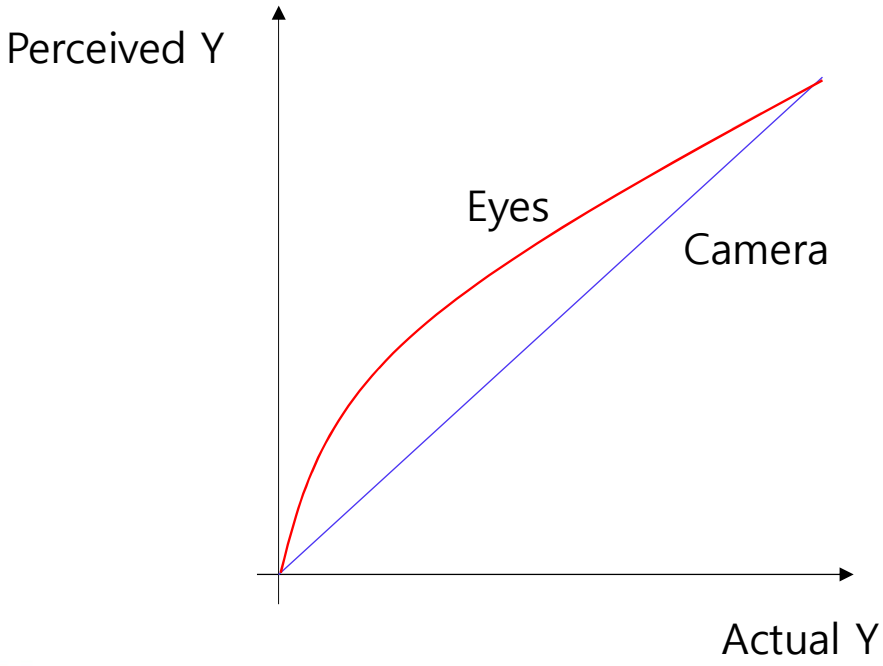
Gamma

이진영

Nonlinearity

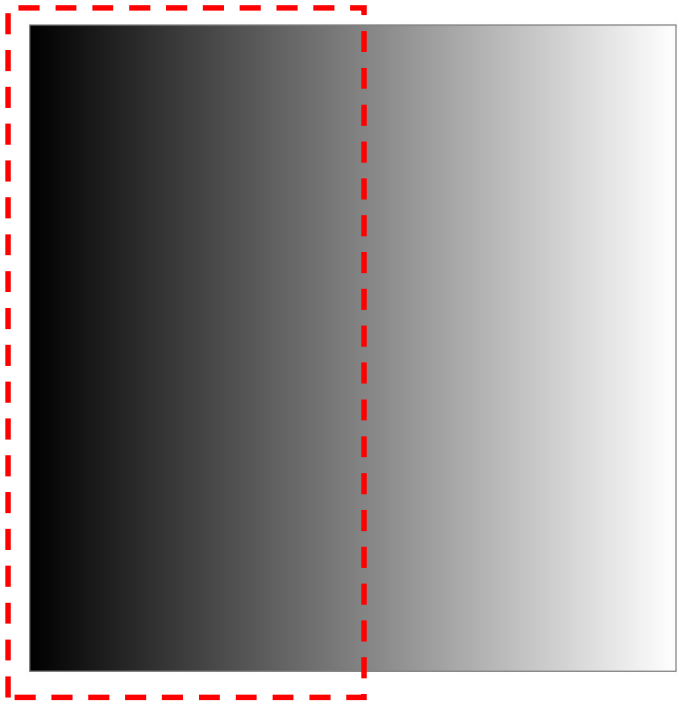
- Nonlinear relationship between the actual luminance and its perceived luminance
- Human eye (Nonlinear) ≠ Camera



