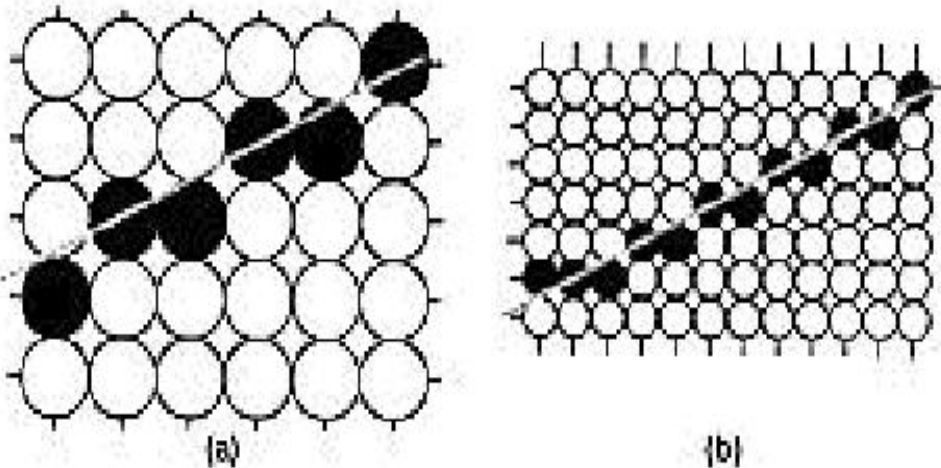


Aliasing and Anti-aliasing

- What is aliasing?
 - Aliasing is a phenomenon that occurs when sampling a continuous function with insufficient resolution
- What is antialiasing?
 - Antialiasing is the application of techniques that reduce or eliminate aliasing
- Why is it necessary?
 - To make the graphics look more realistic
- How is it performed?
 - We'll see

Antialiasing: Increasing Resolution

- Doubling resolution in x and y

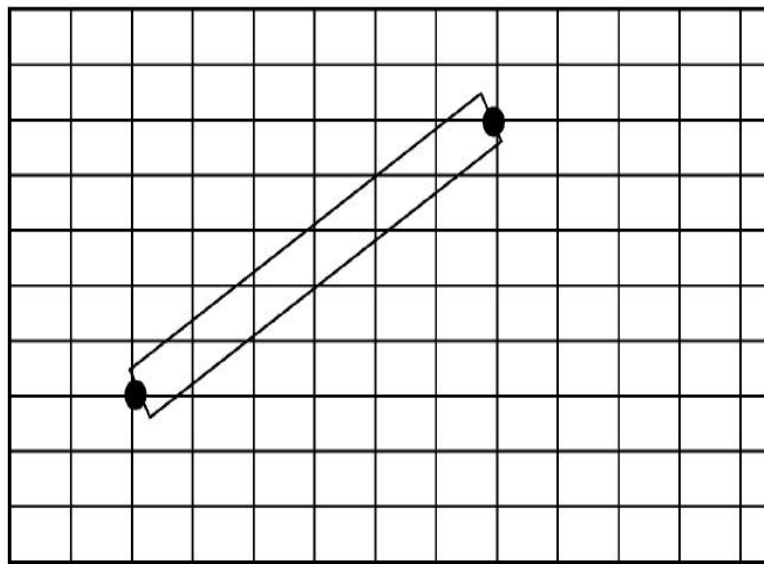


(a) Standard midpoint line on a bilevel display. (b) Same line on a display that has twice the linear resolution.

- This method only lessens the problem
- Costs 4 times memory, memory bandwidth and scan conversion time

Antialiasing: Unweighted Area Sampling (1/3)

