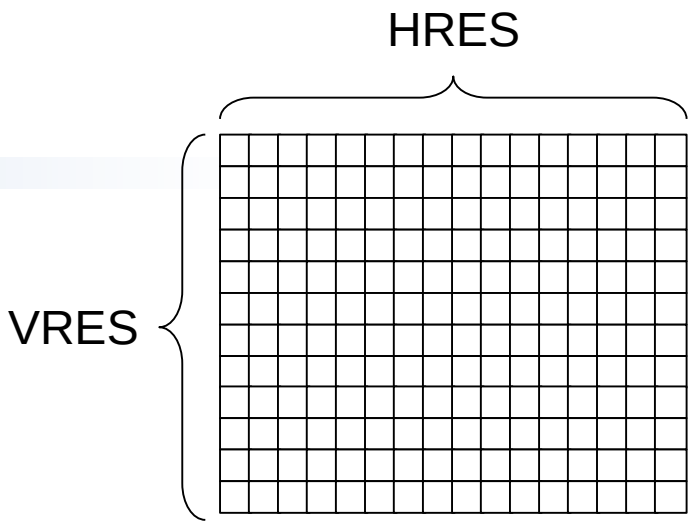
Image Resolutions

CS418 Computer Graphics

John C. Hart

Raster Images



- 2-D Array of Color Values
- Spatial Resolution: HRES × VRES
- Color Resolution (bits per pixel)

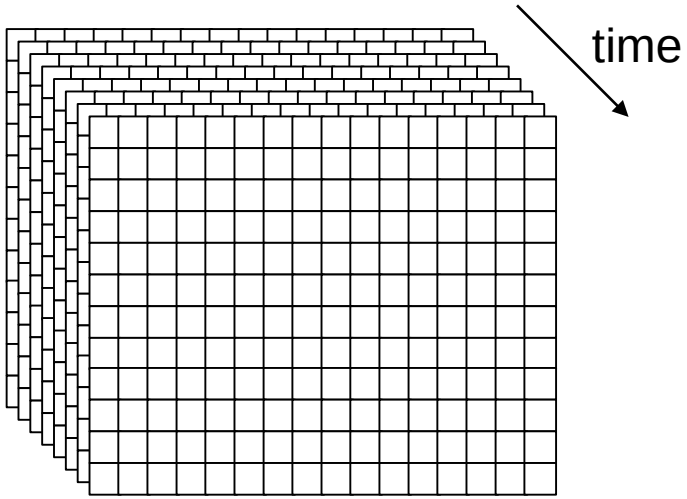
1 bpp: 0 1

8 bpp: = 1 1 1 0 1 1 0 1

24 bpp: = #FF6D55

Raster Images

- 2-D Array of Color Values
- Spatial Resolution: HRES × VRES
- Color Resolution (bits per pixel)
- Temporal Resolution (frames per sec.)



Raster Images

- 2-D Array of Color Values
- Spatial Resolution: HRES × VRES
- Color Resolution (bits per pixel)
- Temporal Resolution (frames per sec.)
- Interlace

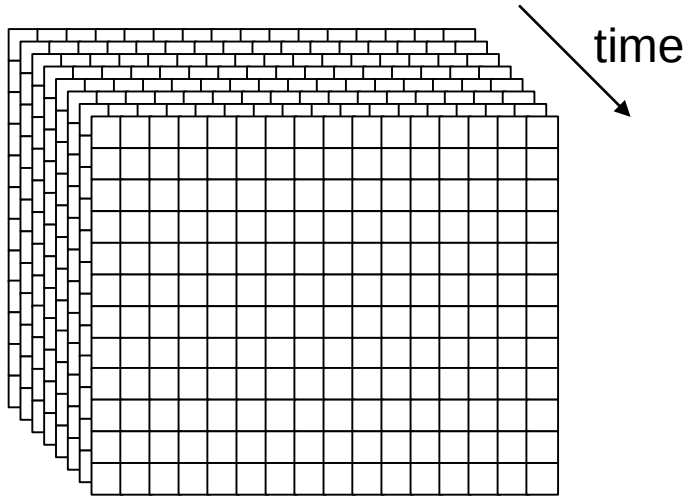
  Odd scan lines (one field)