Human Perception

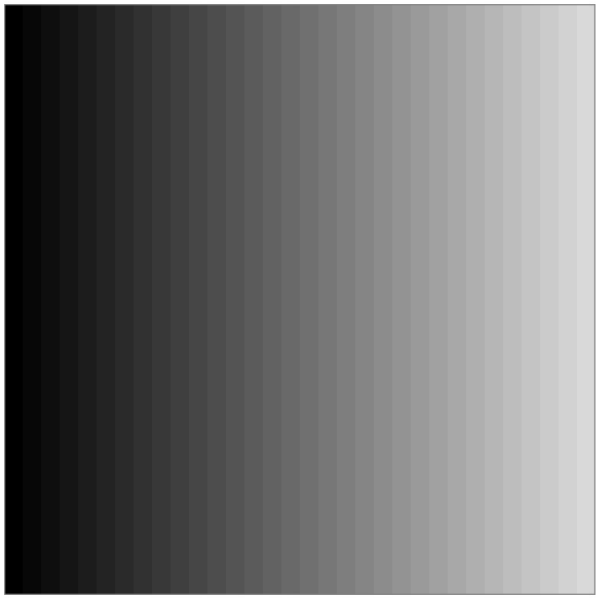
- Differences between darker values (More sensitive) > Differences between lighter values (Less)
- More sensitive eyes, when it is less bright
- In general, more important for dark regions
- Sometimes problem:
  - Many bits in brightness we cannot see
  - Fewer bits in darkness we can see

→ Bit optimization for efficient image representation



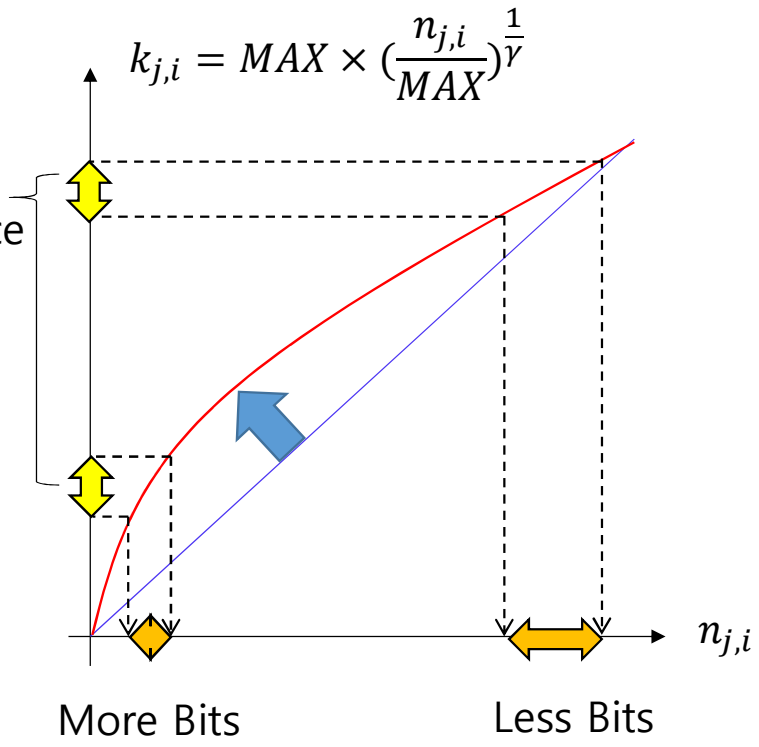
Gamma Encoding

- Maximization of visual quality, by optimizing the usage of bits in the encoding
- Correction of gamma characteristics of early display devices