- Drawing a line as a 1-pixel width rectangle



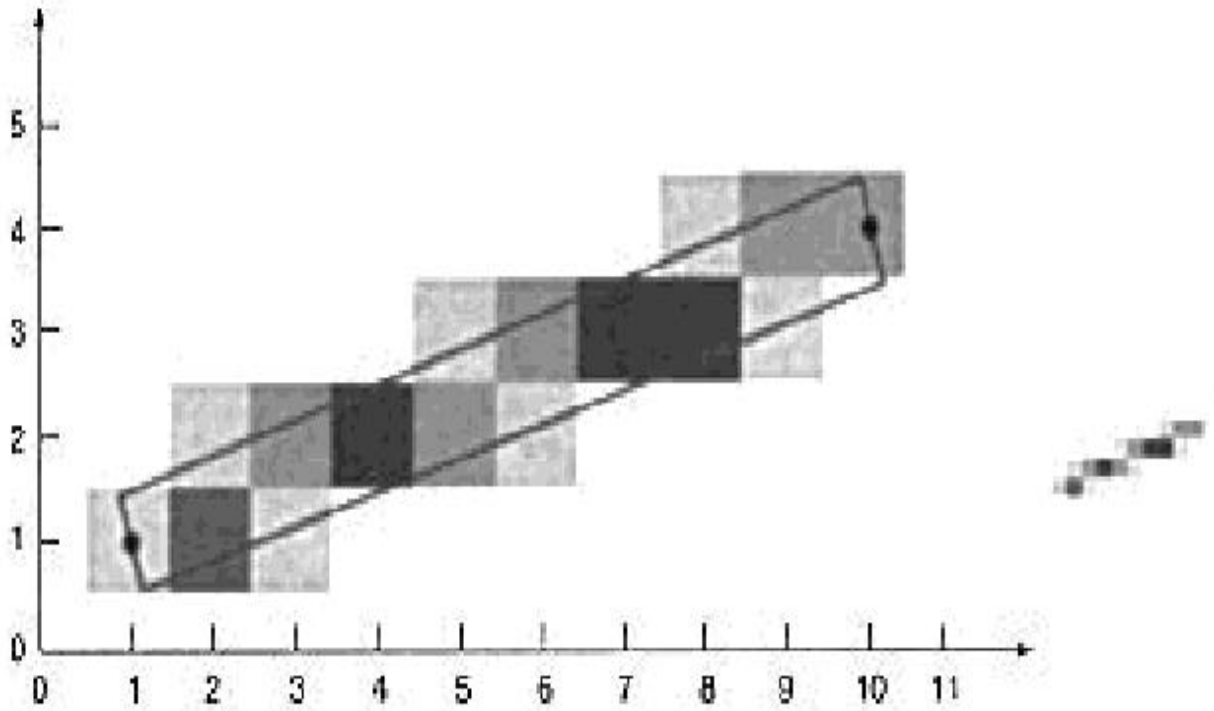
Line from point (2,3) to point (8,8)

- For now pixel is unit square centered on x-y intersection
- Midpoint algorithm: pick single pixel closet to center line of rectangle. This is a form of point sampling

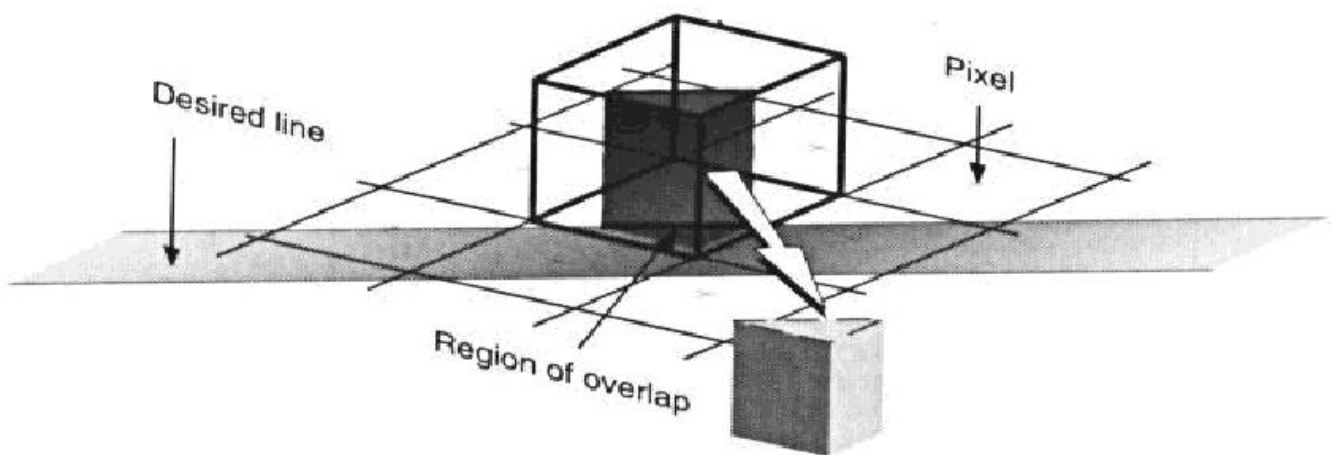
Antialiasing: Unweighted Area Sampling (2/3)

- Set each pixel's intensity value proportional to its area of overlap covered by primitive
- Note more than one pixel/column for lines of $0 < \text{slope} < 1$
- This is a form of unweighted area sampling
 - the further pixel center is from the line, the less influent it has
 - only pixels covered by primitive can contribute
 - only amount of area of overlap matters, regardless of distance of area of overlap from pixel's center

Antialiasing: Unweighted Area Sampling (3/3)



