Escuela Profesional de
Ciencia de la Computación



# Computer graphics

## Image Logical

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# Overview



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# Table of Contents



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# Objectives

- Understand about the logical operators between images.

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# Objectives

- Understand about the logical operators between images.
- Learn the logical operator as AND, OR and NOT between images.

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# Table of Contents



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# Invert/Logical NOT

## Definition

Logical NOT or invert is an operator which takes a binary or graylevel image as input and produces its photographic negative, i.e. dark areas in the input image become light and light areas become dark.

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# Invert/Logical NOT

## Definition

Table: NOT operator

| A | Q |
|---|---|
| 0 | 1 |
| 1 | 0 |

$$Q(i,j) = 255 - P(i,j) \qquad (1)$$

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# Invert/Logical NOT

## Examples

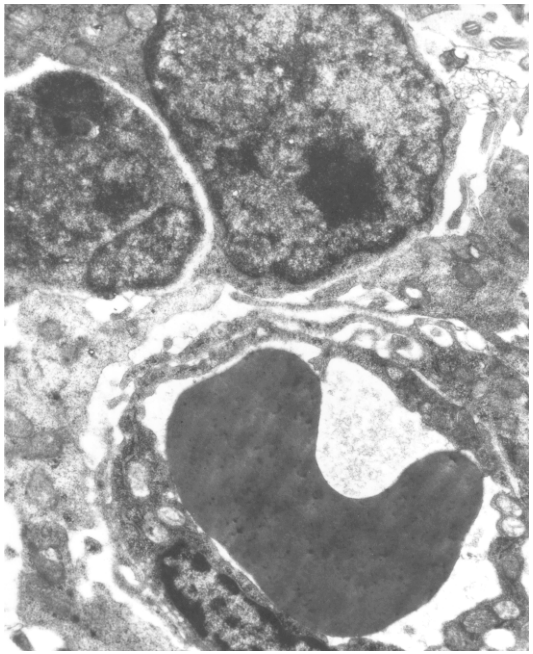

Figure: Original image.

Figure: 255 - Original image.

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# Table of Contents



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# Logical AND/NAND

## Definition

The AND (and similarly the NAND) operator typically takes two binary or integer graylevel images as input, and outputs a third image whose pixel values are just those of the first image, ANDed with the corresponding pixels from the second.

Table: AND

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

Table: NAND

| A | B | Q |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

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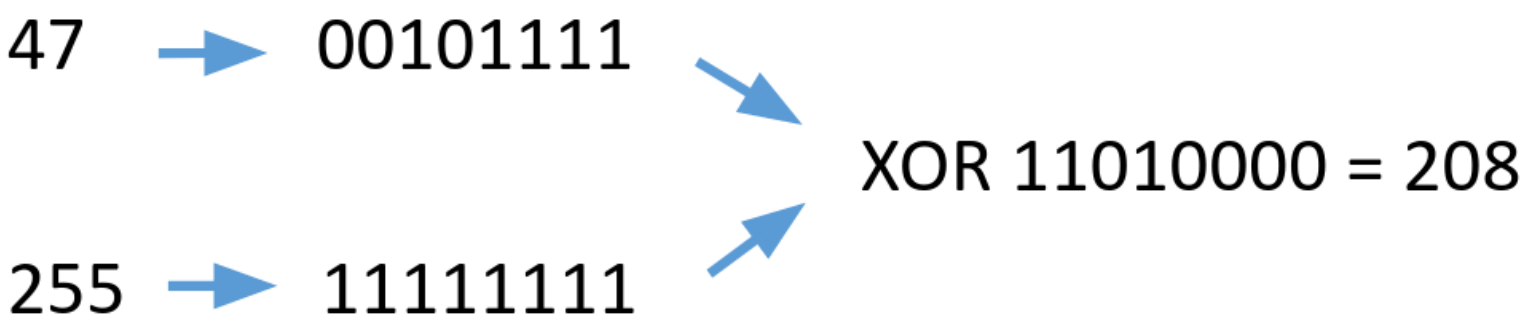
# Logical: Bitwise fashion

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# Logical AND/NAND

## Object intersection


Figure: Example of AND in order to get the intersection of objects.

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# Logical AND/NAND

## Object intersection


Figure: In this case we used invert before AND operation.

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# Logical AND/NAND

## Object intersection


Figure: In this case we threshold each image and then we used AND over the inverted results.

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# Logical AND/NAND

## Object intersection

In order to detect differences or similarities between images the best option is to work with binary images.

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# Table of Contents



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# Logical OR/NOR

## Definition

The OR (and similarly the NOR) operator typically takes two binary or graylevel images as input, and outputs a third image whose pixel values are just those of the first image.

Table: AND

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

Table: NAND

| A | B | Q |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

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# Logical OR/NOR

## Union of images


Figure: Union of images with OR operator.

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# Table of Contents



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# Logical XOR/XNOR

## Definition

The XOR stands for exclusive OR.

Table: XOR

| A | B | Q |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

Table: XNOR

| A | B | Q |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

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# Logical XOR/XNOR

## Change in images


Figure: Example of change image detection with XOR operator.

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# Questions?

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