Escuela Profesional de
Ciencia de la Computación

Computer graphics

Logarithm Operator

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Overview

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Objectives

- Understand the difference between point, local and operators in image processing.

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Objectives

- Understand the difference between point, local and operators in image processing.
- Learn Logarithm Operator method.

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Sample application

Figure: Sample application in pattern recognition

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Sample application

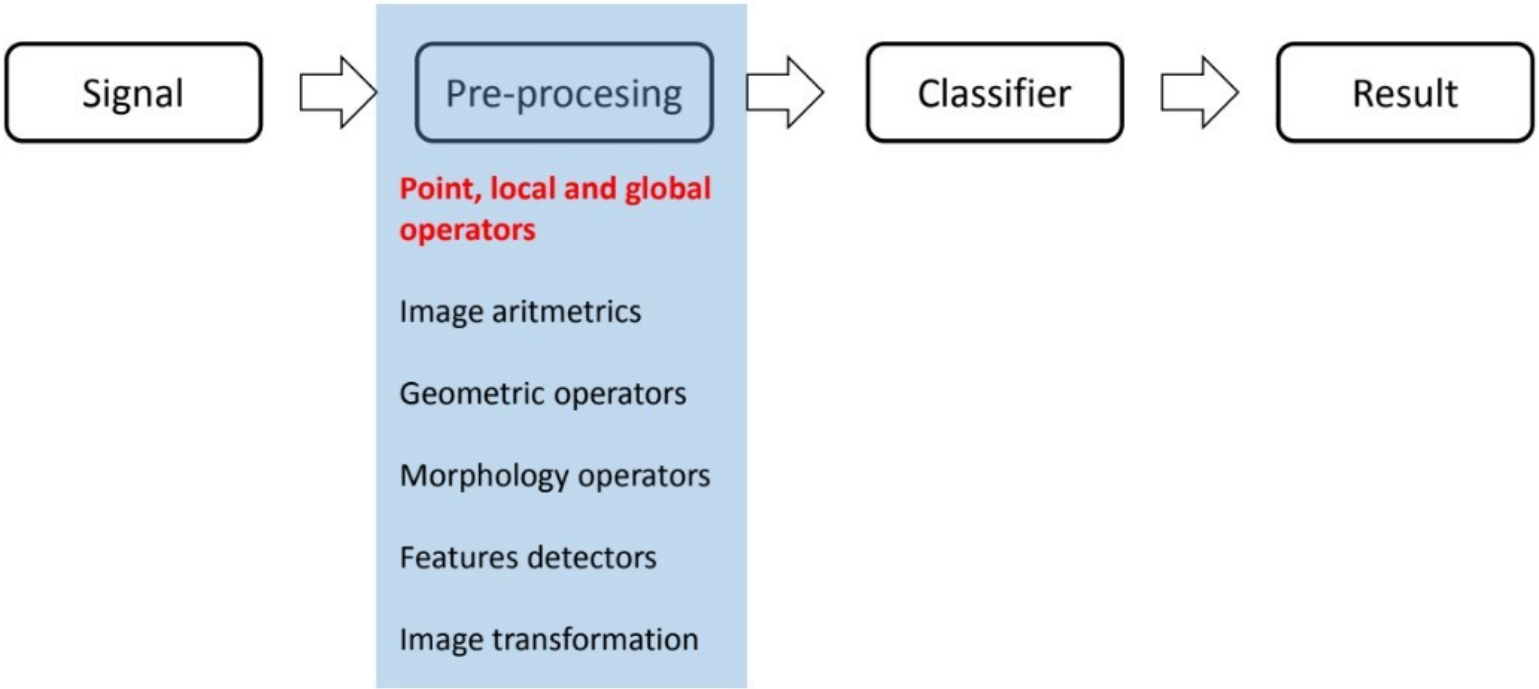

