Lecture 5 – Image Compression

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Administrative

- HW2 due now
- Quiz #1 – Wednesday, Oct. 14, 2015
  - Plan on 60-75 minutes

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Image Compression Usage / Observation

	JPG	TIF	PNG	GIF	BMP	EPS / SVG
Lossless		✓	✓	? ✓	✓	Vector (vs. raster)

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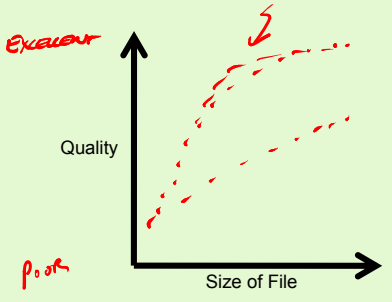
Image exploration

- http://www.cs.pdx.edu/~wuchi/Teaching/410/Image
- Take a look at each set
  - Examine: ONE of {Car, Lion, Hood} and PSU logo
  - Graph



- Is there a knee in the curve?
- When does JPEG / GIF do better?
- When they start to become unacceptable, how does it manifest itself?
- Is one preferred over the other?

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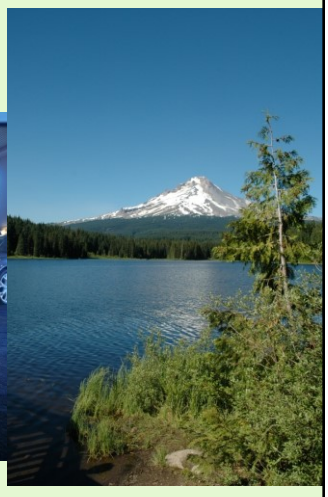
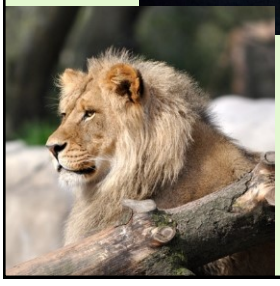
Images





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PPM

- simpler version of TIFF

Portable Pixmap Format

Mostly UNIX/LINUX thing

Netpbm libraries

Cygwin →

16×16

P6\n
16 16\n
255\n

- full color

HEX: FF00DOFF0000 . . .

Color: "PPM"

P6\nXsize Ysize\n 255\n[Xsize*Ysize RGB values]…

Grayscale: "PGM"

P5\nXsize Ysize\n 255\n[Xsize*Ysize gray values]…

1/3 size of RGB

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GIF

"JIF" pronounced

Introduced in late 1980's to compress digital images

8-bit indexed color

supports interlacing + transparent colors

Use LZW compression

Every "pixel" points to an entry that is 24-bits

pixels [0-255][0-255][0-255]

GIF extremely good w/ logos (limited color)

not so good for "real" images

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GIF

- Progressive scan
  - Multiple scans – low detail to high detail
- Animation – EXTENSION
  - Multiple images that are displayed in a row
- Transparent colors
  - Can have backgrounds that are transparent:
    - 

XT
XT
XT
XT
XT

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Reducing Color

GIF requires 256 colors max.

If we have 30000 colors how do we get to 256?

•) Choose colors (subset of 30000)
↑
* may not be exactly in original

•) Dithering - creates an illusion of more colors

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Choose colors to separate color space

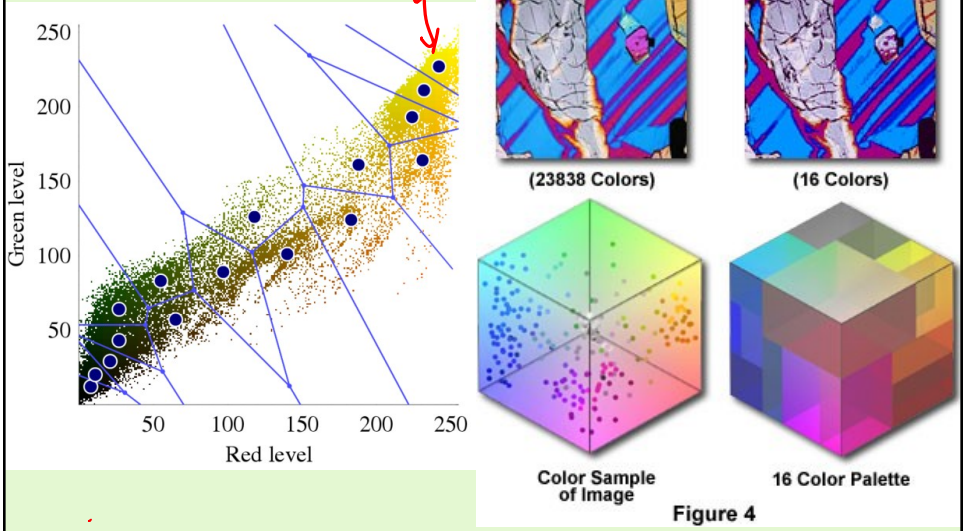

Figure 4

http://en.wikipedia.org/wiki/Color_quantization
http://micro.magnet.fsu.edu/primer/java/digitalimaging/processing/colorreduction/

