

Format

教授：連震杰

助教：

機器人實驗室

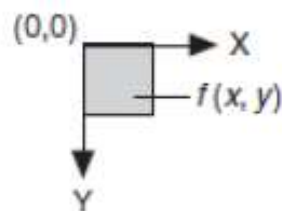
1.0 影像檔格式(Image Format) (1/3)

影像是以二維陣列來表示影像的光影強度大小。影像光強度方程式為

$$f(x, y) = I(x, y)$$

Intensity = grayvalue

x, y 分別代表二維陣列的行(column)與列(row)。



影像光強度方程式

Pixel: Picture element
Voxel: Volume element
Dexel: Depth element

數位影像處理式利用感測器，將影像轉換成離散的像素(pixels)，就是 $f(x, y)$ 所代表影像感測器(sensor)陣列的一個圖素(pixel)的強度。

1.0 影像檔格式(Image Format) (2/3)

影像與資料型態列表

影像資料型態	單位 pixel 的 byte 數
1 bit , Line art	1/8 byte per pixel
1/8 byte per pixel	1/8 byte per pixel
8 bit , Grayscale 8 bits = 0~255	1 bytes per pixel
24 bit , RGB	3 bytes per pixel
32 Bit , CMYK	4 bytes per pixel
48 bit , RGB	6 bytes per pixel

CMYK:

C (Cyan) 青色 、 M (Magenta) 洋紅色 、 Y (Yellow) 黃色 、 K (Black) 黑色

1.0 影像檔格式(Image Format) (3/3)

影像檔格式	優點	缺點
1. BMP (Windows Bitmap)	專門用在Windows作業系統， 支援RGB全彩	無法壓縮 全彩影像，不適用於網路
2. GIF	網頁上最常用，可製作透明圖，交錯圖，動畫，提供 非破壞性壓縮(Lossless Compression) ，適用遠距傳遞，網頁設計	最多只能存256色 (8 bit, gray value??)
3. JPG/JPEG	高壓縮率 支援RGB全彩，灰階影像	破壞性壓縮， 易失真 不支援16色、256色、黑白圖
4. PNG (Portable Network Graphic)	非破壞性壓縮，結合GIF優點，JPEG 支援RGB全彩	無法儲存動畫
5. TGA	非破壞性壓縮，支援24位元(RGB)全彩、32位元全彩，用於影像合成，視訊合成，3D動畫製作的影像合成	需藉由專業影像處理軟體解讀
6. TIF (Tagged Image File Format)	跨平台， 非破壞性壓縮 ，支援RGB全彩、16色、256色、灰階、黑白影像	無
7. PCD	洗相片	柯達公司制定的相片光碟格式

1.1 點陣資料格式與取樣 (Raster Image and Sampling)

Raster Image (網格圖檔):

- 由掃描機、影像光碟、數位元元像機等設備或影像編輯軟體所產生之圖檔，為印前組頁檔案格式之一種。
- 其內容可分為灰階及彩色光點兩種，影像色彩輸出較真實；惟放大後會產生鋸齒狀現象。

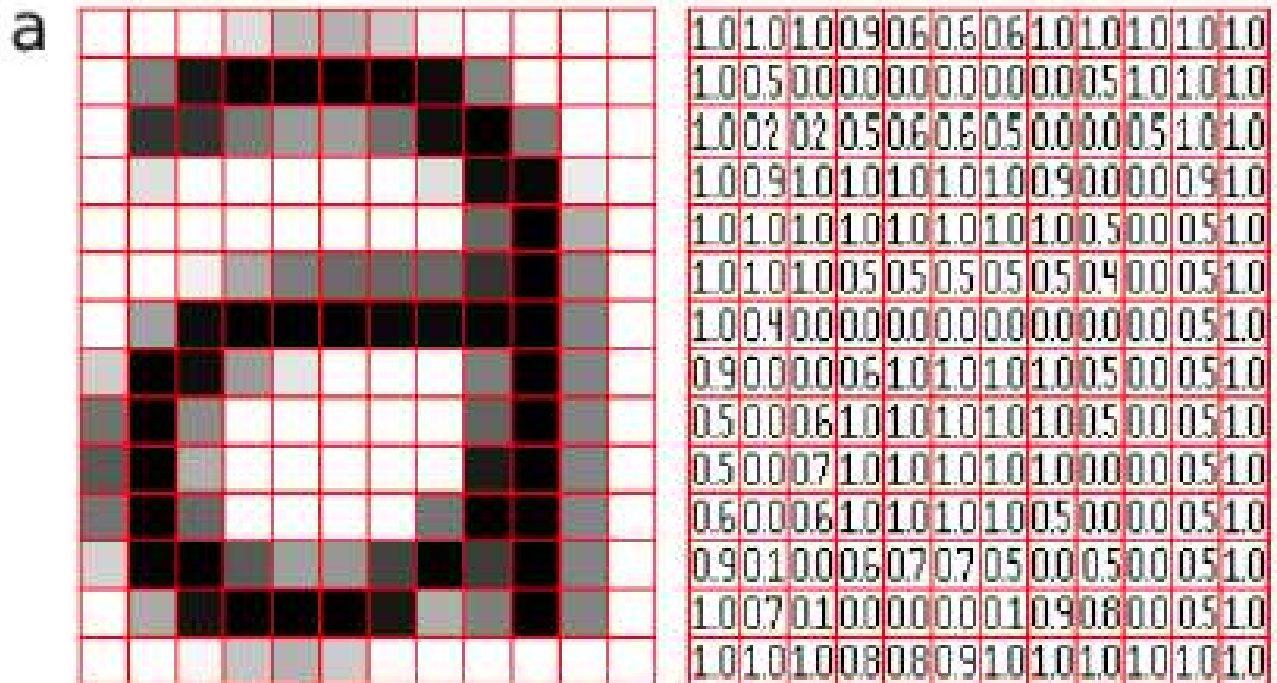
Raster Graphics (點陣圖形):

- 與位元影像圖形相同，是利用小點距來顯示出影象圖形，當點距越小，代表它的品質越高。

Gray value:

