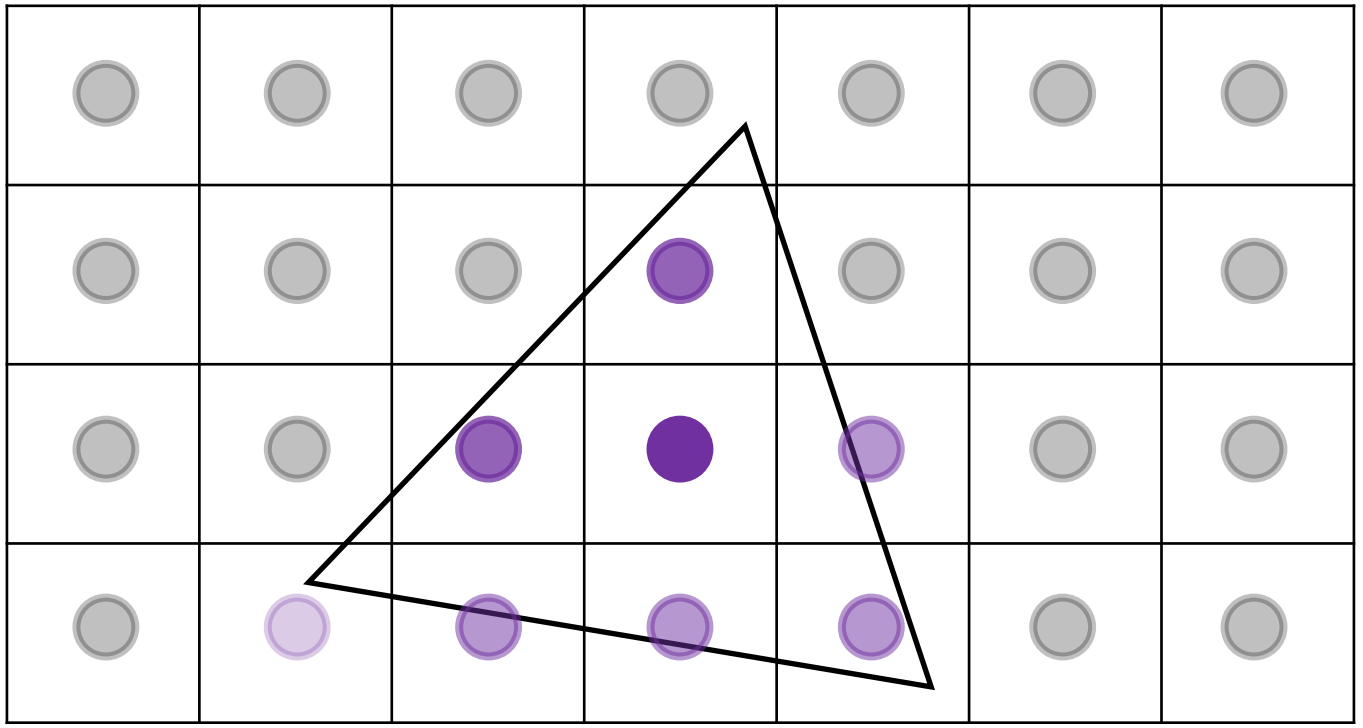
Average the NxN samples “inside” each pixel.