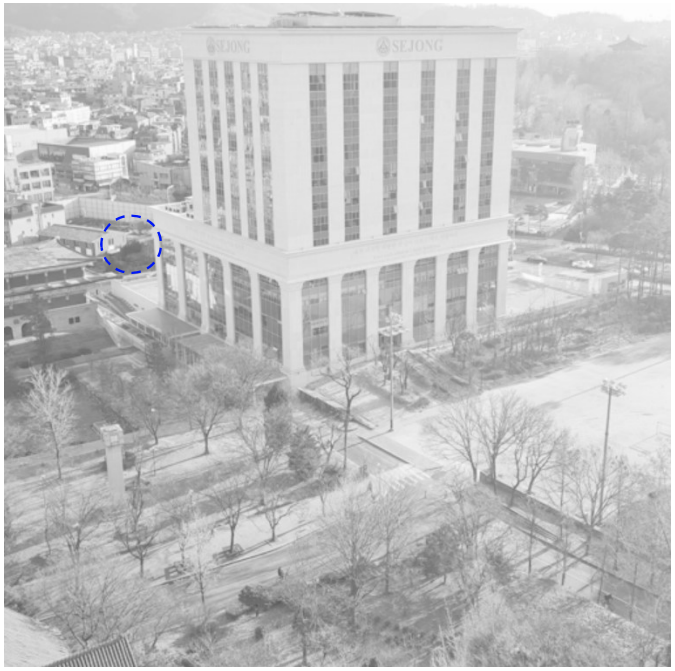
Linearly Encoding

Gamma Encoding

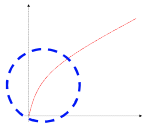


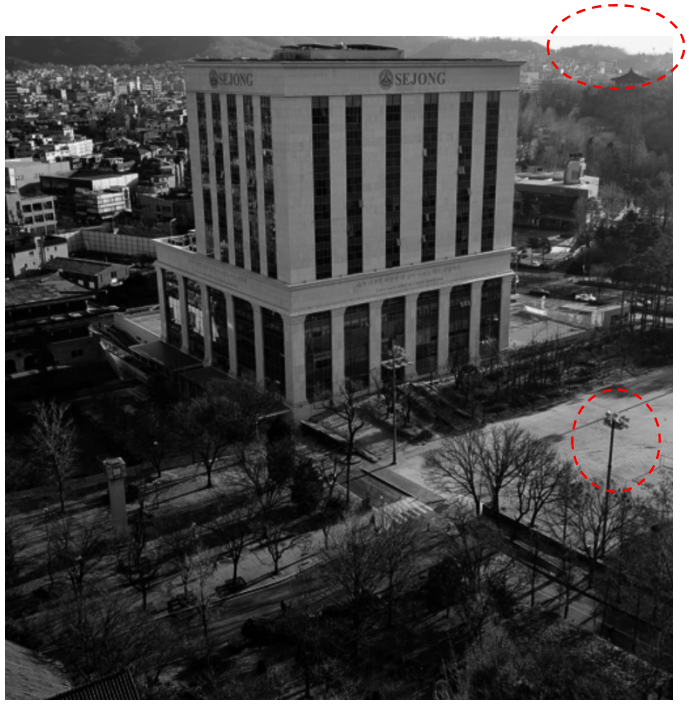
Comparison

AICenterY.bmp

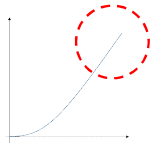


Gamma = 2.5



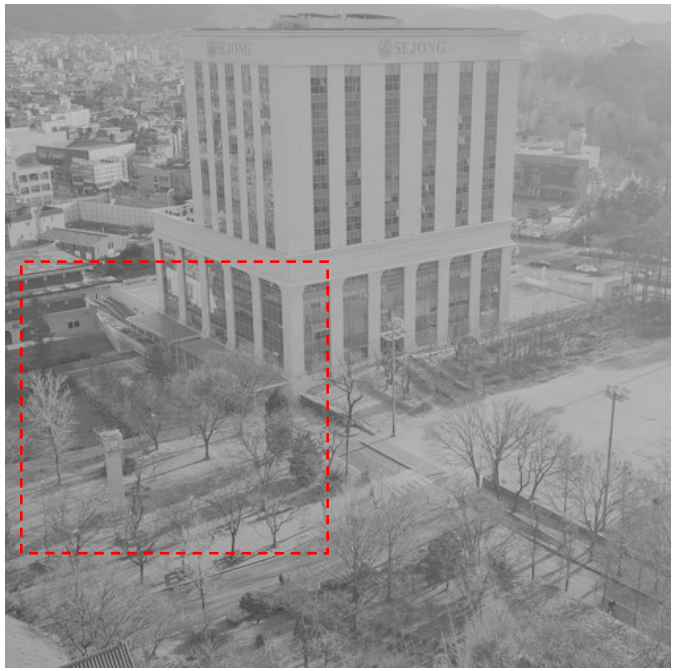


Gamma = 0.4

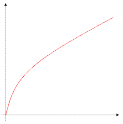


Good Example

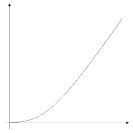
AICenterY_Dark.bmp



Gamma = 2.5

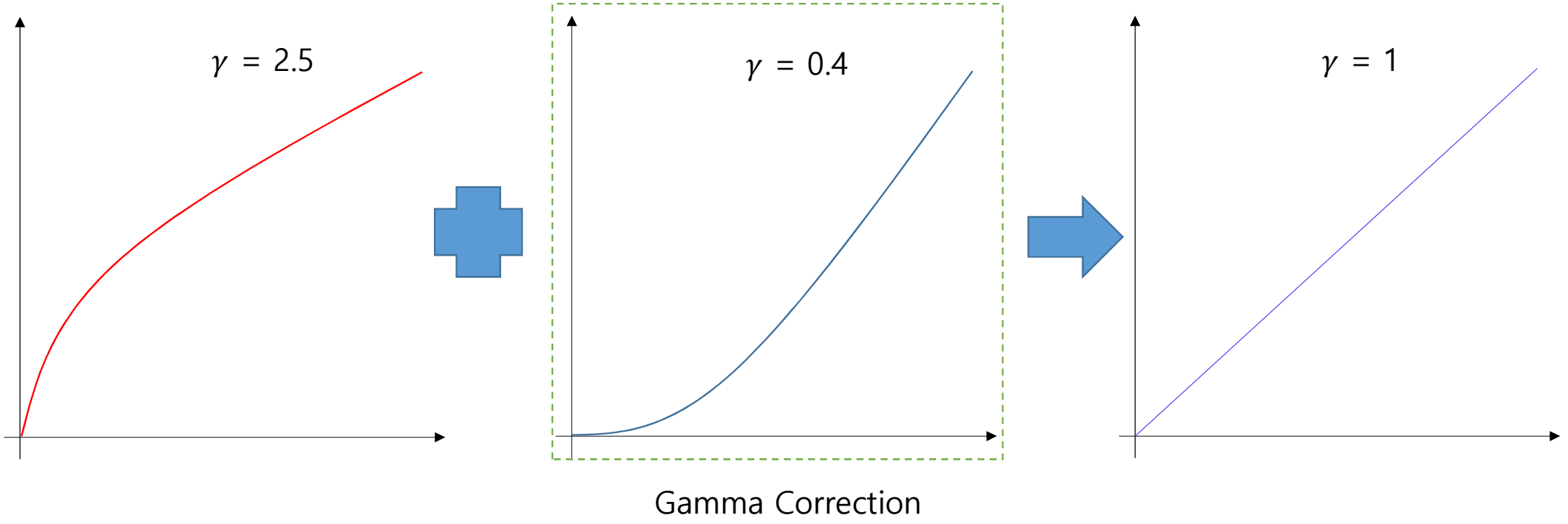


Gamma = 0.4



Gamma Correction

