University of Al-Hamdaniya
Computer Science Department
Digital image processing

Spatial and Color Resolution

Lec-3

By

Dr. Omar F. Mohammad

Spatial Resolution

- High sampling rate
  - High quality digital image. Round curves appear smooth and has high zoom in details.
  - High storage capacity. Triple in size in case of color images
- Low sampling rate
  - Low quality image. Round curves appear jagged and visually unacceptable if zoom in.
  - Low storage requirement.

Spatial Resolution

1024 x 1024

512

256

128

64

32

Spatial Resolution

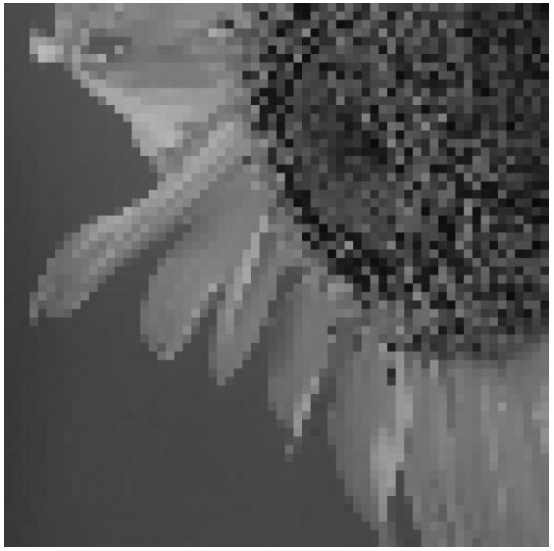
- Effect of sub-sampling – reduce details
- To give a better view, a gray-scale image of the flower will be sampled at 6 different spatial resolutions i.e. 512, 256, 128, 64, 32, and 16.
- The results are then displayed at a common size among each other.

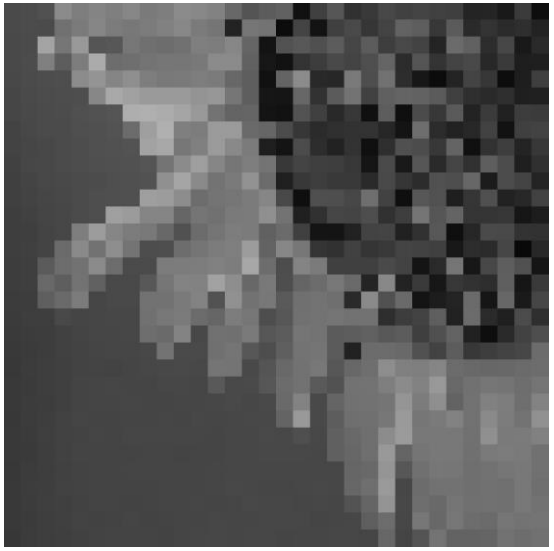
Spatial Resolution

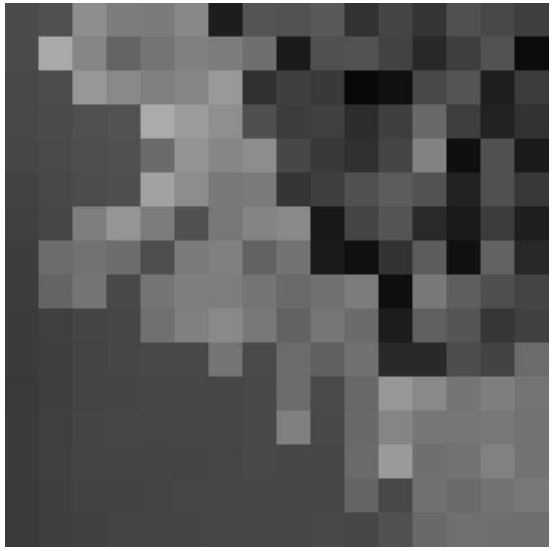

512


256


128


64


32


16

Color Resolution

- Assign number of bits to be used to represent each pixel.
- The higher the bit, the more is the available color.
- For an 8-bit gray-scale, there are 2^8 possible colors i.e. 256 colors ranging from 0 (black) to 255 (white). Other colors show different shades of gray.

Color Resolution

- High color resolution
  - More colors
  - Visually pleasant with distinct details
  - High storage capacity (for color images 3x more)
- Low color resolution
  - Less available colors
  - Noticeable false contours
  - Small storage capacity
  - Useful in speed up computation (binary image)

Color Resolution

16 colors

8 colors

4 colors

2 colors

Sampling & Quantization

- Suppose the image is sampled such that it has *M* rows and *N* columns (*M* x *N* image).
- If *M* = *N* then we have a square image. Normally the ratio is approximately 3:4.
- Suppose the image is quantized into *L* levels where $L = 2^k$, *k* is the number of bits needed to get *L*.
- *L* normally range from 0 to *L* – 1.

Sampling & Quantization

- The total number of bits, *b*, required to store this image would be:

$$b = M \times N \times k$$

- In terms of bytes, this would simply be

$$B = b/8$$

Sampling & Quantization

Size	k – number of bits							
N	1(L=2)	2(L=4)	3(L=8)	4(L=16)	5(L=32)	6(L=64)	7(L=128)	8(L=256)
32	1,024	2,048	3,072	4,096	5,120	6,144	7,168	8,192
64	4,096	8,192	12,288	16,384	20,480	24,576	28,672	32,768
128	16,384	32,768	49,152	65,536	81,920	98,304	114,688	131,072
256	65,536	131,072	196,608	262,144	327,680	393,216	458,752	524,288
512	262,144	524,288	786,432	1,048,576	1,310,720	1,572,864	1,835,008	2,097,152
1024	1,048,576	2,097,152	3,145,728	4,194,304	5,242,880	6,291,456	7,340,032	8,388,608
2048	4,194,304	8,388,608	12,582,912	16,777,216	20,971,520	25,165,824	29,369,128	33,554,432
4096	16,777,216	33,554,432	50,331,648	67,108,864	83,886,080	100,663,296	117,440,512	134,217,728
8192	67,108,864	134,217,728	201,326,592	268,435,456	335,544,320	402,653,184	469,762,048	536,870,912

Sampling & Quantization

- The table shows for gray scale images.
- Normally gray scale image used k = 8 bits. Hence 256 available colors.
- For color images, k = 24 bits (8 bit for Red, 8 bits for Green, and 8 bits for Blue). Thus total available colors is approximately 16.7 million colors(true colors).

Image File Formats

1. JPEG (or JPG) - Joint Photographic Experts Group
2. PNG - Portable Network Graphics
3. GIF - Graphics Interchange Format
4. TIFF - Tagged Image File
5. PSD - Photoshop Document
6. PDF - Portable Document Format
7. EPS - Encapsulated Postscript
8. AI - Adobe Illustrator Document
9. INDD - Adobe InDesign Document
10. RAW - Raw Image Formats

End Of Lecture