Averaging down

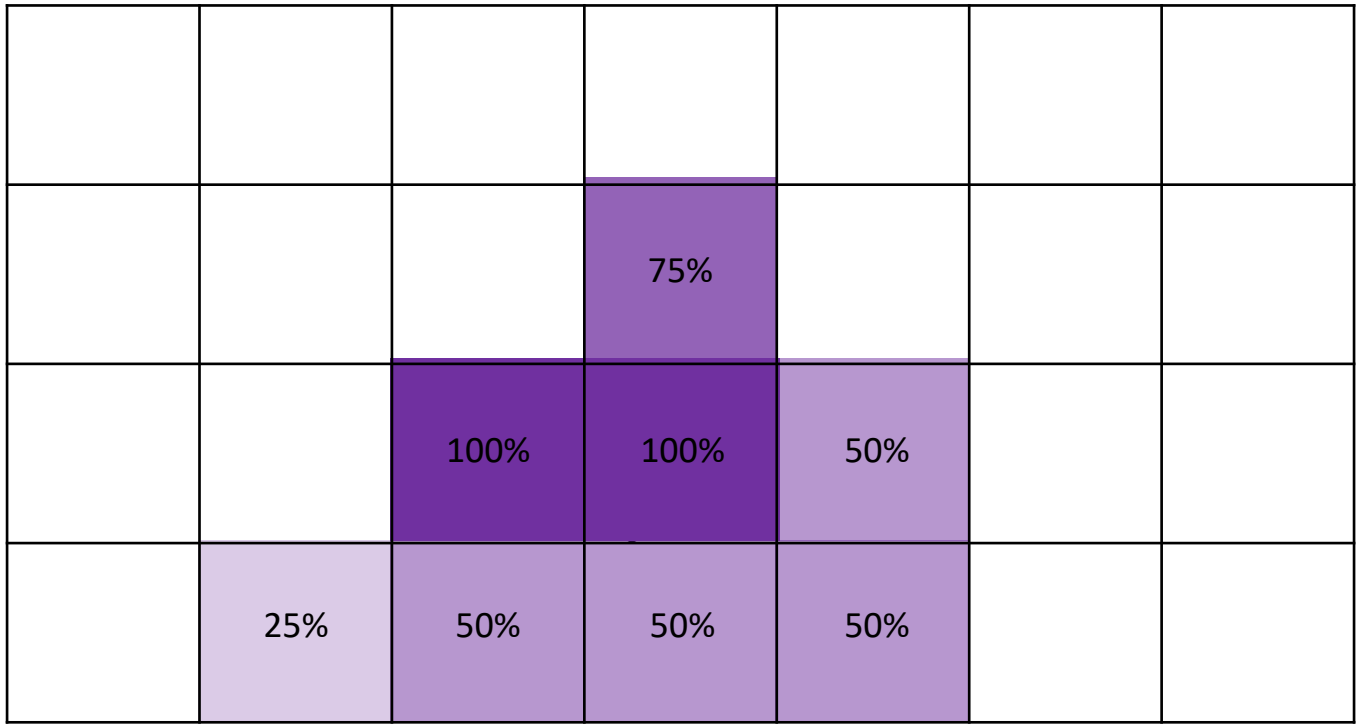
Supersampling: Step 2

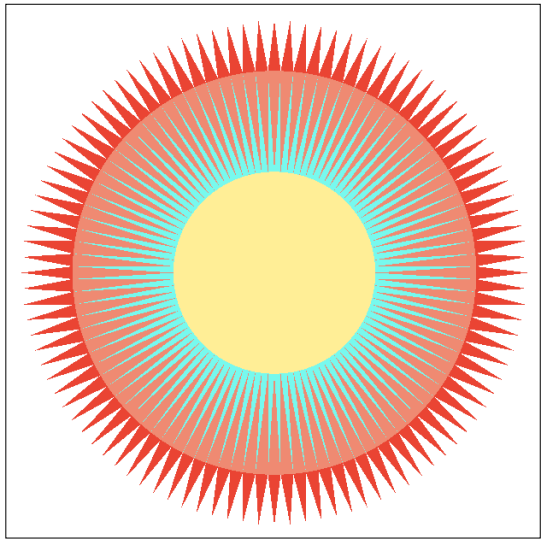
Average the NxN samples “inside” each pixel.