Figure: Sample application in pattern recognition

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Point operators

Example

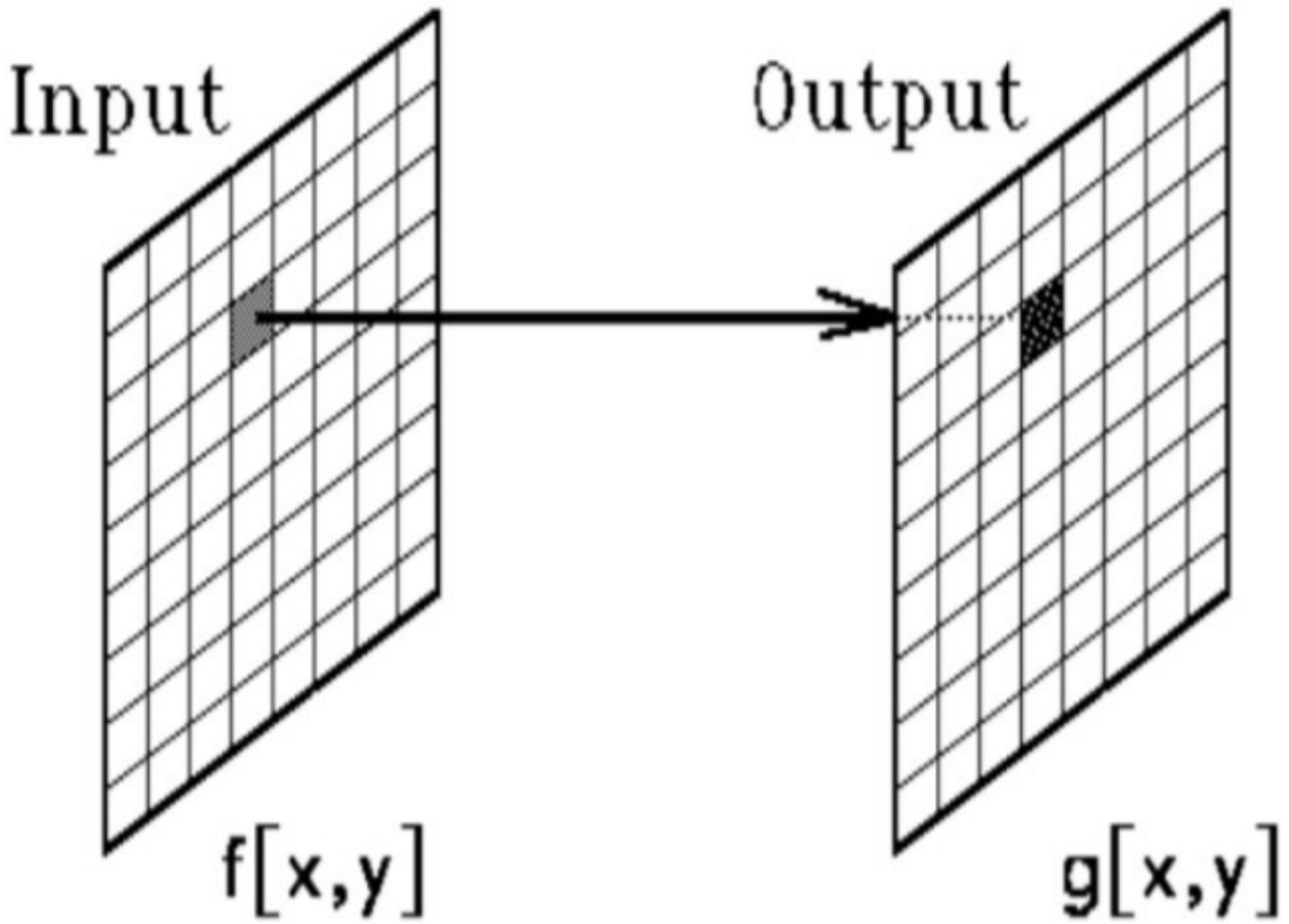

Figure: Point operator.

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Point operators

Formal definition

Point operator

$$O\{f[x,y]\} = g[x',y']$$

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Point operators

Examples

- Thresholding
- Contrast Stretching
- Histogram Equalization
- **Logarithm Operator**
- Exponential/Raise to Power Operator

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Logarithm Operator

Figure: Original image. it have low intensity pixels.

Figure: Image after logarithm operator.