- Inverse conversion from a gamma encoded image to an original image

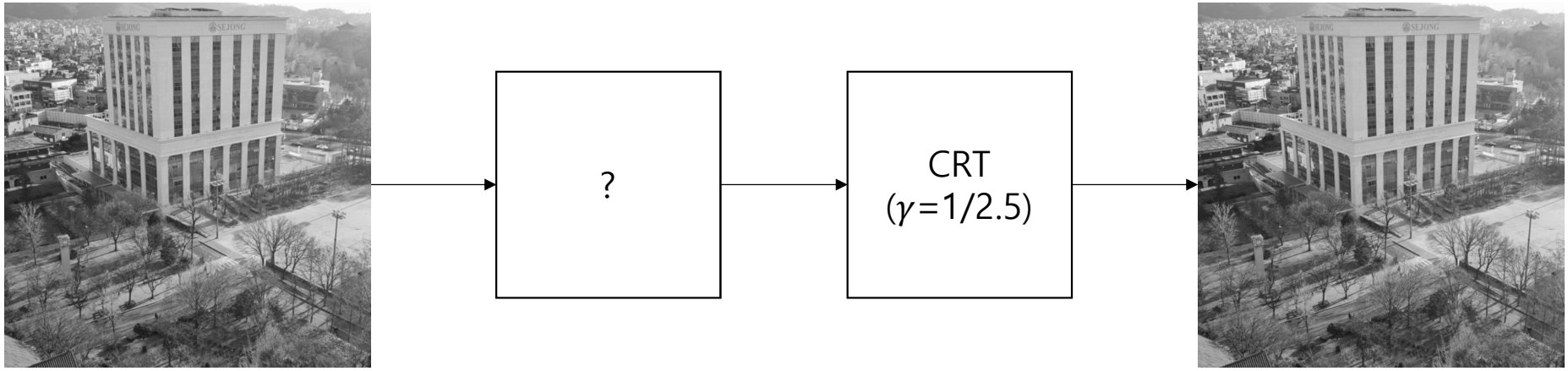


Display Gamma

- Nonlinear input and output characteristics of display devices
- Gamma of cathode ray tube (CRT) displays = 1/2.5 = 0.4 (Almost inverse of our eyes)
- Sometimes, display gamma = gamma correction
- For example, monitor setting

Experiment

- Considering the characteristic of CRT, please perform gamma encoding



Original

Output

```
#include <math.h>
Y2[j * width + i] = (unsigned char)(255 * pow(Y1[j * width + i] / 255.0, 1/gamma));
```