Лекц 5: Image Operations

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Агуулга

2.1 Point Operation

2.1.1 Concepts

- Image Processing Algorithms
  - Point operation
  - Local operation
  - Total operation
  - Algebraic operation
  - Geometric operation

2.1.1 Concepts

- Point Operation
  - Point operation is a process that evaluate each pixel in an image based solely upon its brightness.
  - A point operation takes a single input image into a single output image in such a way that each output pixel's gray-level depends only upon the gray level of the corresponding input pixel.

2.1.1 Concepts

- Point Operation
  - The result brightness is determined by a mapping function that maps each of the 256 possible input pixel brightnesses to one of 256 output brightnesses.
  - Point operations are sometimes called by other names, including contrast enhancement, contrast stretching and gray-level transformations.
  - $O(X,Y)=f(I(X,Y))$

2.1.1 Concepts

- Gray-level histogram
  - Histogram is a kind of graph which shows the relationship of pixel gray-level and counted number of pixels of an image.
  - Histogram is a powerful tool for image processing.

2.1.1 Concepts

- Demo and Practice
  - Open an gray-level image.
  - Check the histogram of the image.
  - Open an color image.
  - Check the histogram of the image.

2.1.2 Gray-level Transformation

- Gray-level Transformation
  - Gray-level transforms are typical point operations.
- Image Enhancement
  - The most common usage of gray-level transformation is image enhancement.
  - Image enhancement is trying to improve visual quality of an image.

2.1.2 Gray-level Transformation

- Gray-level transformation
  - Linear transformation
  - Non-linear transformation
  - Histogram equalization
  - Pseudo-color transformation

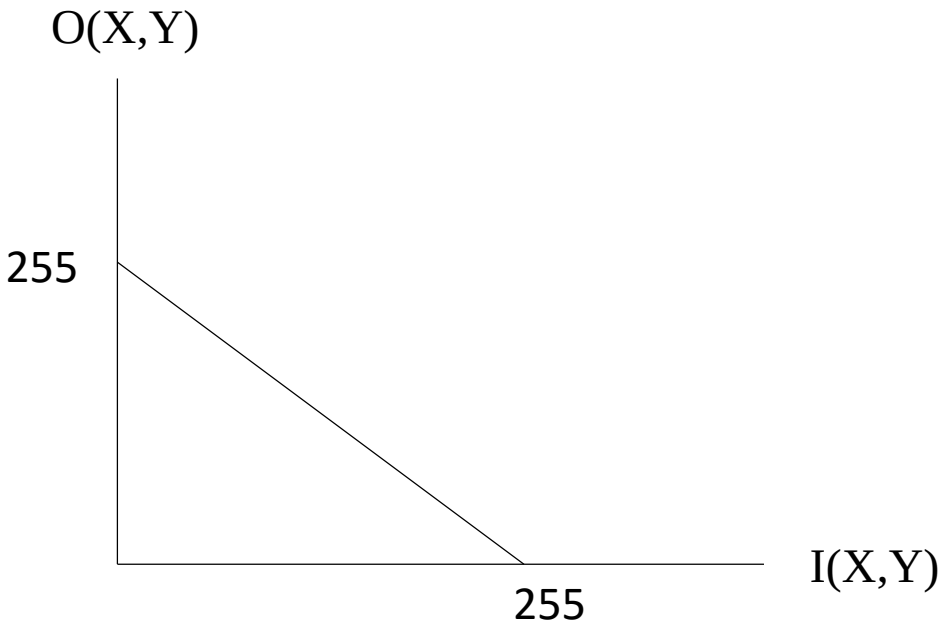
Linear Transformation

- Gray-level inverting
  - To make a positive gray-level image negative or vice versa.
  - Conditions
    - Input image I(X,Y)
    - Output image O(X,Y)
  - Inverting formula

    $O(X,Y) = 255 - I(X,Y)$

Linear Transformation

- O(X,Y) = 255 - I(X,Y)
  - Linear transformation
  - Point operation



Linear Transformation

- Demo and Practice
  - Open a gray-level image.
  - Invert the gray-levels of the image.

Linear Transformation

- Gray-level Stretching
  - To enlarge the gray-level range of a bad image.
  - To enhance the image.
- Other names
  - Contrast enhancement
  - Contrast stretching

Linear Transformation

- Gray-level Stretching
  - ➢ Conditions
    - Input imageI(X,Y)
    - Output imageO(X,Y)
    - Min and max gray-level value of input image

