

- **Image input/flip/output**

BMP is a file format typically consisting of two main components: a File Header (14 bytes), info header (40bytes) and Bitmap Data. The BMP format is generally uncompressed. The File Header contains essential metadata about the image, such as the image width (bytes 18–21), height (bytes 22–25), color depth (bytes 28–29), and other information. The Bitmap Data section stores each pixel's RGB (or RGBA) values, starting from the bottom-left corner of the image and moving to the top-right. Mind that each row of data must have its total byte count aligned to a multiple of 4, if not, padding bytes are added to the end of the row.

Method

整體架構：讀入資料→處理padding→影像處理→將處理後的Bitmap存入新變數→(處理padding)→輸出資料→釋放內存

Start from	bytes	Information (normal value)
0	2	File type(fix)
2	4	File size
6	2	Reserved 1 (0)
8	2	Reserved 2 (0)
10	4	Pixel data offset (54)
14	4	DIB header size (40)
18	4	Image width
22	4	Image height
26	2	Number of color planes(fix)
28	2	Bits per pixel
32	4	Compression method
36	4	Image size
40	4	Horizontal resolution
44	4	Vertical resolution
48	4	Number of colors
52	4	Important colors

- **Resolution**

Method

原本0~255的色階/ $(\frac{256}{n})$ (取商，其中 n 為2目標 $bits$ 數)

此時色階映射成0~ $n - 1$ ，再乘上 $\frac{255}{(n-1)}$ 映射回255階(實際只使用 n 個色階)，應為此為假的低 bit 數圖片，故未更改header

Discussion

當色彩的解析度降低時，圖片對比變得較強烈，顏色的分界變得明顯。

- **Cropping**

Method

從 x,y 的位置橫向取 $width$ 個縱向取 $height$ 個，因為新圖片的 $width$ 跟 $high$ 有改變，故header對應的資訊也改變。因 bmp 由圖片左下儲存，與助教定義座標軸相同，故無需做座標轉換。