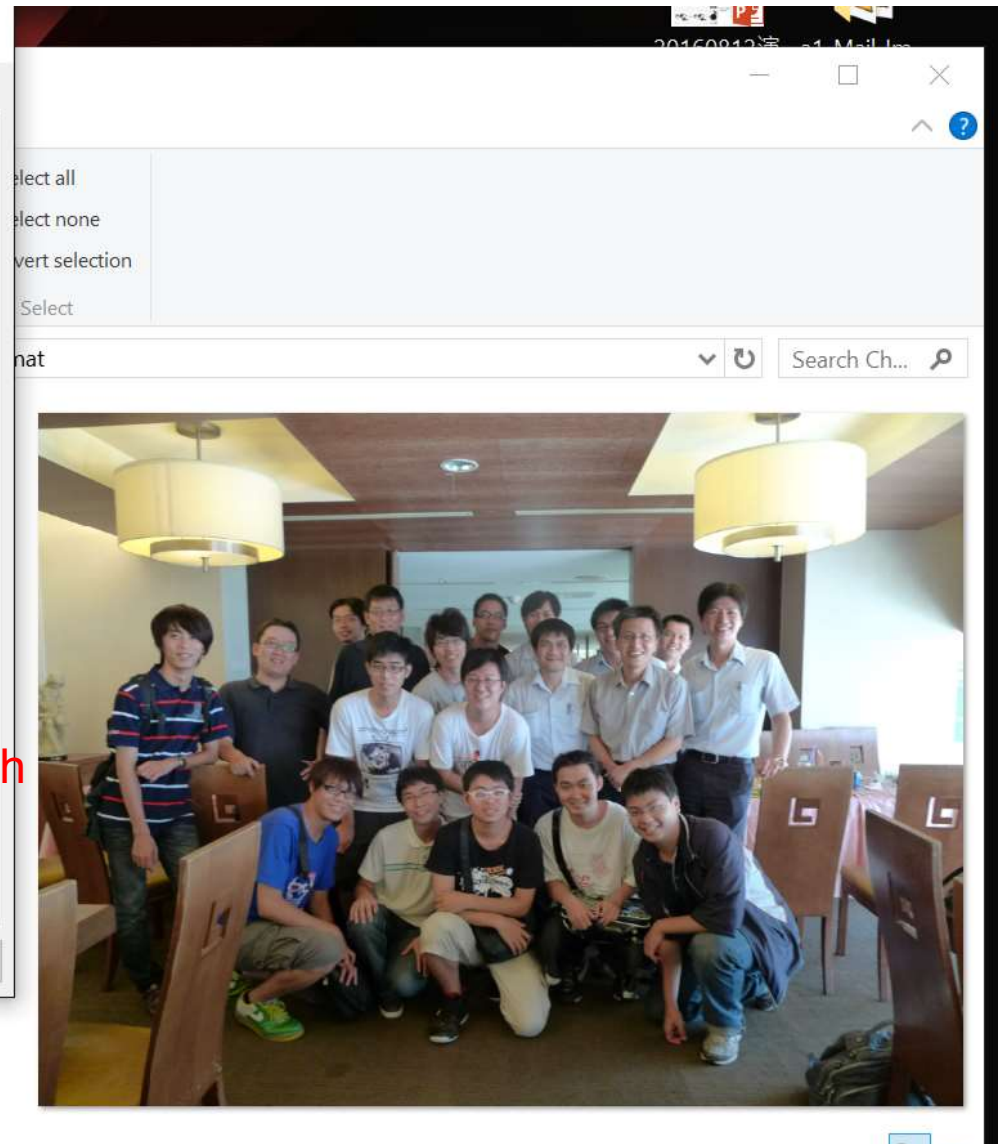
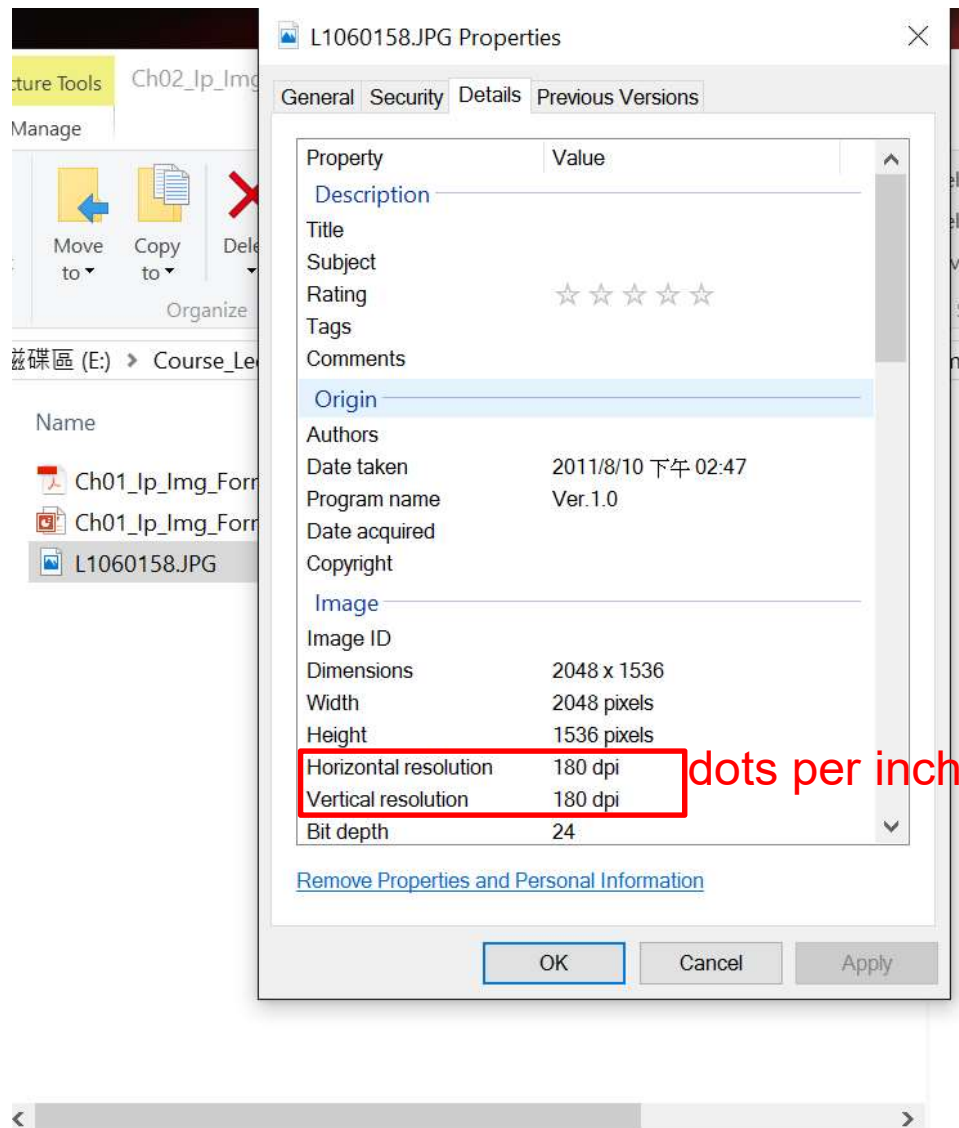
1.0 = 255 white,