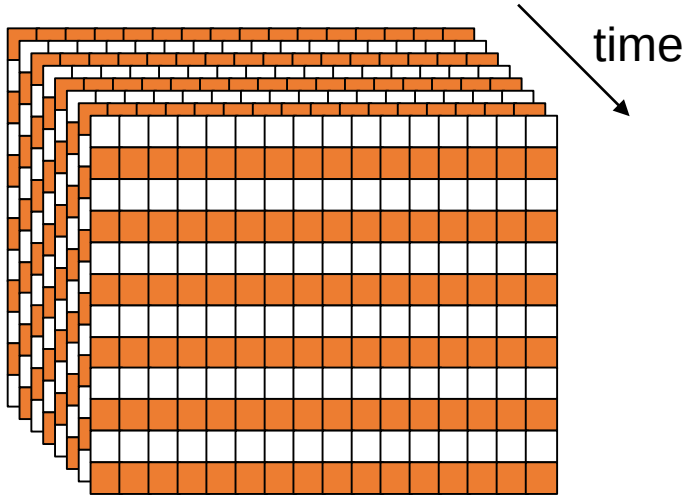
  Even scan lines (other field)

  Repeat

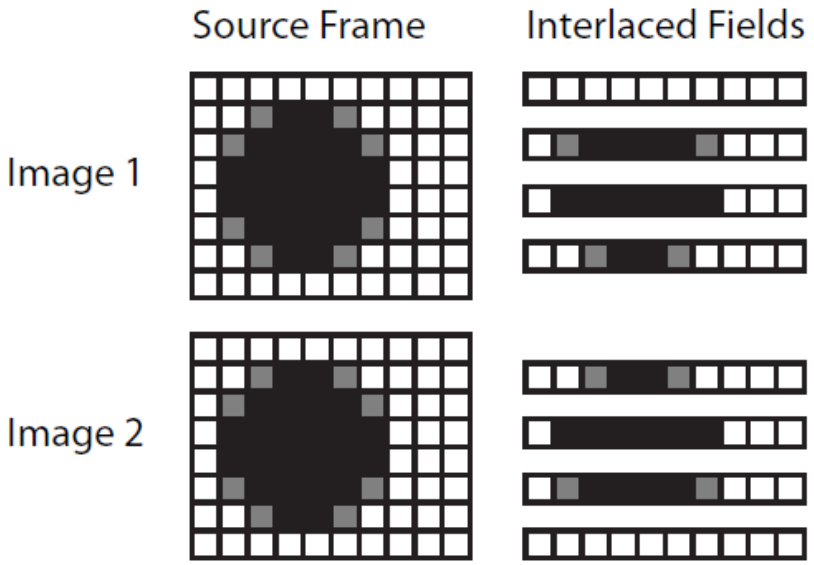
  Doubles temporal resolution

  Halves spatial resolution





Interlaced v. Progressive Scan



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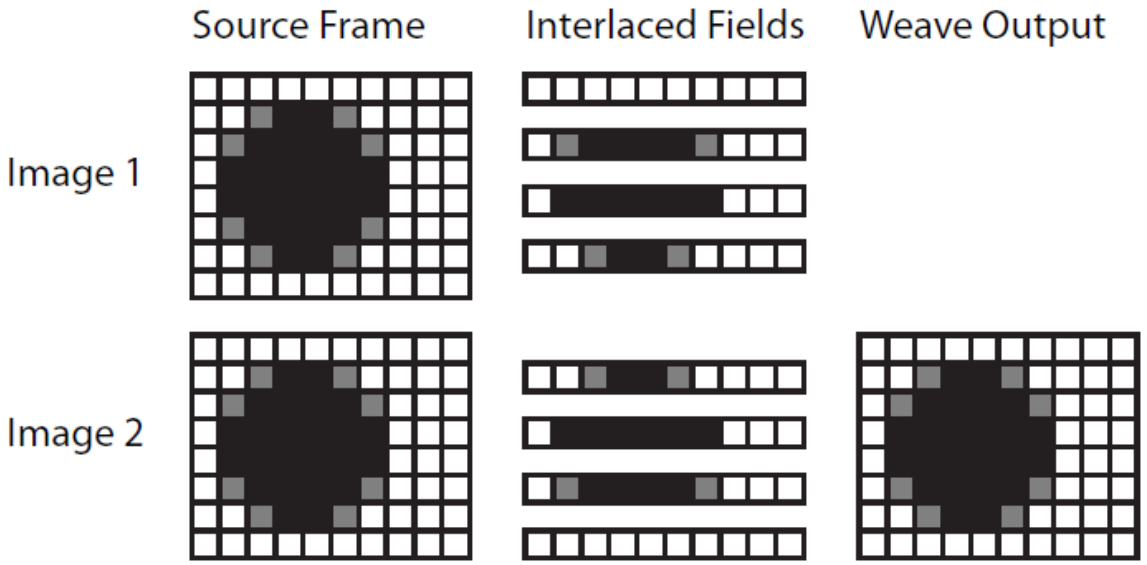

