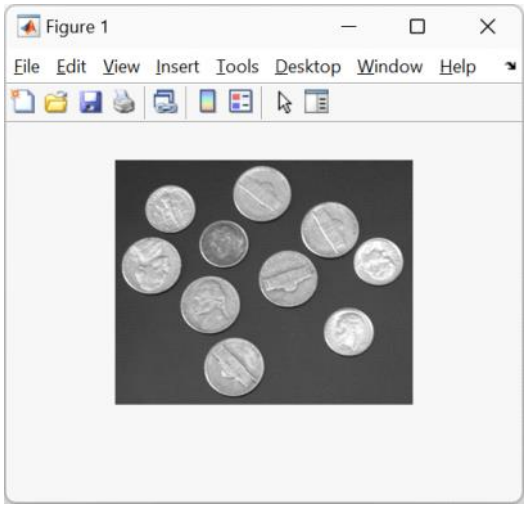
Lecture 5

(Cont'd) Save the raw image as a ('clean' -- no image file header) binary file using fwrite, fread, fopen, fclose functions.

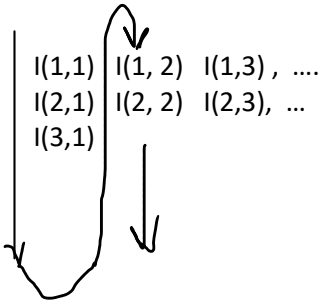
- Read in the binary file and convert 1D to the 2D image:

```
>> fileid = fopen('coins.bin', 'r');
>> I_rec = fread(fileid, 'uint8');
>> whos I_rec
  Name         Size          Bytes  Class     Attributes

  I_rec      73800x1          590400  double

>> I_2d = reshape(I_rec, 246, 300);
>> I_2d_uint8 = uint8(I_2d);
>> imshow(I_2d_uint8)
>> isequal(I, I_2d_uint8)
ans =
  logical
   1
```




```
>> A = 1: 10

A =

    1    2    3    4    5    6    7    8    9   10

>> B = reshape(A, 2, 5)

B =

    1    3    5    7    9
    2    4    6    8   10
```

Column-wise scan



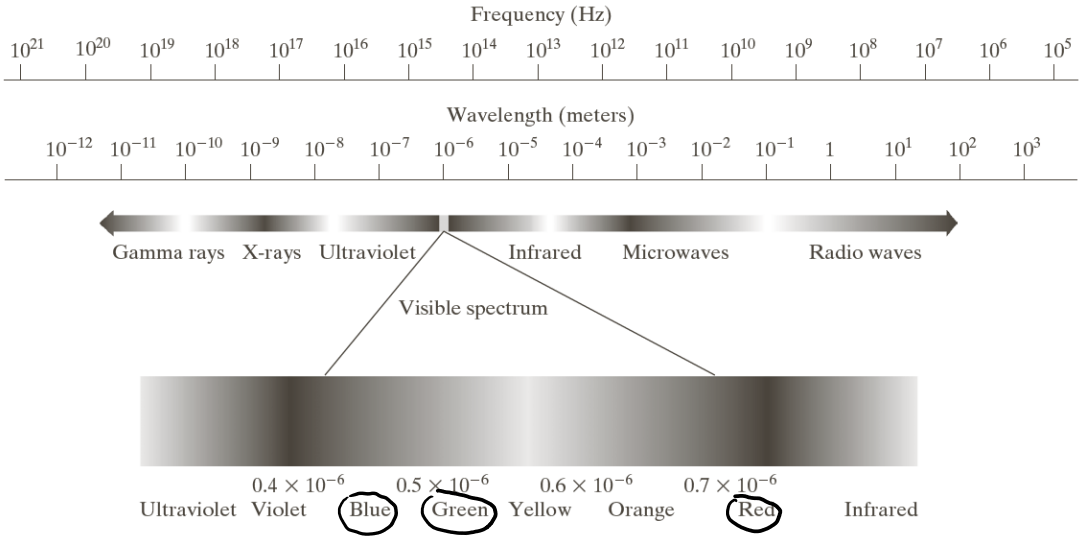
Introduction:

http://www.ece.uah.edu/~dwpan/course/ee604/slides/Introduction.pdf

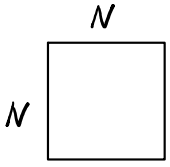
Fundamentals:
http://www.ece.uah.edu/~dwpan/course/ee604/slides/Fundamentals.pdf

Wavelength(λ), Frequency(ν), Energy(E)

$$\lambda = \frac{c}{\nu} \qquad c = 2.988 \times 10^8\ m/s$$



$L = 2^k$, where k: bits/pixel (Intensity Resolution)



N^2 pixels

$(N^2 \times L)$ – bits/image

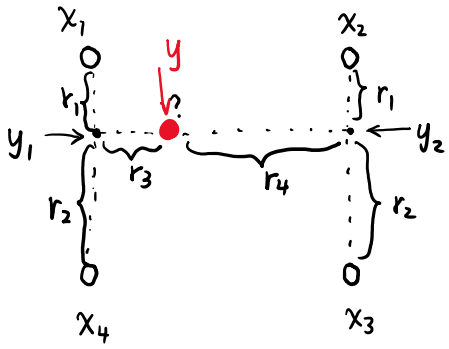
TABLE 2.1
Number of storage bits for various values of N and k.

N (Spatial Resolution) ↓ , k →

N/k	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

Image Interpolation (to increase the spatial resolution:

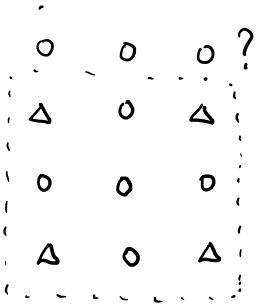
Use the four nearest neighbors to estimate the intensity at a given location:



$$y_1 = x_1 \cdot \frac{r_2}{r_1 + r_2} + x_4 \cdot \frac{r_1}{r_1 + r_2}$$

$$y_2 = x_2 \cdot \frac{r_2}{r_1 + r_2} + x_3 \cdot \frac{r_1}{r_1 + r_2}$$

$$y = y_1 \cdot \frac{r_4}{r_3 + r_4} + y_2 \cdot \frac{r_3}{r_3 + r_4}$$



? Boundary Extension ?

Original Image : 4 x 4 Δ : pixels

Three Types of Adjacency

4-adjacency
–Two pixels p and q with values from V are 4-adjacent if q is in the set $N4(p)$.

•8-adjacency
–Two pixels p and q with values from V are 8-adjacent if q is in the set $N8(p)$.

•m-adjacency (mixed adjacency).