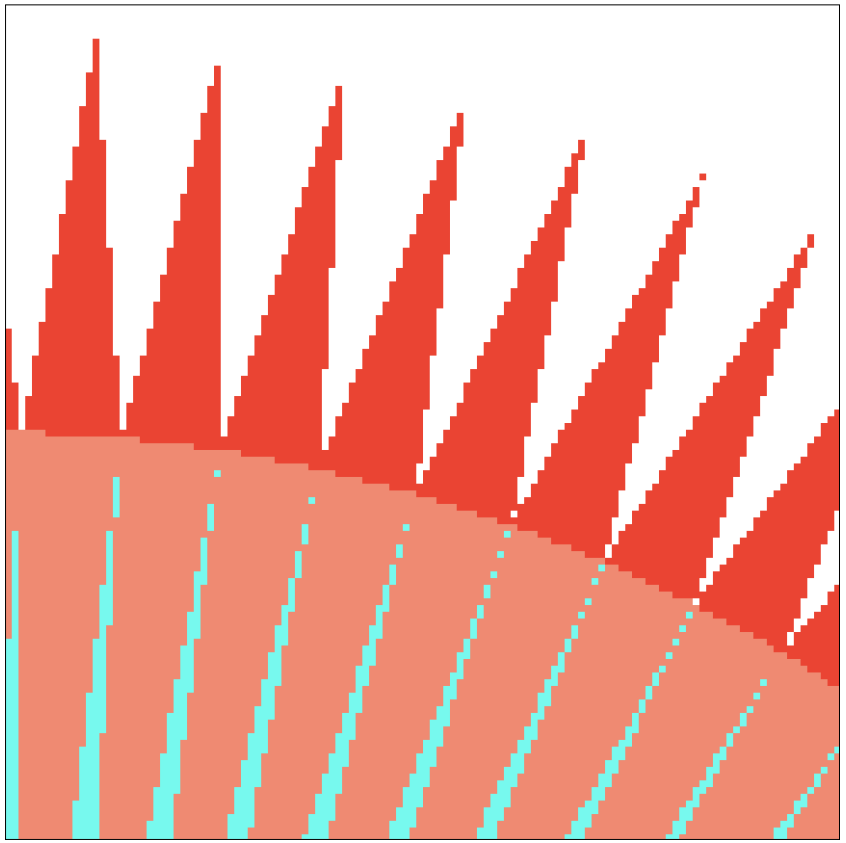


Supersampling: Result

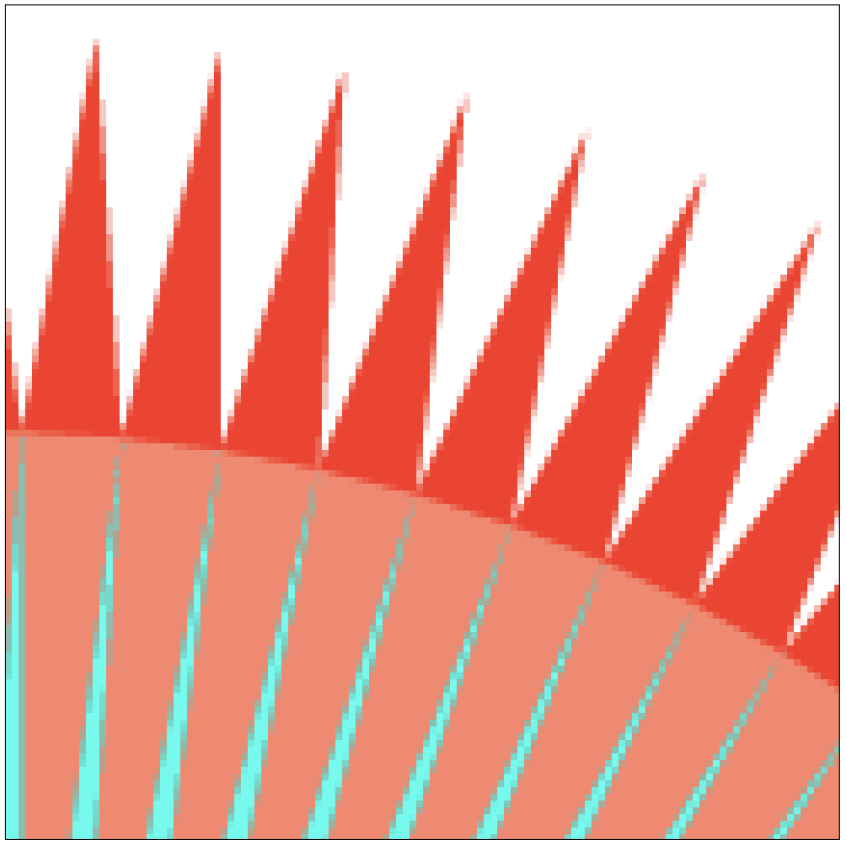
This is the corresponding signal emitted by the display