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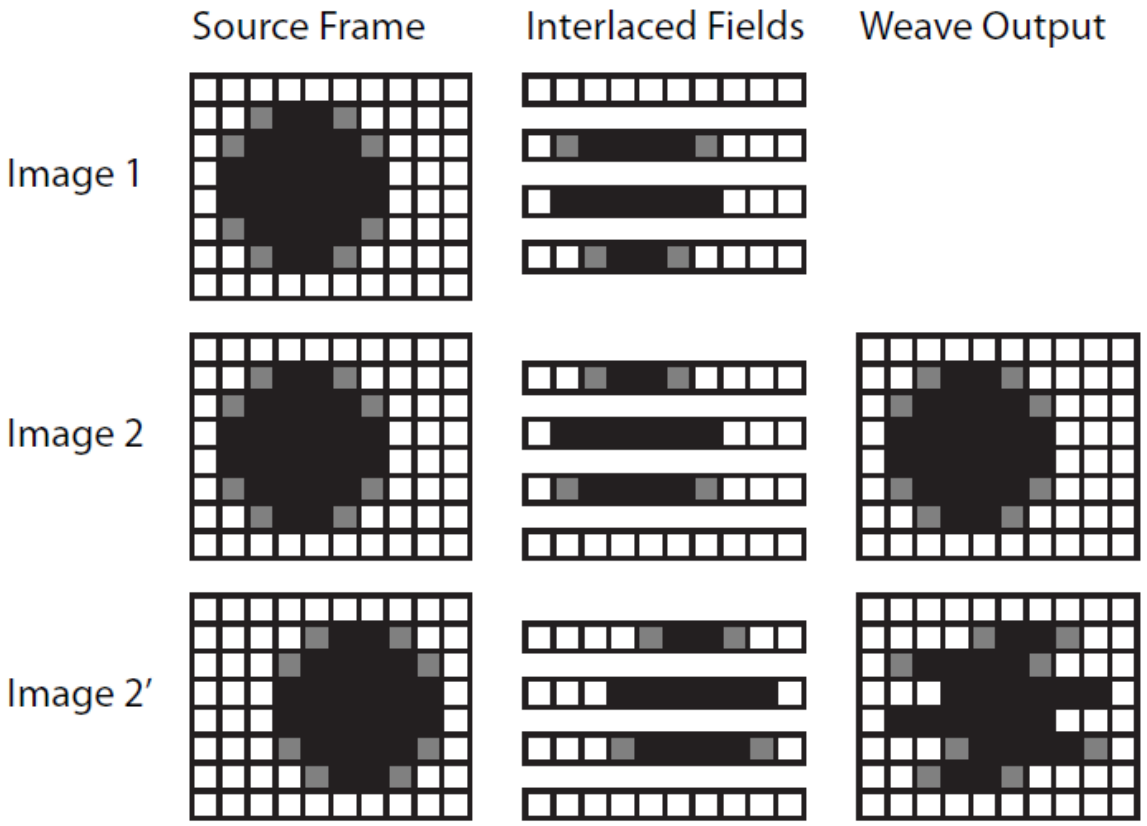