“Box Filter” Represents Unweighted Area Sampling

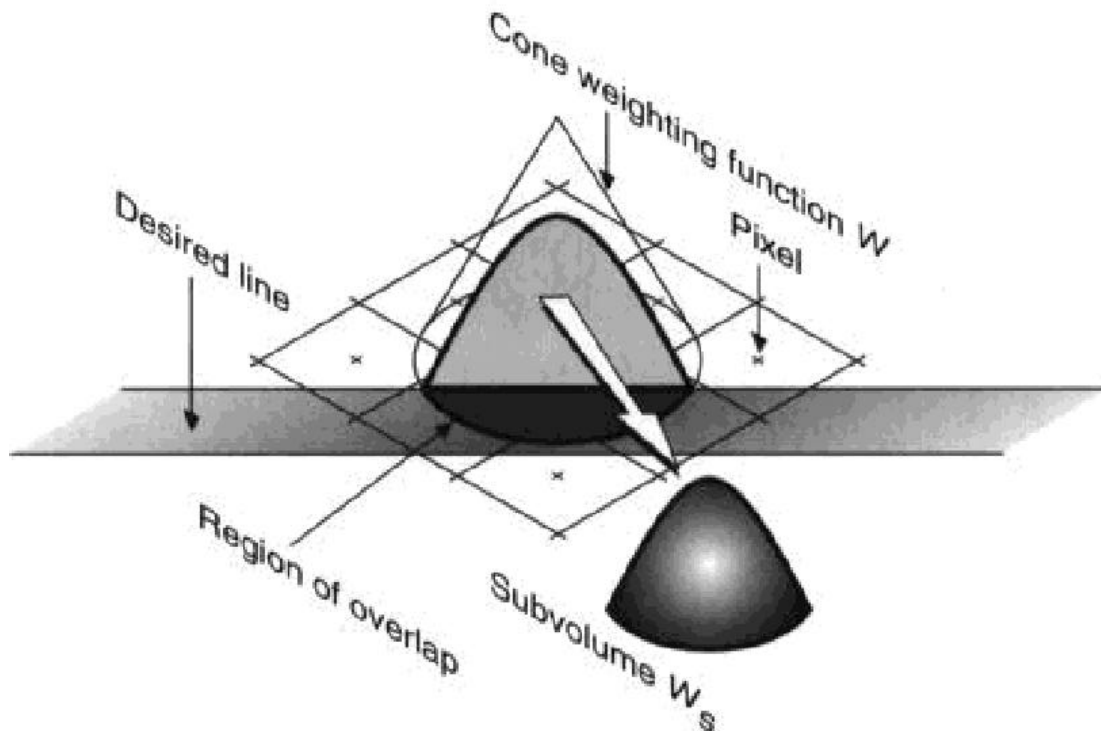


- Weight function $W(x,y)$ gives weight for incremental area dA centered at (x,y) ; it is constant here, hence the name “box”
- The intensity contribute by dA is $(W(x,y)*dA(x,y))$
- Then the total intensity (0-1) is

$$\int W(x,y)dA(x,y)$$

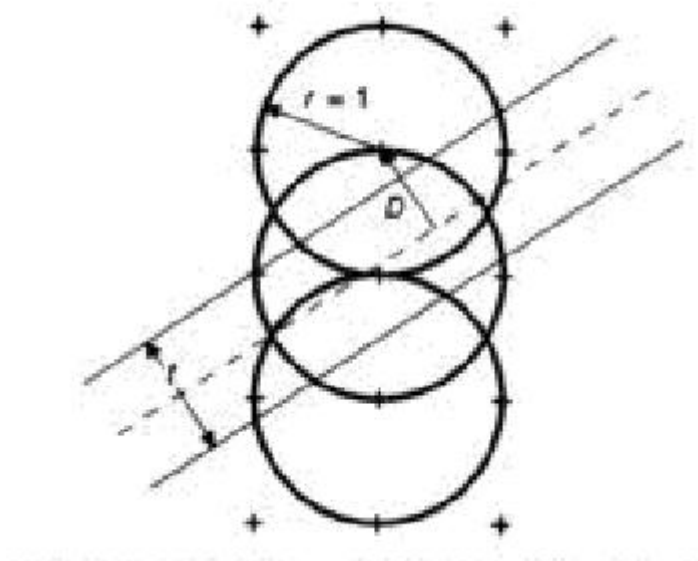
this is volume over the area of overlap

Cone Filter for Weighted Area Sampling (1/2)



- We change to circular pixel; we set cone's diameter to 2 pixel units
- dA has greater weight if closer to center of pixel
- Normalize so that volume=1, sub volume is conical wedge

Cone Filter for Weighted Area Sampling (2/2)



- 2 unit support implies up to 3 pixels/column
- Gupta-Sproull algorithm provides fast anti-aliased lines via table look-up