0.0 = 0 black



記憶體影像光強度

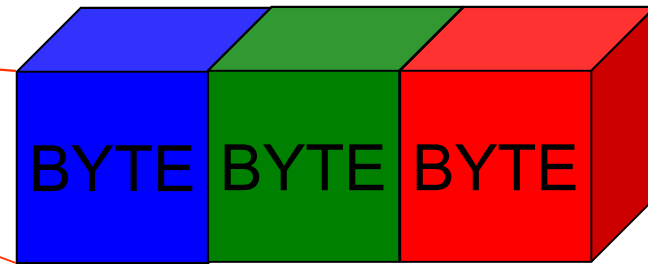
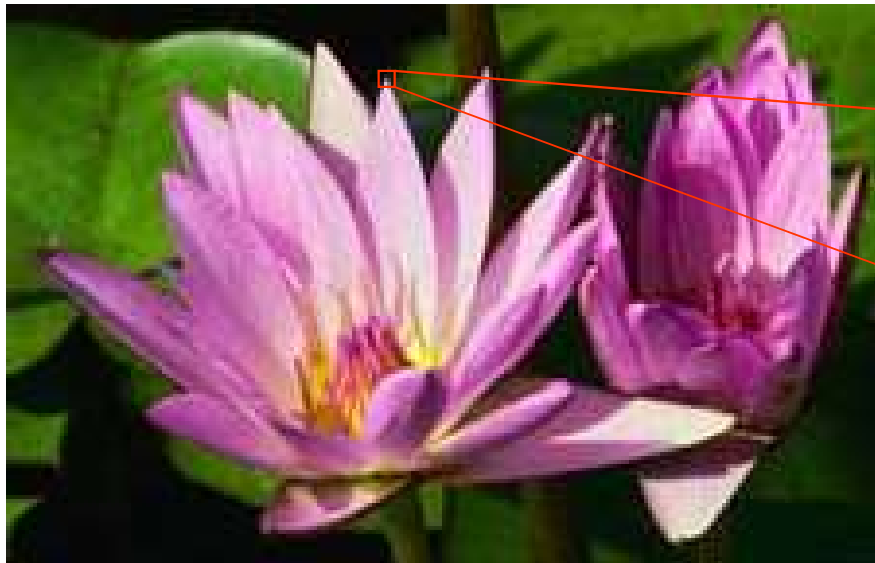
1.1 Image Property



2.0 What is BMP?

- The structure of BMP file was defined by Microsoft (BMP = Bitmap)
- Including **black-and-white** (1-bit per pixel), **gray value** (2 , 4 or 8 bits), **colorful** ($8*3=24$ or $8*4=32$ bits).
- Gray and black-and-white types have **palette**.
- We only deal with 24-bits BMP.

2.0 24-bit BMP file



1 BYTE=8 bits
=> 0 ~255



➤ Check ppt file color map

2.0 BMP file

ASCII Code

```
00000000h: 42 4D B6 49 03 00 00 00 00 00 36 04 00 00 28 00 ; BM貂.....6...(.
00000010h: 00 00 15 02 00 00 90 01 00 00 01 00 08 00 00 00 ; .....?.....
00000020h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 ; .....
00000030h: 00 00 00 01 00 00 00 00 00 00 01 01 01 00 02 02 ; .....
00000040h: 02 00 03 03 03 00 04 04 04 00 05 05 05 00 06 06 ; .....
00000050h: 06 00 07 07 07 00 08 08 08 00 09 09 09 00 0A 0A ; .....
00000060h: 0A 00 0B 0B 0B 00 0C 0C 0C 00 0D 0D 0D 00 0E 0E ; .....
00000070h: 0E 00 0F 0F 0F 00 10 10 10 00 11 11 11 00 12 12 ; .....
00000080h: 12 00 13 13 13 00 14 14 14 00 15 15 15 00 16 16 ; .....
00000090h: 16 00 17 17 17 00 18 18 18 00 19 19 19 00 1A 1A ; .....
000000a0h: 1A 00 1B 1B 1B 00 1C 1C 1C 00 1D 1D 1D 00 1E 1E ; .....
000000b0h: 1E 00 1F 1F 1F 00 20 20 20 00 21 21 21 00 22 22 ; ..... .!!!!."
000000c0h: 22 00 23 23 23 00 24 24 24 00 25 25 25 00 26 26 ; ".###.$$.%&
000000d0h: 26 00 27 27 27 00 28 28 28 00 29 29 29 00 2A 2A ; &.''.(((.)).*
000000e0h: 2A 00 2B 2B 2B 00 2C 2C 2C 00 2D 2D 2D 00 2E 2E ; *.+++.,,.-...
000000f0h: 2E 00 2F 2F 2F 00 30 30 30 00 31 31 31 00 32 32 ; ..///.000.111.22
00000100h: 32 00 33 33 33 00 34 34 34 00 35 35 35 00 36 36 ; 2.333.444.555.66
00000110h: 36 00 37 37 37 00 38 38 38 00 39 39 39 00 3A 3A ; 6.777.888.999.:
00000120h: 3A 00 3B 3B 3B 00 3C 3C 3C 00 3D 3D 3D 00 3E 3E ; :.;;.<<<==.>
00000130h: 3E 00 3F 3F 3F 00 40 40 40 00 41 41 41 00 42 42 ; >.???.@@.AAA.BB
00000140h: 42 00 43 43 43 00 44 44 44 00 45 45 45 00 46 46 ; B.CCC.DDD.EEE.FF
00000150h: 46 00 47 47 47 00 48 48 48 00 49 49 49 00 4A 4A ; F.GGG.HHH.III.JJ
00000160h: 4A 00 4B 4B 4B 00 4C 4C 4C 00 4D 4D 4D 00 4E 4E ; J.KKK.LLL.MMM.NN
00000170h: 4E 00 4F 4F 4F 00 50 50 50 00 51 51 51 00 52 52 ; N.OOO.PPP.QQQ.RR
00000180h: 52 00 53 53 53 00 54 54 54 00 55 55 55 00 56 56 ; R.SSS.TTT.UUU.VV
```

1) BITMAPFILEHEADER (Bit Map File Header), 14 Bytes

2) BITMAPINFOHEADER (Bit Map Info Header), 40 Bytes

3) RGBQUAD (RGB Quad, **palette**), 256*(3+1) Bytes

2.0 What's in a BMP file?

- 1) BITMAPFILEHEADER (Bit Map File Header) //14 bytes
- 2) BITMAPINFOHEADER (Bit Map Info Header) //40 bytes
- 3) **RGBQUAD * 2^N** (RGB Quad) // exp. **$N=8$: $256*(3+1)$ bytes**
(in our case)
- 4) Image Data Array

N (*bits*): How many bits stand for a pixel (black-and-white (1-bit per pixel), gray value (2 , 4 or 8 bits)).