Interlaced v. Progressive Scan

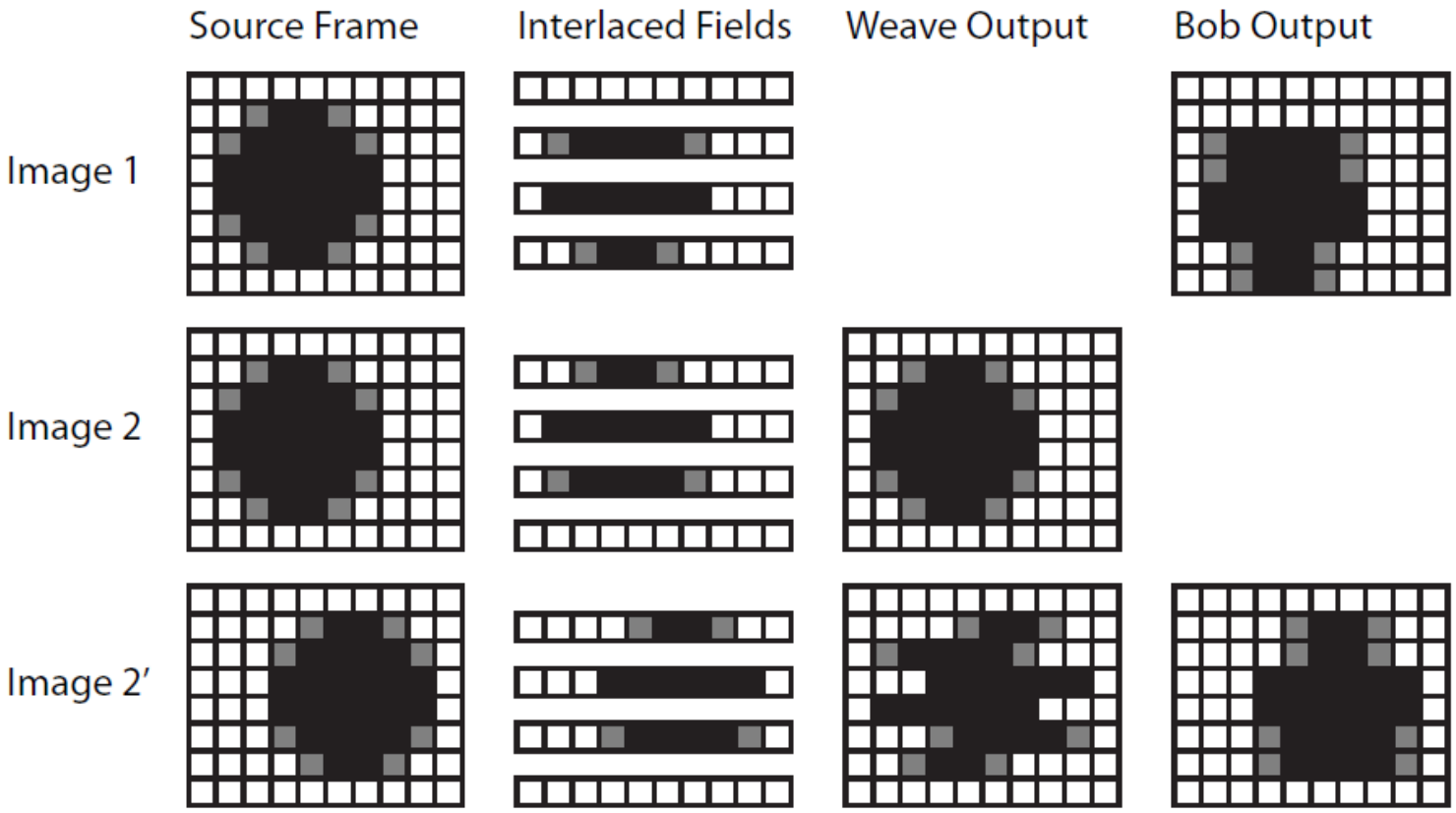
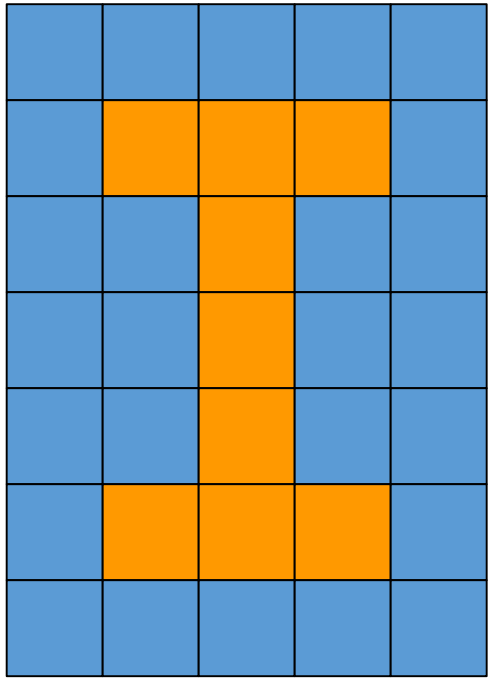


