

EECS 203A HW1 Yucun Qin

1. By definition of objectionable, a pixel-to-pixel difference of 6 is considered objectionable, where $2^3 = 8 > 6$, the minimum difference in grey scale is $00000000 \rightarrow 00001000$ of $b = 8 - 3 = 5$, which is objectionable, therefore $b \geq 6$.
~~other~~ image will not be objectionable.

For $N = 2^5 = 32$, image is still objectionable, as a result, N should larger than 64.
 $\therefore b \geq 6, N \geq 64$

2. (1) $H[I(x,y)] = 3I(x,y) + 6$

$$H[af(x,y) + bg(x,y)] = 3(a \cdot f + b \cdot g) + 6$$

$$= 3af(x,y) + 3bg(x,y) + 6$$

$$aH[f] + bH[g] = 3af(x,y) + 6 + 3bg(x,y) + 6$$

$$= 3af(x,y) + 3bg(x,y) + 12 \neq H[af(x,y) + bg(x,y)]$$

Non-Linear

(2) Let H be the median operator.

• prove by contradiction pixels $(6, 7, 10, 15, 17)$ in $f(x,y)$
 value of pixels $(1, 2, 3, 4, 5)$ in $g(x,y)$

As a result, $H[f(x,y)] = 10$

$$H[g(x,y)] = 3$$

$$\text{Let } a = b = 1$$

$$\text{then } H[af(x,y) + bg(x,y)] = 5.5 \neq aH[f(x,y)] + bH[g(x,y)]$$

which is 13

so it is Non-Linear.

3. (a) By definition of bilinear:

$$I(x,y) = ax + by + cxy + d$$

$$\begin{cases} 8 = a + b + c + d \\ 12 = a + 2b + 2c + d \\ 11 = 2a + b + 2c + d \\ 16 = 2a + 2b + 4c + d \end{cases} \Rightarrow \begin{cases} a = 2 \\ b = 3 \\ c = 1 \\ d = 2 \end{cases}$$

$$I(x,y) = 2x + 3y + xy + 2$$

(b) ~~11.75~~ $b(1.5, 1.5) = 11.75$

4. height = 1125
 width = $1125 \times \frac{16}{9} = 2000$

$$S = 2 \times 60 \times 60 \times 30 \times 1125 \times 2000 \times 24 = 1.166 \times 10^{13} \text{ bits}$$