2.1 BITMAPFILEHEADER (1/2)

```
MadEdit - [C:\Documents and Settings\Roy123\桌面\CppTA\Hw2\ex2.bmp]
檔案(F) 編輯(E) 尋找(S) 檢視(V) 工具(T) 視窗(W) 說明(H)
ex2.bmp
Offset 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F | 0123456789ABCDEF
00000000: 42 4D 16 1A 01 00 00 00 00 00 36 04 00 00 28 00 | BM.....6...[.
00000010: 00 00 20 01 00 00 F7 00 00 00 01 00 08 00 00 00 | .....+.....
00000020: 00 00 E0 15 01 00 C4 0E 00 00 C4 0E 00 00 01 01 | ..à...Ä...Ä....
00000030: 00 00 00 00 00 00 00 00 00 00 01 01 01 00 02 02 | .....
00000040: 02 00 03 03 03 00 04 04 04 00 05 05 05 00 06 06 | .....
00000050: 06 00 07 07 07 00 08 08 08 00 09 09 09 00 0A 0A | .....
00000060: 0A 00 0B 0B 0B 00 0C 0C 0C 00 0D 0D 0D 00 0E 0E | .....
00000070: 0E 00 0F 0F 0F 00 10 10 10 00 11 11 11 00 12 12 | .....
00000080: 12 00 13 13 13 00 14 14 14 00 15 15 15 00 16 16 | .....
00000090: 16 00 17 17 17 00 18 18 18 00 19 19 19 00 1A 1A | .....
000000A0: 1A 00 1B 1B 1B 00 1C 1C 1C 00 1D 1D 1D 00 1E 1E | .....
000000B0: 1E 00 1F 1F 1F 00 20 20 20 00 21 21 21 00 22 22 | .....!..""
000000C0: 22 00 23 23 23 00 24 24 24 00 25 25 25 00 26 26 | ".###.$$$.%%.&&
000000D0: 26 00 27 27 27 00 28 28 28 00 29 29 29 00 2A 2A | &.''.(((.)).**
000000E0: 2A 00 2B 2B 2B 00 2C 2C 2C 00 2D 2D 2D 00 2E 2E | *.+++.,,.,---...
000000F0: 2E 00 2F 2F 2F 00 30 30 30 00 31 31 31 00 32 32 | ..///.000.111.22
00000100: 32 00 33 33 33 00 34 34 34 00 35 35 35 00 36 36 | 2.333.444.555.66
00000110: 36 00 37 37 37 00 38 38 38 00 39 39 39 00 3A 3A | 6.777.888.999.:
00000120: 3A 00 3B 3B 3B 00 3C 3C 3C 00 3D 3D 3D 00 3E 3E | :.;;.<<<==.>>
00000130: 3E 00 3F 3F 3F 00 40 40 40 00 41 41 41 00 42 42 | >.???.@@@.AAA.BB
00000140: 42 00 43 43 43 00 44 44 44 00 45 45 45 00 46 46 | B.CCC.DDD.EEE.FF
00000150: 46 00 47 47 47 00 48 48 48 00 49 49 49 00 4A 4A | F.GGG.HHH.III.JJ
00000160: 4A 00 4B 4B 4B 00 4C 4C 4C 00 4D 4D 4D 00 4E 4E | J.KKK.LLL.MMM.NN
00000170: 4E 00 4F 4F 4F 00 50 50 50 00 51 51 51 00 52 52 | N.OOO.PPP.QQQ.RR
00000180: 52 00 53 53 53 00 54 54 54 00 55 55 55 00 56 56 | R.SSS.TTT.UUU.VV
00000190: 56 00 57 57 57 00 58 58 58 00 59 59 59 00 5A 5A | V.WWW.XXX.YYY.ZZ
000001A0: 5A 00 5B 5B 5B 00 5C 5C 5C 00 5D 5D 5D 00 5E 5E | Z.[[[.\]].^^
000001B0: 5E 00 5F 5F 5F 00 60 60 60 00 61 61 61 00 62 62 | ^._.```.aaa.bb
000001C0: 62 00 63 63 63 00 64 64 64 00 65 65 65 00 66 66 | b.ccc.ddd.eee.ff
000001D0: 66 00 67 67 67 00 68 68 68 00 69 69 69 00 6A 6A | f.ggg.hhh.iii.jj
000001E0: 6A 00 6B 6B 6B 00 6C 6C 6C 00 6D 6D 6D 00 6E 6E | j.kkk.lll.mmm.nn
000001F0: 6E 00 6F 6F 6F 00 70 70 70 00 71 71 71 00 72 72 | n.ooo.ppp.qqq.rr
00000200: 72 00 73 73 73 00 74 74 74 00 75 75 75 00 76 76 | r.sss.ttt.uuu.vv
Ln:1 of 1 (Sub:0) Col:14 FilePos:14 of 72,214 SelSize:14 OVR
```

2.1 BITMAPFILEHEADER (2/2)

```
typedef struct tagBITMAPFILEHEADER {  
    WORD bfType;           //(2bytes)    // (14bytes)  
                             //          File type, in BMP  
                             //          case, it'll be  
                             //          'BM'(0x424D)  
    DWORD bfSize;          //(4bytes)    BMP file size  
    WORD bfReserved1;       //(2bytes)    Always 0  
    WORD bfReserved2;       //(2bytes)    Always 0  
    DWORD bfOffbytes;       //(4bytes)    Size of  
                             //          Headers (14+40  
                             //          bytes) + Palette,  
                             //          14+40 in our case  
} BITMAPFILEHEADER;
```