raw sampling



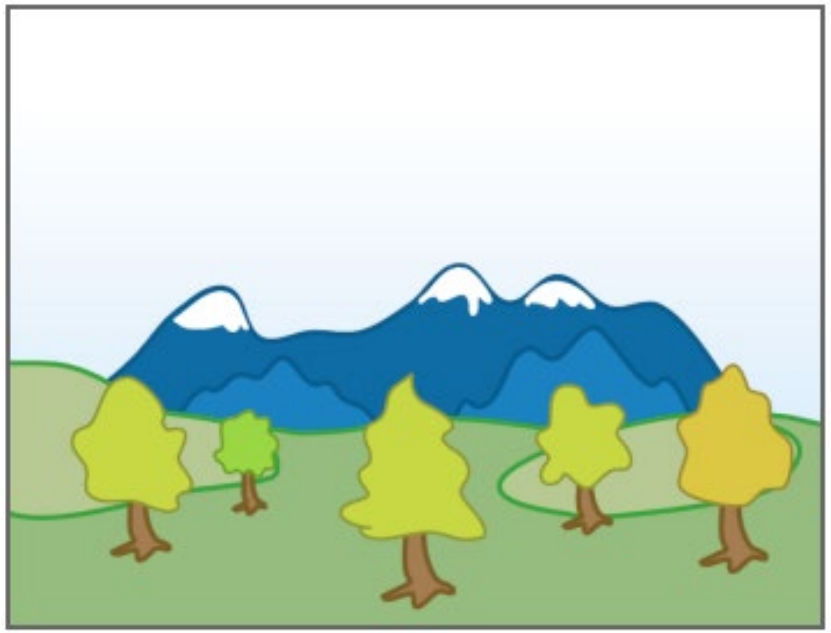
4x4 up-sampling


No AA
SSAA

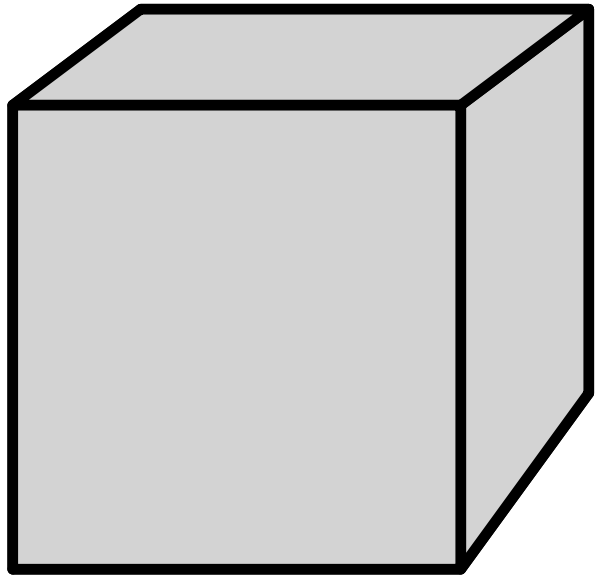
Visibility / Occlusion

Painter's Algorithm

- Inspired by how painters paint
- Paint from back to front, overwrite in the framebuffer

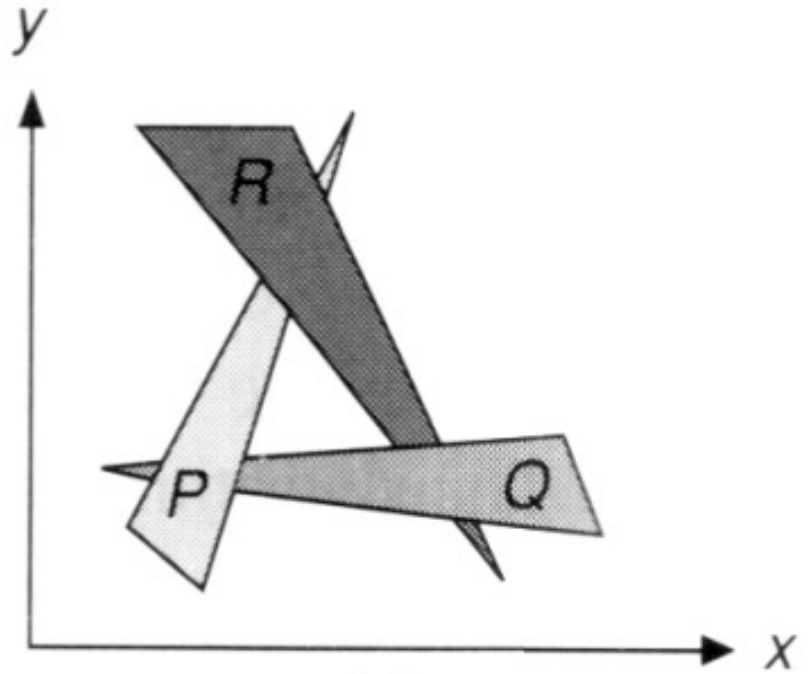


[Wikipedia]



Painter's Algorithm

- Requires sorting in depth (O(n log n) for n triangles)
- Can have unresolvable depth order