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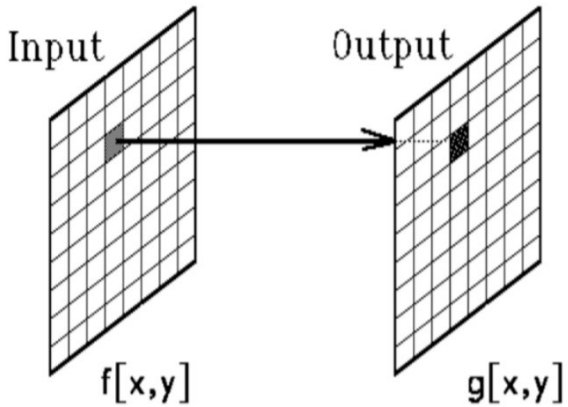
Logarithm Operator



$$g[x, y] = c * log(1 + f[x, y])$$

Where:

- c : Constant.

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Logarithm Operator

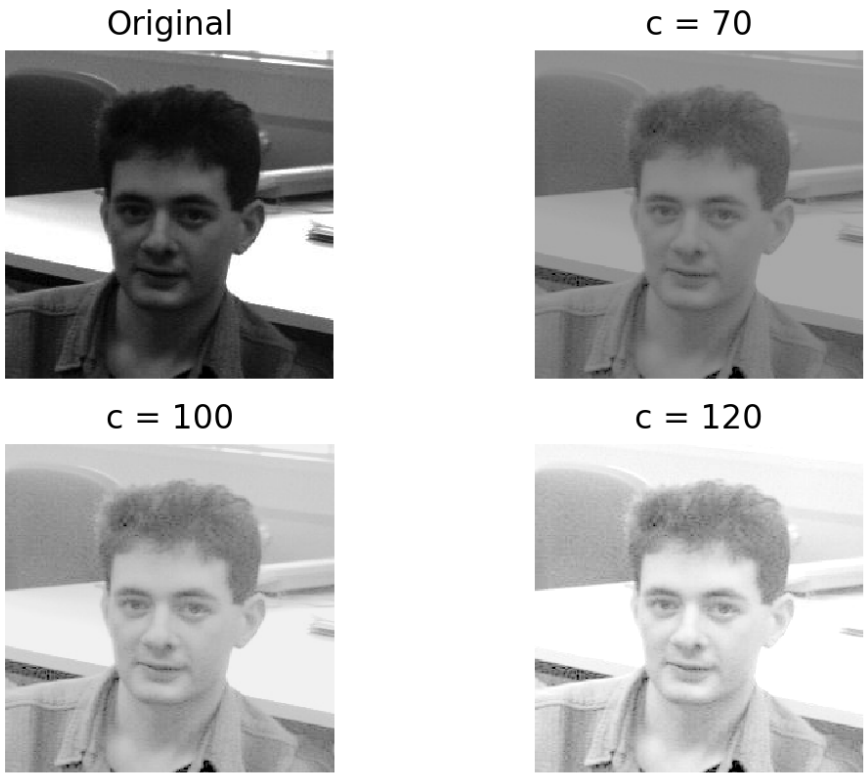

Figure: Example of logarithm operator with different *c* values.

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Logarithm Operator

The dynamic range of an image can be compressed by replacing each pixel value with its logarithm. This has the effect that low intensity pixel values are enhanced.

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Logarithm Operator

Since the logarithmic function becomes more linear close to the origin, the compression is smaller for an image containing small input values. The function is almost linear