2.2 BITMAPINFOHEADER (1/2)

```
MadEdit - [C:\Documents and Settings\Roy123\桌面\CppTA\Hw2\ex2.bmp]
檔案(F) 編輯(E) 尋找(S) 檢視(V) 工具(T) 視窗(W) 說明(H)

ex2.bmp
Offset 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F | 0123456789ABCDEF
00000000: 42 4D 16 1A 01 00 00 00 00 00 36 04 00 00 28 00 | BM.....6...(.
00000010: 00 00 20 01 00 00 F7 00 00 00 01 00 08 00 00 00 | .....÷.....
00000020: 00 00 E0 15 01 00 C4 0E 00 00 C4 0E 00 00 00 01 | ..à...Ä...Ä....
00000030: 00 00 00 00 00 00 00 00 01 01 01 01 01 02 02 | .....
00000040: 02 00 03 03 03 00 04 04 04 00 05 05 05 00 06 06 | .....
00000050: 06 00 07 07 07 00 08 08 08 00 09 09 09 00 0A 0A | .....
00000060: 0A 00 0B 0B 0B 00 0C 0C 0C 00 0D 0D 0D 00 0E 0E | .....
00000070: 0E 00 0F 0F 0F 00 10 10 10 00 11 11 11 00 12 12 | .....
00000080: 12 00 13 13 13 00 14 14 14 00 15 15 15 00 16 16 | .....
00000090: 16 00 17 17 17 00 18 18 18 00 19 19 19 00 1A 1A | .....
000000A0: 1A 00 1B 1B 1B 00 1C 1C 1C 00 1D 1D 1D 00 1E 1E | .....
000000B0: 1E 00 1F 1F 1F 00 20 20 20 00 21 21 21 00 22 22 | .....! ! ! . " "
000000C0: 22 00 23 23 23 00 24 24 24 00 25 25 25 00 26 26 | ".###.$$$.%%.&&
000000D0: 26 00 27 27 27 00 28 28 28 00 29 29 29 00 2A 2A | &.''.(((.)).**
000000E0: 2A 00 2B 2B 2B 00 2C 2C 2C 00 2D 2D 2D 00 2E 2E | *.+++.,,.,---...
000000F0: 2E 00 2F 2F 2F 00 30 30 30 00 31 31 31 00 32 32 | ..///.000.111.22
00000100: 32 00 33 33 33 00 34 34 34 00 35 35 35 00 36 36 | 2.333.444.555.66
00000110: 36 00 37 37 37 00 38 38 38 00 39 39 39 00 3A 3A | 6.777.888.999.:
00000120: 3A 00 3B 3B 3B 00 3C 3C 3C 00 3D 3D 3D 00 3E 3E | :.;;.<<<==.>>
00000130: 3E 00 3F 3F 3F 00 40 40 40 00 41 41 41 00 42 42 | >.???.@#@.AAA.BB
00000140: 42 00 43 43 43 00 44 44 44 00 45 45 45 00 46 46 | B.CCC.DDD.EEE.FF
00000150: 46 00 47 47 47 00 48 48 48 00 49 49 49 00 4A 4A | F.GGG.HHH.III.JJ
00000160: 4A 00 4B 4B 4B 00 4C 4C 4C 00 4D 4D 4D 00 4E 4E | J.KKK.LLL.MMM.NN
00000170: 4E 00 4F 4F 4F 00 50 50 50 00 51 51 51 00 52 52 | N.OOO.PPP.QQQ.RR
00000180: 52 00 53 53 53 00 54 54 54 00 55 55 55 00 56 56 | R.SSS.TTT.UUU.VV
00000190: 56 00 57 57 57 00 58 58 58 00 59 59 59 00 5A 5A | V.WWW.XXX.YYY.ZZ
000001A0: 5A 00 5B 5B 5B 00 5C 5C 5C 00 5D 5D 5D 00 5E 5E | Z.[[.[\.\.]].^^
000001B0: 5E 00 5F 5F 5F 00 60 60 60 00 61 61 61 00 62 62 | ^._.```.aaa.bb
000001C0: 62 00 63 63 63 00 64 64 64 00 65 65 65 00 66 66 | b.ccc.ddd.eee.ff
000001D0: 66 00 67 67 67 00 68 68 68 00 69 69 69 00 6A 6A | f.ggg.hhh.iii.jj
000001E0: 6A 00 6B 6B 6B 00 6C 6C 6C 00 6D 6D 6D 00 6E 6E | j.kkk.lll.mmm.nn
000001F0: 6E 00 6F 6F 6F 00 70 70 70 00 71 71 71 00 72 72 | n.ooo.ppp.qqq.rr
00000200: 72 00 73 73 73 00 74 74 74 00 75 75 75 00 76 76 | r.sss.ttt.uuu.vv
00000210: 76 00 77 77 77 00 78 78 78 00 79 79 79 00 7A 7A | .....
```

Ln:1 of 1 (Sub:0) Col:54 FilePos:54 of 72,214 SelSize:40 OVR

2.2 BITMAPINFOHEADER (2/2)

```
typedef struct tagBITMAPINFOHEADER{           //(40bytes)
    DWORD biSize;           //(4bytes) After Windows 3.X, it's always 40 (x28), which is
                             // the structure size of BITMAPINFOHEADER
    LONG biWidth;           //(4bytes) The width of image
    LONG biHeight;          //(4bytes) The height of image
    WORD biPlanes;          //(2bytes) How many images in this file. For BMP, it's
                             // always 1
    WORD biBitCount;        //(2bytes) How many bits stand for a pixel, 24 in our case
    DWORD biCompression;    //(4bytes) 0 is no compression, 1 is 8-bitRLE
                             // compression, 2 is 4-bitRLE compression.
                             // We only deal with no compression image.
    DWORD biSizeImage;      //(4bytes) The image size after compress. If no compression,
                             // it could be 0 or image size
    LONG biXPelsPerMeter;    //(4bytes) horizontal dots per meter
    LONG biYPelsPerMeter;    //(4bytes) vertical dots per meter
    DWORD biClrUsed;         //(4bytes) How many colors used in palette, 0 for all colors
    DWORD biClrImportant;    //(4bytes) How many colors are important, 0 for all
} BITMAPINFOHEADER;
```