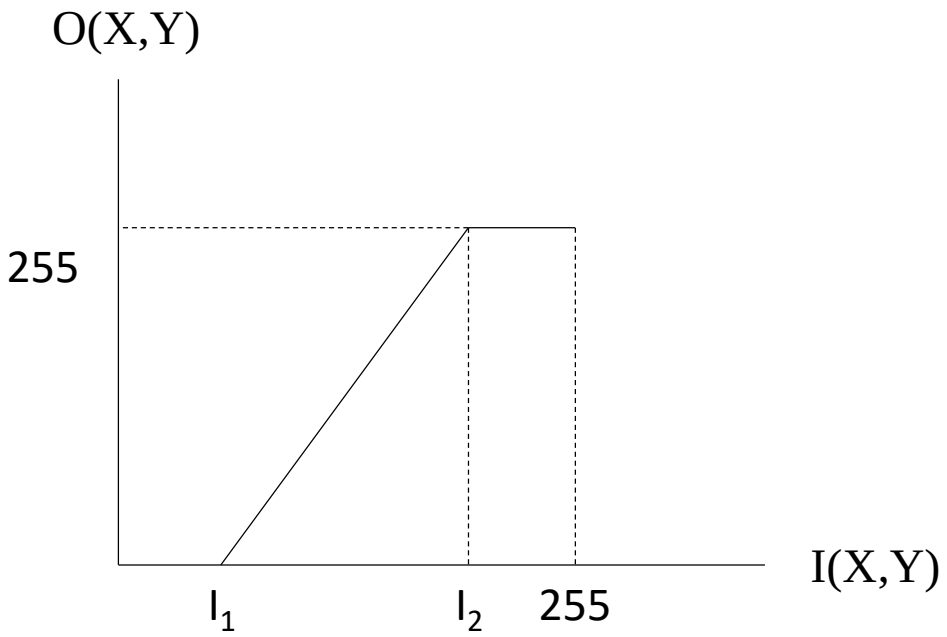
      I_1（> 0）and I_2（< 255）
    - Min and max gray-level value of output image

      O_1（=0）and O_2（=255）
- Stretching formula

$$O(X,Y)=\frac{(O_2-O_1)(I(X,Y)-I_1)}{I_2-I_1}+O_1$$

Linear Transformation

- Linear transformation
- Point operation

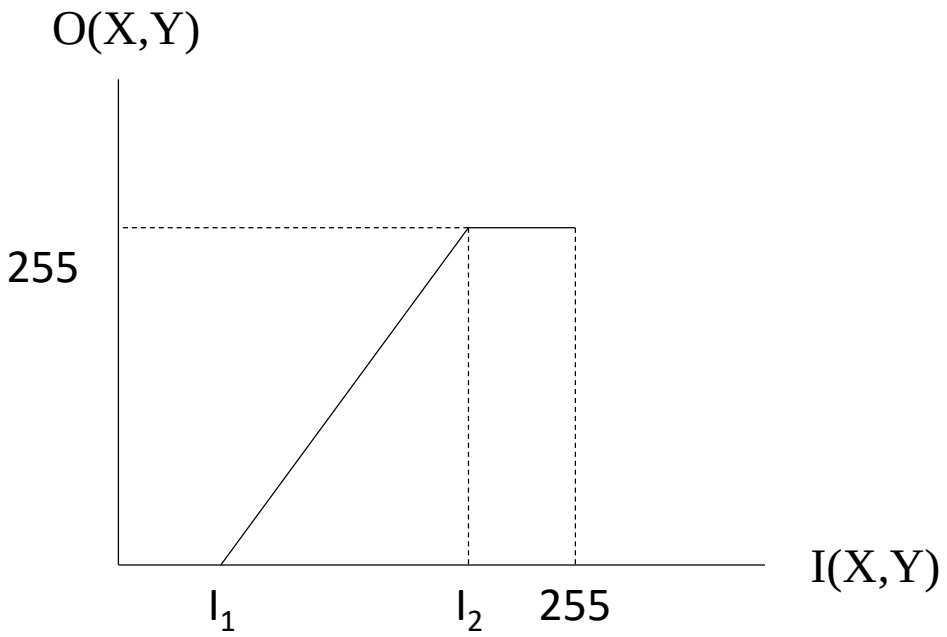


Linear Transformation

- Demo and Practice
  - Open a gray-level image.
  - Stretch the gray-level range of the image.

Non-linear Transformation

- Non-linear transform if conditions changed
- Point operation



Non-linear Transformation

- Non-linear transformation
  - Curve transformation
  - Histogram equalization
- Key
  - Some gray-level ranges are stretched.
  - While other ranges are compressed.

Non-linear Transformation

- Demo and Practice
  - Open a gray-level image.
  - Curve the gray-levels of the image.

Histogram Equalization

- Histogram Equalization
  - ✓ Try to make the values of a histogram equalized.
- Key
  - ✓ Some ranges are stretched.
  - ✓ While other ranges are compressed.

Histogram Equalization

- Demo and Practice
  - ✓ Open a gray-level image.
  - ✓ Equalize the image.

Pseudo-color Transformation

- Pseudo-color transformation
  - ✓ To map gray-levels into pseudo-colors
  - ✓ Colored images might be easier to view.
- Examples
  - ✓ Enhance thermal infrared images.
  - ✓ Enhance height images.

Pseudo-color Transformation

- Demo and Practice
  - ✓ Open a gray-level image.
  - ✓ Colorize (enhance) the gray-levels of the image.

2.1.3 Color Transformation

- Color Transformation are same as gray-level transforms.
- The Only difference is that the object images are color (RGB, CMY, etc.) images.

2.1.3 Color Transformation

- Demo and Practice
  - Open a color image.
  - Enhance the image.