Image File Formats

Format	Fidelity	Complexity	Use
BMP	Uncompressed	**Simple**, Microsoft	Easy to process, windows icons
PPM	Uncompressed	**Simple**, open, dated	Easy to process, unix icons
GIF	Compressed Lossless (LZW)	**Only 256 colors**	Charts, graphs, diagrams, text
JPG (Exif)	Compressed **Lossy** (DCT)	Blocky, edges ring	Photographs
TIFF	Compressed Lossless (LZW)	**Flexible** but complex structure	Fax, scanning, artwork
PNG	Compressed Lossless (zlib)	**Flexible** but complex structure	Distributing images
SVG	Uncompressed	Flexible	**Vector/Line Art**

Color Palettes

- Store all RGB colors used in any image pixel in a table
- Store index to color in each pixel to compress data size



=

97 97 217	97 97 217	97 97 217	97 97 217	97 97 217
97 97 217	255 153 0	255 153 0	255 153 0	97 97 217
97 97 217	97 97 217	255 153 0	97 97 217	97 97 217
97 97 217	97 97 217	255 153 0	97 97 217	97 97 217
97 97 217	97 97 217	255 153 0	97 97 217	97 97 217
97 97 217	255 153 0	255 153 0	255 153 0	97 97 217
97 97 217	97 97 217	97 97 217	97 97 217	97 97 217

or

0	0	0	0	0
0	1	1	1	0
0	0	1	0	0
0	0	1	0	0
0	0	1	0	0
0	1	1	1	0
0	0	0	0	0

where:

0=

1=

Reducing Color

- How to convert a full color image into a paletted image
- “Posterize” picks color in the palette closest to full color pixel
- Dithering adds colors by combining palette colors of neighboring pixels

N. Damera-Venkata, B.L. Evans & V. Monga
Color Error Diffusion Halftoning,
IEEE Signal Processing 20(4), 51-58, July 2003.

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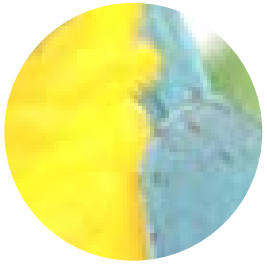