2.3 RGBQUAD (1/2)

```
MadEdit - [C:\Documents and Settings\Roy123\桌面\CppTA\Hw2\ex2.bmp]
檔案(E) 編輯(E) 尋找(S) 檢視(V) 工具(T) 視窗(W) 說明(H)
ex2.bmp
Offset 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F | 0123456789ABCDEF
00000000: 42 4D 16 1A 01 00 00 00 00 00 36 04 00 00 28 00 | BM.....6... (.
00000010: 00 00 20 01 00 00 F7 00 00 00 01 00 08 00 00 00 | .....+.....
00000020: 00 00 E0 15 01 00 C4 0E 00 00 C4 0E 00 00 00 01 | ..à...Ä...Ä....
00000030: 00 00 00 00 00 00 00 00 00 00 01 01 01 00 02 02 | .....[...].
00000040: 02 00 03 03 03 00 04 04 04 00 05 05 05 00 06 06 | .....
00000050: 06 00 07 07 07 00 08 08 08 00 09 09 09 00 0A 0A | .....
00000060: 0A 00 0B 0B 0B 00 0C 0C 0C 00 0D 0D 0D 00 0E 0E | .....
00000070: 0E 00 0F 0F 0F 00 10 10 10 00 11 11 11 00 12 12 | .....
00000080: 12 00 13 13 13 00 14 14 14 00 15 15 15 00 16 16 | .....
00000090: 16 00 17 17 17 00 18 18 18 00 19 19 19 00 1A 1A | .....
000000A0: 1A 00 1B 1B 1B 00 1C 1C 1C 00 1D 1D 1D 00 1E 1E | .....
000000B0: 1E 00 1F 1F 1F 00 20 20 20 00 21 21 21 00 22 22 | .....! ! ! . " "
000000C0: 22 00 23 23 23 00 24 24 24 00 25 25 25 00 26 26 | ".###.$$$.%%.&&
000000D0: 26 00 27 27 27 00 28 28 28 00 29 29 29 00 2A 2A | &.''.(((.))).**
000000E0: 2A 00 2B 2B 2B 00 2C 2C 2C 00 2D 2D 2D 00 2E 2E | *.+++.,,.,---...
000000F0: 2E 00 2F 2F 2F 00 30 30 30 00 31 31 31 00 32 32 | ..///.000.111.22
00000100: 32 00 33 33 33 00 34 34 34 00 35 35 35 00 36 36 | 2.333.444.555.66
00000110: 36 00 37 37 37 00 38 38 38 00 39 39 39 00 3A 3A | 6.777.888.999.:
00000120: 3A 00 3B 3B 3B 00 3C 3C 3C 00 3D 3D 3D 00 3E 3E | :.;;.<<<==.>>
00000130: 3E 00 3F 3F 3F 00 40 40 40 00 41 41 41 00 42 42 | >.???.@@@.AAA.BB
00000140: 42 00 43 43 43 00 44 44 44 00 45 45 45 00 46 46 | B.CCC.DDD.EEE.FF
00000150: 46 00 47 47 47 00 48 48 48 00 49 49 49 00 4A 4A | F.GGG.HHH.III.JJ
00000160: 4A 00 4B 4B 4B 00 4C 4C 4C 00 4D 4D 4D 00 4E 4E | J.KKK.LLL.MMM.NN
00000170: 4E 00 4F 4F 4F 00 50 50 50 00 51 51 51 00 52 52 | N.OOO.PPP.QQQ.RR
00000180: 52 00 53 53 53 00 54 54 54 00 55 55 55 00 56 56 | R.SSS.TTT.UUU.VV
00000190: 56 00 57 57 57 00 58 58 58 00 59 59 59 00 5A 5A | V.WWW.XXX.YYY.ZZ
000001A0: 5A 00 5B 5B 5B 00 5C 5C 5C 00 5D 5D 5D 00 5E 5E | Z.[[[]\.\.]].^^
000001B0: 5E 00 5F 5F 5F 00 60 60 60 00 61 61 61 00 62 62 | ^._.```.aaa.bb
000001C0: 62 00 63 63 63 00 64 64 64 00 65 65 65 00 66 66 | b.ccc.ddd.eee.ff
000001D0: 66 00 67 67 67 00 68 68 68 00 69 69 69 00 6A 6A | f.ggg.hhh.iii.jj
000001E0: 6A 00 6B 6B 6B 00 6C 6C 6C 00 6D 6D 6D 00 6E 6E | j.kkk.lll.mmm.nn
000001F0: 6E 00 6F 6F 6F 00 70 70 70 00 71 71 71 00 72 72 | n.ooo.ppp.qqq.rr
00000200: 72 00 73 73 73 00 74 74 74 00 75 75 75 00 76 76 | r.sss.ttt.uuu.vv
00000210: 76 00 77 77 77 00 78 78 78 00 79 79 79 00 7A 7A | v.www.xxx.yyy.zz
00000220: 7A 00 7B 7B 7B 00 7C 7C 7C 00 7D 7D 7D 00 7E 7E | z.{[{.|||.}]}..~
00000230: 7E 00 7F 7F 7F 00 80 80 80 00 81 81 81 00 82 82 | ~. .000.000.00
```

2.3 RGBQUAD (2/2)

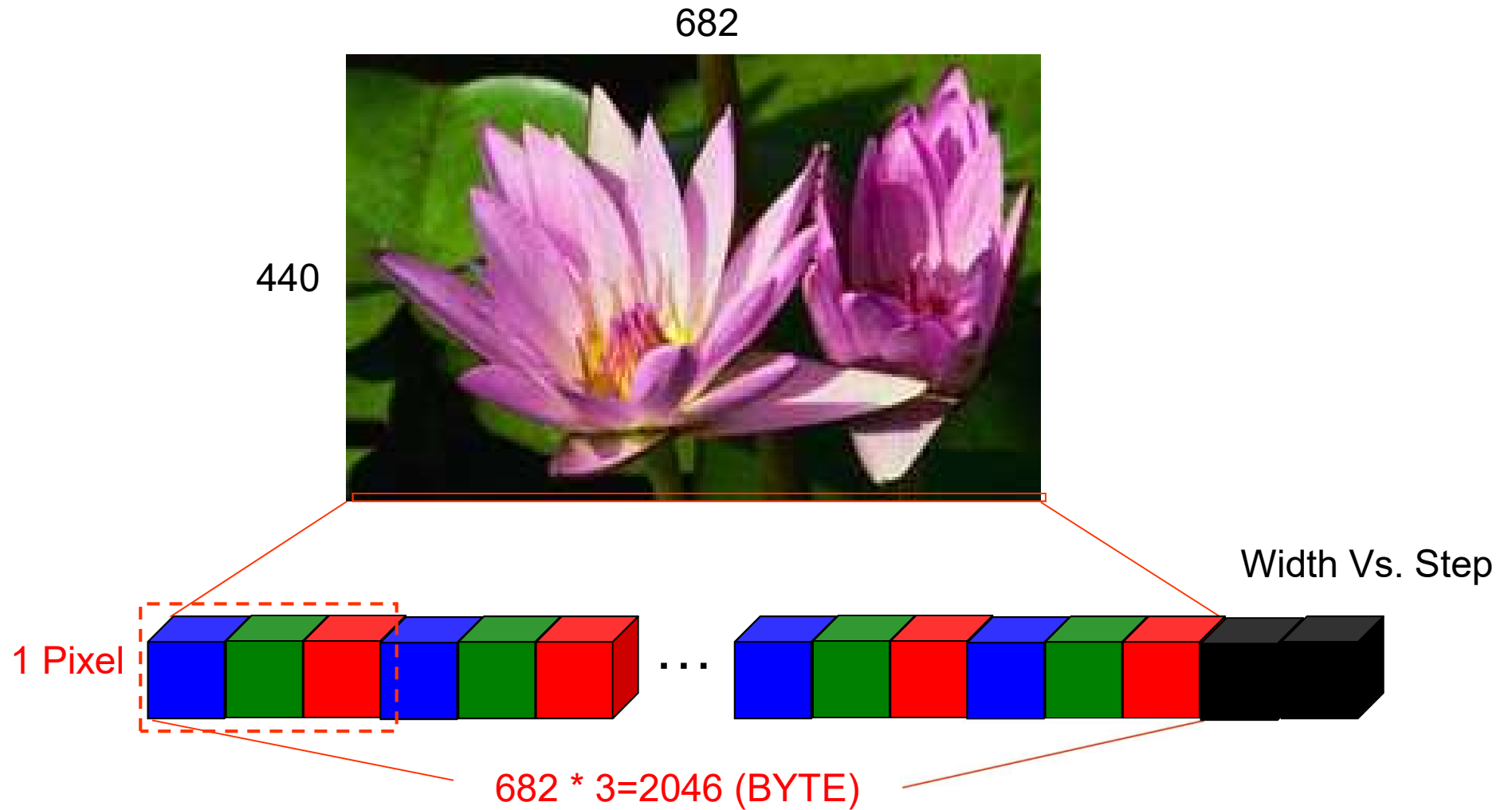
```
typedef struct tagRGBQUAD{                               //(4bytes)
    BYTE rgbBlue;           //(1bytes)   blue channel
    BYTE rgbGreen;         //(1bytes)   green channel
    BYTE rgbRed;           //(1bytes)   red channel
    BYTE rgbReserved;      //(1bytes)   must be 0
} RGBQUAD;
```