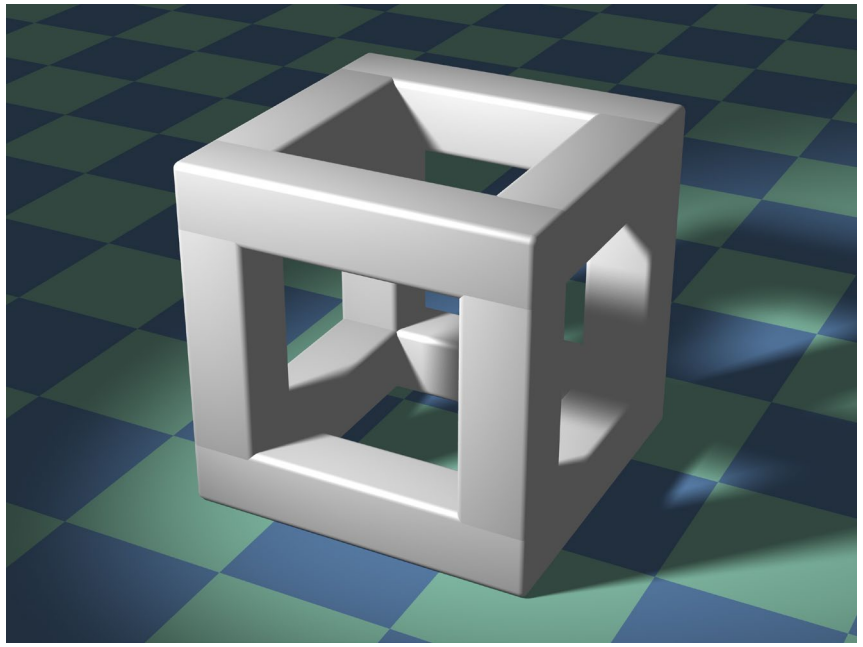
[Foley et al.]

Z-Buffer

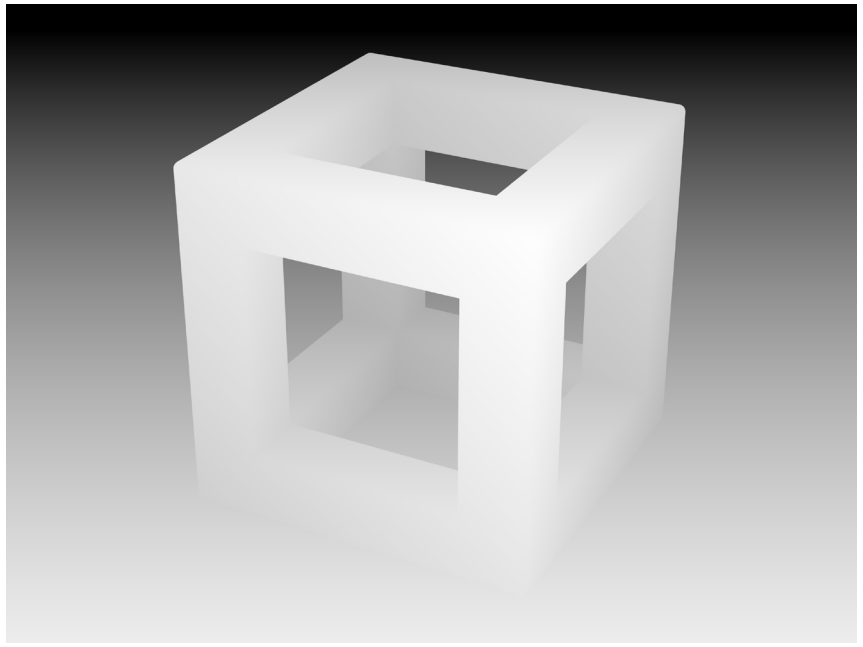
- Idea:
  - Store current min. z-value for each sample (pixel)

- IMPORTANT: For simplicity we suppose
  z is always positive
  (smaller z -> closer, larger z -> further)

Z-Buffer Example



Rendering



Depth / Z buffer

Image credit: Dominic Alves, flickr.

Z-Buffer Algorithm

- Initialize depth buffer to ∞
- During rasterization:

```
for (each triangle T)
    for (each sample (x,y,z) in T)
        if (z < zbuffer[x,y])  // closest sample so far
            framebuffer[x,y] = rgb; // update color
            zbuffer[x,y]     = z;   // update z
        else
            ;  // do nothing, this sample is occluded
```

Z-Buffer Algorithm