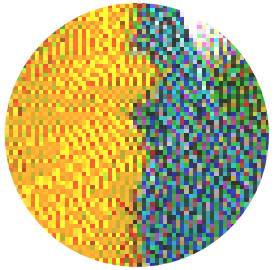

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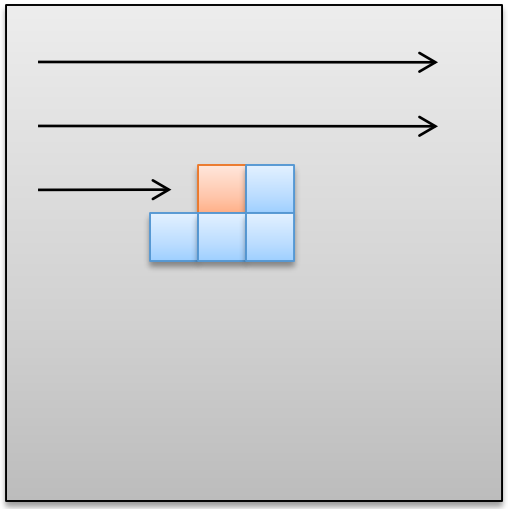
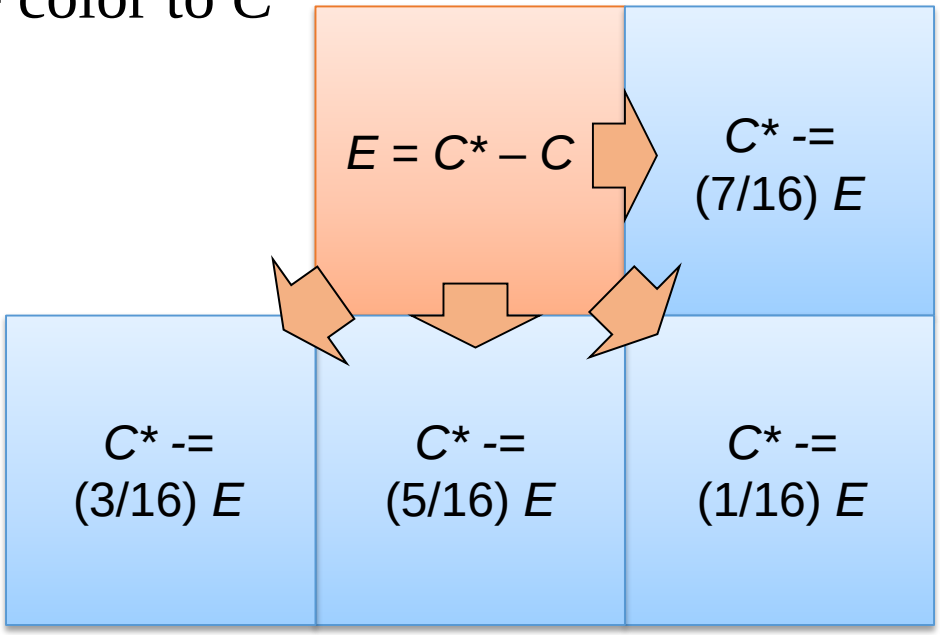
Error Diffusion

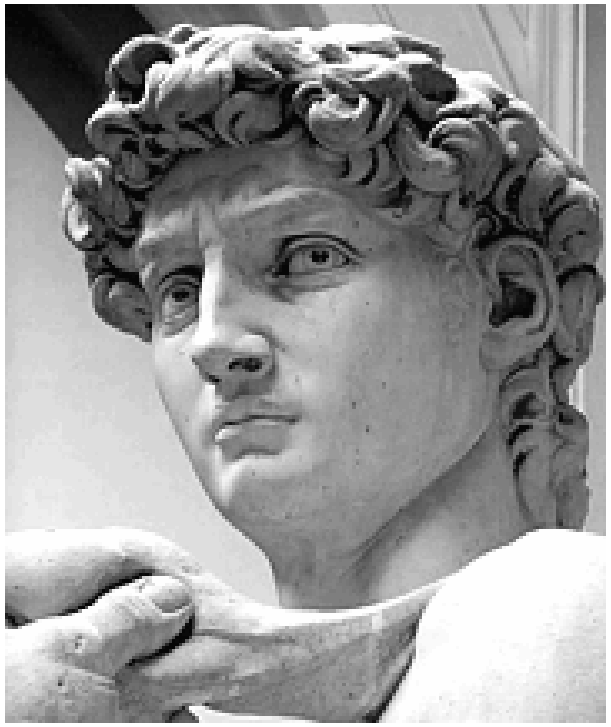


Floyd-Steinberg Algorithm

- Each pixel color $C(x,y)$ has an approximation $C^*(x,y)$
- Initialize $C^*(x,y) = \text{approx}(C(x,y))$ for all pixels
  - approx(C) returns closest palette color to C
- Approximation error: $E = C^* - C$
  - positive E: C^* too bright
  - negative E: C^* too dim
- Counteract error by changing brightness of unprocessed neighboring pixels



Dithered Images



Lego Mosaics