// Palette - **256*(3+1) bytes**

2.4 Image Data Array (1/4)

```
MadEdit - [C:\Documents and Settings\Roy123\桌面\圖片1.bmp]
檔案(E) 編輯(E) 尋找(S) 檢視(V) 工具(T) 視窗(W) 說明(H)
圖片1.bmp
Offset 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F | 0123456789ABCDEF
00000000: 42 4D 36 C0 0D 00 00 00 00 00 36 00 00 00 28 00 | BM6A.....6... (.
00000010: 00 00 AA 02 00 00 B8 01 00 00 01 00 18 00 00 00 | ..^.....
00000020: 00 00 00 C0 0D 00 12 17 00 00 12 17 00 00 00 00 | ...A.....
00000030: 00 00 00 00 00 00 FF FF FF FF FF FF FF FF FF | .....VVVVVVVVVV
00000040: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000050: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000060: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000070: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000080: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000090: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000000F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000100: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000110: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000120: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000130: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000140: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000150: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000160: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000170: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000180: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000190: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
000001F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000200: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000210: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000220: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000230: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000240: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000250: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000260: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000270: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
00000280: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | VVVVVVVVVVVVVVVV
Ln:1 of 1 (Sub:0) Col:671 FilePos:671 of 901,174
```

2.4 Image Data Array (2/4)



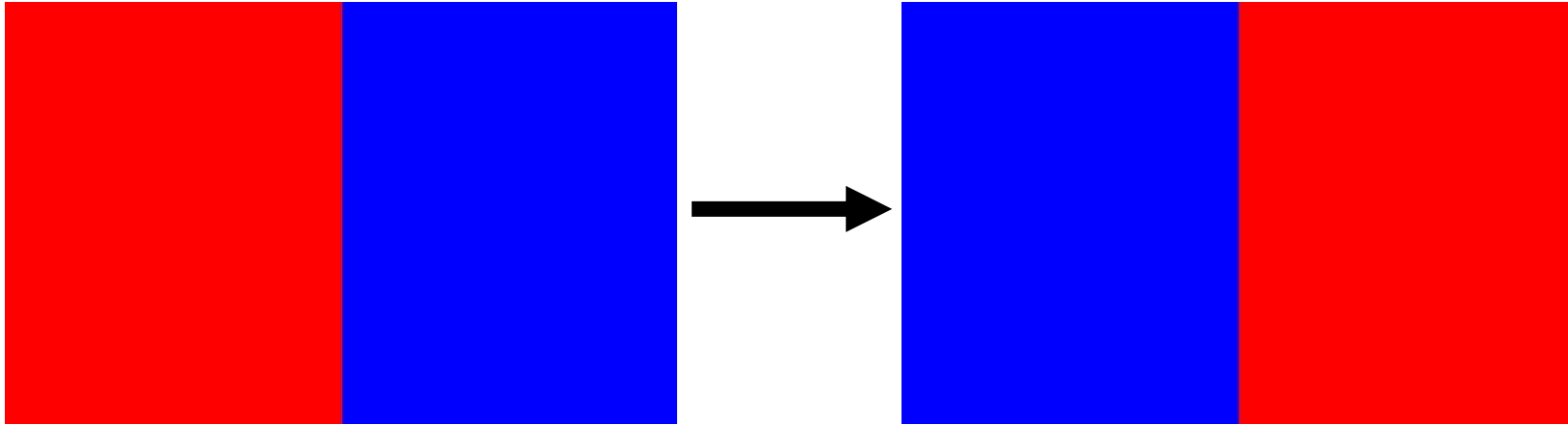
2.4 Image Data Array (3/4)

```
MadEdit - [C:\Documents and Settings\Roy123\桌面\圖片1.bmp]
檔案(E) 編輯(E) 尋找(S) 檢視(V) 工具(T) 視窗(W) 說明(H)
圖片1.bmp
Offset 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F | 0123456789ABCDEF
00000690: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000006F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000700: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000710: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000720: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000730: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000740: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
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00000760: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000770: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000780: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000790: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000007A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
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000007C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000007D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000007E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
000007F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000800: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000810: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000820: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF | YYYYYYYYYYYYYYYY
00000830: FF FF FF FF 00 00 FF FF FF 00 11 09 00 10 08 00 | YYY...YY
00000840: 0E 07 00 0B 06 00 09 03 00 07 01 01 06 01 03 06 | .....
00000850: 01 06 07 02 09 09 04 0C 0B 07 10 0C 09 10 0E 0A | .....
00000860: 11 0E 0A 10 0D 09 0E 0B 07 0B 0A 06 08 08 04 04 | .....
00000870: 07 03 02 07 02 01 08 03 02 09 04 02 09 04 02 09 | .....
00000880: 04 02 0A 05 02 09 04 02 09 04 02 09 04 03 09 04 | .....
00000890: 04 09 04 06 08 04 08 08 04 0A 08 04 0A 08 04 0B | .....
000008A0: 08 04 0C 08 04 0C 07 04 0D 07 04 0D 07 04 0D 07 | .....
000008B0: 04 0C 08 04 0A 08 04 09 08 04 08 08 04 06 08 04 | .....
000008C0: 06 09 04 05 09 04 05 09 05 06 08 05 06 07 06 07 | .....
000008D0: 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 | .....
000008E0: 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 | .....
000008F0: 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 | .....
00000900: 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 | .....
00000910: 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 07 | .....
Ln:1 of 1 (Sub:0) Col:2,102 FilePos:2,102 of 901,174
```


2.4 Image Data Array (4/4)

- Image data array is a huge array that record all pixel values of image.
- Each row should be **a multiple of 4**.
- If the width of image wasn't a multiple of 4, we should **fill up with zeros**.
 - ex: width = 13 → fill up with 3 zeros, then the new width = 16
- The order of image is **upper-side-down**, the last row in image is the first row in file. It is because of displayer - **Scanning**.