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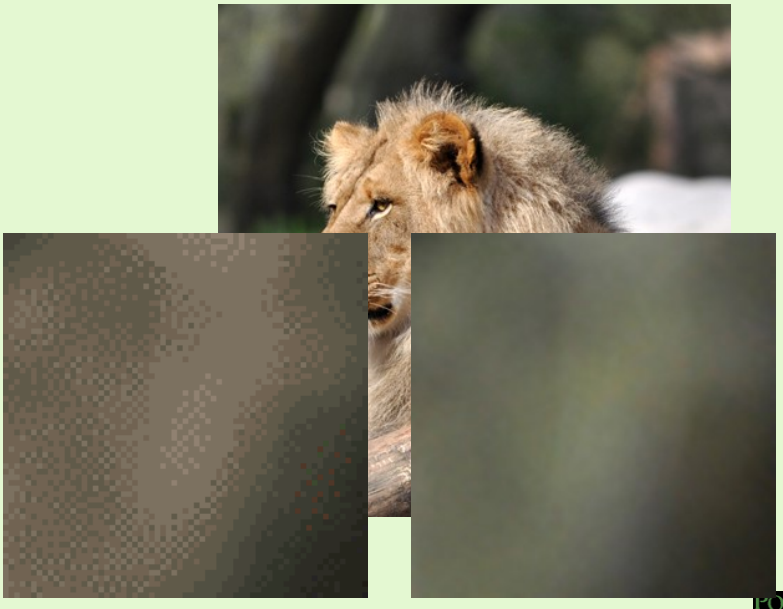

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GIF Format

```
byte#  hexadecimal  text or
(hex)               value       Meaning
0:     47 49 46
       38 39 61     GIF89a      Header
                                Logical Screen Descriptor
6:     03 00        3           - logical screen width in pixels
8:     05 00        5           - logical screen height in pixels
A:     F7                       - GCT follows for 256 colors with
  resolution 3 x 8 bits/primary
B:     00           0           - background color #0
C:     00                       - default pixel aspect ratio
                    R    G    B  Global Color Table
D:     00 00 00     0    0    0   - color #0 black
10:    80 00 00   128    0    0   - color #1
 :                                       :
85:    00 00 00     0    0    0   - color #40 black
 :                                       :
30A:   FF FF FF   255  255  255   - color #255 white
```

actual color of 1

1 1 1 1 1 1
1 2 2 2 1 1

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GIF Format

```
byte#  hexadecimal  text or
(hex)               value       Meaning
…
30D:   21 F9                    Graphic Control Extension
30F:   04           4            - 4 bytes of GCE data follow
310:   01                        - there is a transparent background
  color
311:   00 00                     - delay for animation: not used
313:   10          16            - color #16 is transparent
314:   00                        - end of GCE block
315:   2C                      Image Descriptor
316:   00 00 00 00 (0,0)         - NW corner position of image in logical
  screen
31A:   03 00 05 00 (3,5)         - image width and height in pixels
31E:   00                        - no local color table
31F:   08           8           Start of image - LZW minimum code size
320:   0B          11            - 11 bytes of LZW encoded image data
  follow
321:   00 51 FC 1B 28 70 A0 C1 83 01 01
32C:   00                        - end of image data
32D:   3B                       GIF file terminator
```

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PNG

1996 - grassroots effort to create a better GIF

1995 - dot com

GIF / JPG in HTML

Compuserve / Borroughs / Unisys had patent on GIF

GIF limitation
- 256 colors
- patent problem

PNG - allows 24-bit color (full color)

Can choose reduced color or not

256 GIF ← PNG → full color TIF

Grayscale, RGB, Indexed RGB, alpha channel

RGBa RGBa & transparency

Interlacing (progressive scan)

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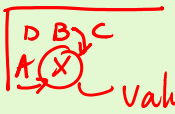
PNG

Compression

Filtering



value to predict

predict X with A, B, or f(a,b)

mean of A+B

Deflate (LZ77)

original lempel-ziv algorithm from 1977

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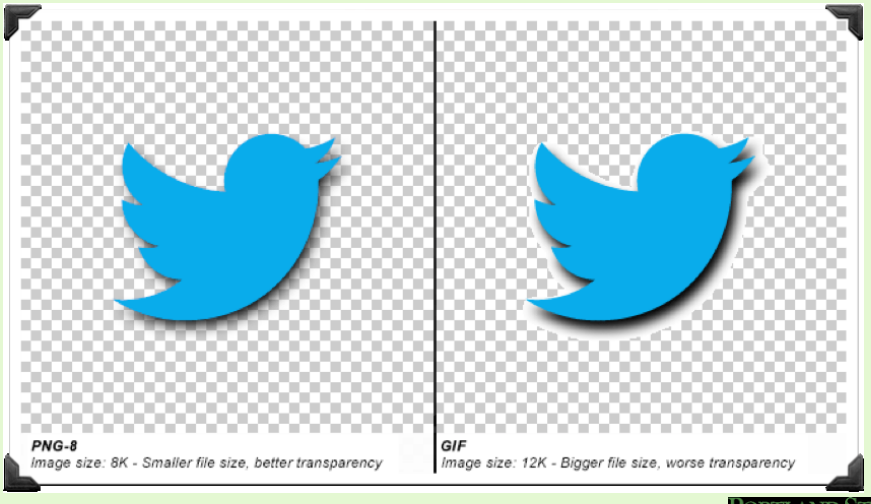
PNG

- Alpha Transparency



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