Grayscale Intensity Transformations

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Image processing transformations alter the appearance of images through mathematical operations. We will explore various transformations including image negation, log transform, power-law transform, gamma correction, and piece-wise linear transform.

1 Image Negation

Image negation inverts the intensity levels of an image. Given an input image $I(x, y)$ and an output image $O(x, y)$, the negation is calculated as:

$$O(x, y) = 255 - I(x, y)$$

2 Log Transform

The log transform enhances the darker areas of an image. The log transform with scaling factor c is given by:

$$O(x, y) = c \cdot \log(1 + I(x, y))$$

3 Power-Law Transform

The power-law transform adjusts the image contrast using a power function. The power-law transform with exponent γ and scaling factor c is:

$$O(x, y) = c \cdot (I(x, y))^{\gamma}$$

4 Gamma Correction

Gamma correction adjusts the overall brightness and contrast of an image. Gamma correction with gamma value γ is given by:

$$O(x, y) = 255 \cdot \left(\frac{I(x, y)}{255}\right)^{\gamma}$$

5 Piece-Wise Linear Transform

Piece-wise linear transform modifies different intensity ranges differently. The piece-wise linear transform is defined as:

$$O(x, y) = \begin{cases} s_1 \cdot I(x, y) & \text{if } I(x, y) < b_1 \\ s_2 \cdot I(x, y) + (s_1 \cdot b_1) & \text{if } b_1 \leq I(x, y) < b_2 \\ s_3 \cdot I(x, y) + (s_2 \cdot b_2) & \text{if } I(x, y) \geq b_2 \end{cases}$$

6 Results

Image processing transformations provide tools to manipulate the appearance of images. Understanding and applying these transformations can enhance image quality and convey desired visual effects.

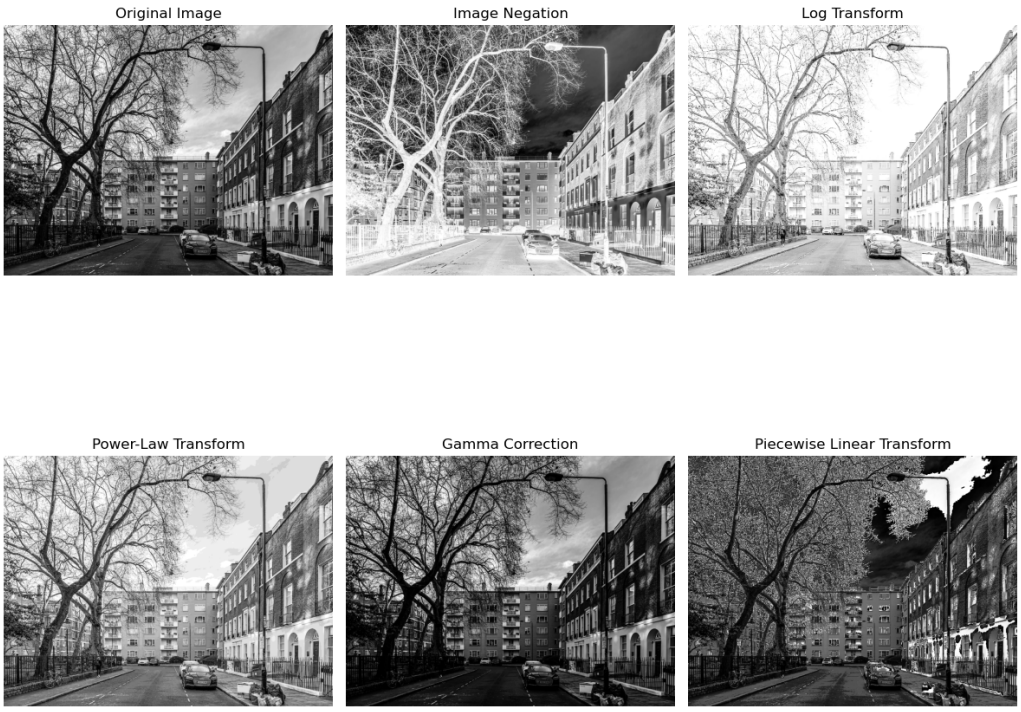

Figure 1: Grayscale Image Transformations