2.5 Others: Mirror

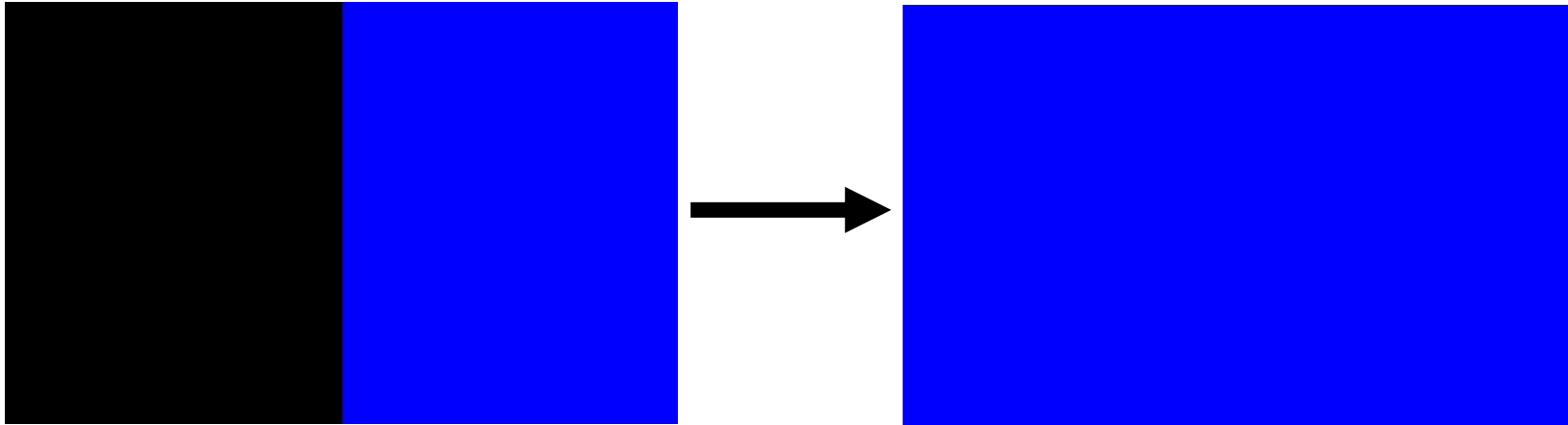


255,0,0	255,0,0	0,0,255	0,0,255
255,0,0	255,0,0	0,0,255	0,0,255
255,0,0	255,0,0	0,0,255	0,0,255




0,0,255	0,0,255	255,0,0	255,0,0
0,0,255	0,0,255	255,0,0	255,0,0
0,0,255	0,0,255	255,0,0	255,0,0

2.5 Others: Color change



0,0,0	0,0,0	0,0,255	0,0,255
0,0,0	0,0,0	0,0,255	0,0,255
0,0,0	0,0,0	0,0,255	0,0,255



0,0,255	0,0,255	0,0,255	0,0,255
0,0,255	0,0,255	0,0,255	0,0,255
0,0,255	0,0,255	0,0,255	0,0,255

2.5 Others: Embossment (1/3)



- Converting the input image to the gray level image.
- Convolute with 2 sobel mask, vertical and horizontal
- Then normalize to $[0, 255]$

2.5 Others: Embossment (2/3)

Vertical

-1	0	1
-2	0	2
-1	0	1

Horizontal

-1	-2	-1
0	0	0
1	2	1

Sobel Mask or Filter

- You may leave the boundary of image without dealing with it.
- New pixel value was calculated by neighboring pixels.

2.5 Others: Embossment (3/3)

Filter		Original image																			
<table><tr><td>-1</td><td>0</td><td>1</td></tr><tr><td>-2</td><td>0</td><td>2</td></tr><tr><td>-1</td><td>0</td><td>1</td></tr></table>	-1	0	1	-2	0	2	-1	0	1	*	<table><tr><td>(x-1, y-1)</td><td>(x, y-1)</td><td>(x+1, y-1)</td></tr><tr><td>(x-1, y)</td><td>(x, y)</td><td>(x+1, y)</td></tr><tr><td>(x-1, y+1)</td><td>(x, y+1)</td><td>(x+1, y+1)</td></tr></table>	(x-1, y-1)	(x, y-1)	(x+1, y-1)	(x-1, y)	(x, y)	(x+1, y)	(x-1, y+1)	(x, y+1)	(x+1, y+1)	+
-1	0	1																			
-2	0	2																			
-1	0	1																			
(x-1, y-1)	(x, y-1)	(x+1, y-1)																			
(x-1, y)	(x, y)	(x+1, y)																			
(x-1, y+1)	(x, y+1)	(x+1, y+1)																			
<table><tr><td>-1</td><td>-2</td><td>-1</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>2</td><td>1</td></tr></table>	-1	-2	-1	0	0	0	1	2	1	*	<table><tr><td>(x-1, y-1)</td><td>(x, y-1)</td><td>(x+1, y-1)</td></tr><tr><td>(x-1, y)</td><td>(x, y)</td><td>(x+1, y)</td></tr><tr><td>(x-1, y+1)</td><td>(x, y+1)</td><td>(x+1, y+1)</td></tr></table>	(x-1, y-1)	(x, y-1)	(x+1, y-1)	(x-1, y)	(x, y)	(x+1, y)	(x-1, y+1)	(x, y+1)	(x+1, y+1)	=
-1	-2	-1																			
0	0	0																			
1	2	1																			
(x-1, y-1)	(x, y-1)	(x+1, y-1)																			
(x-1, y)	(x, y)	(x+1, y)																			
(x-1, y+1)	(x, y+1)	(x+1, y+1)																			

New value of central pixel

- New value $\rightarrow [0, 255]$