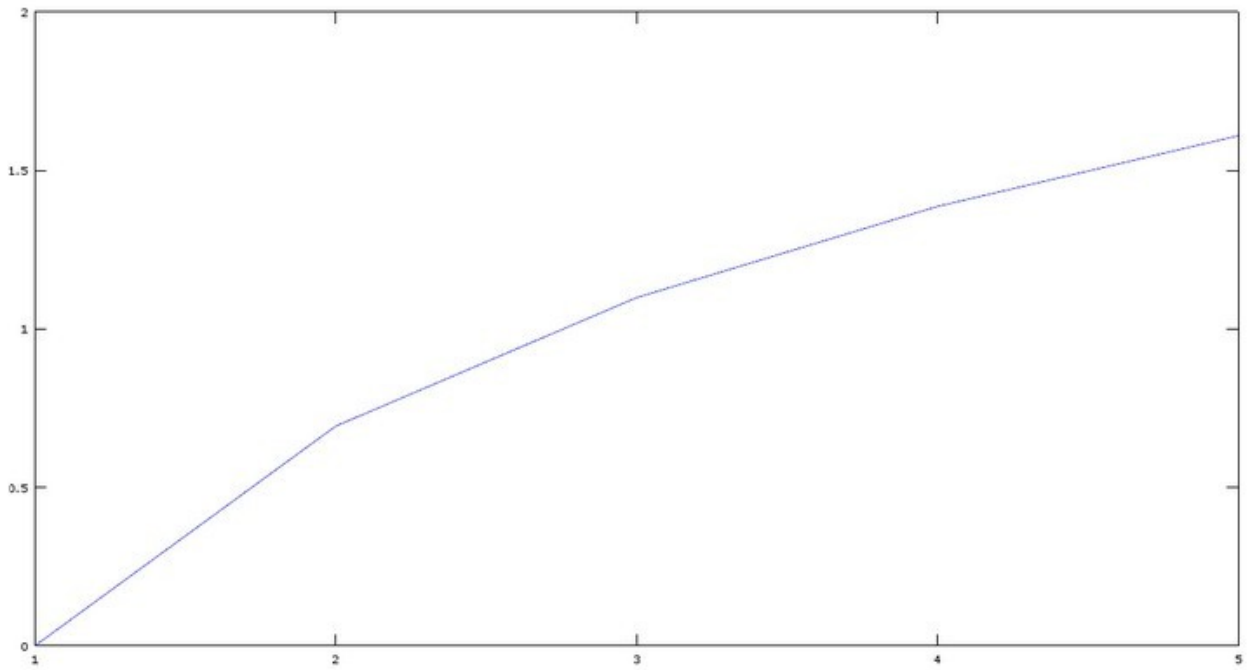

Figure: Compression is smaller for an image containing small input values.

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Logarithm Operator

For bigger values we get better compression

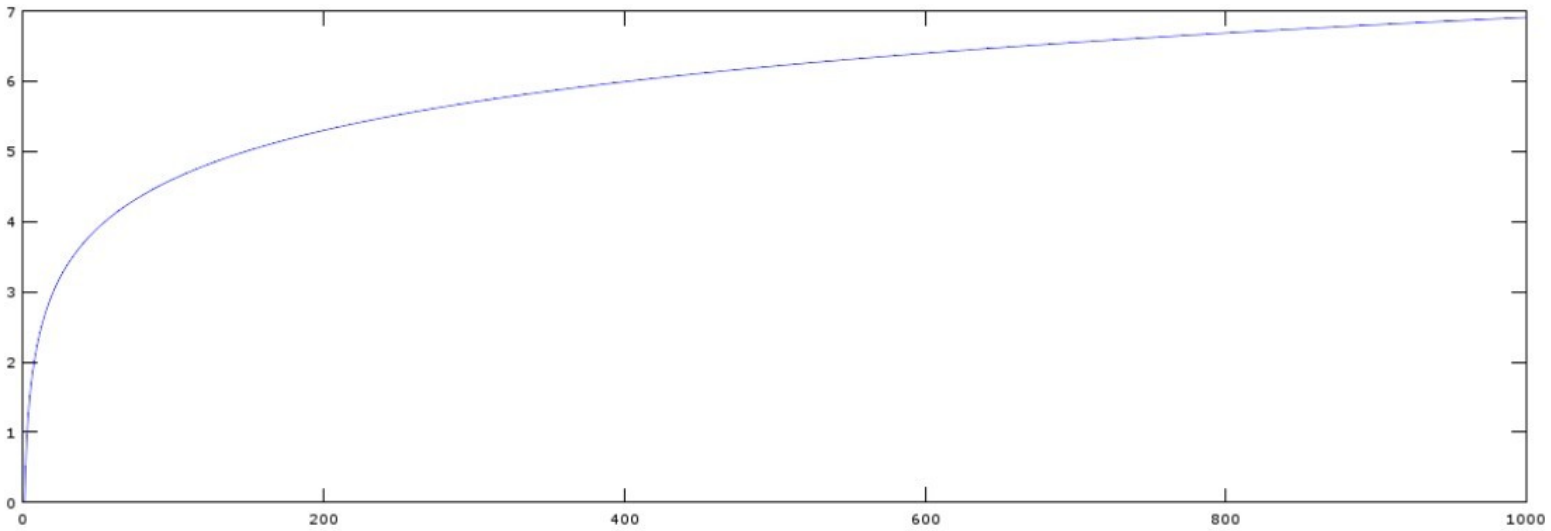

Figure: For bigger values we get better compression.

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Logarithm Operator

Problem

Problem

The logarithmic operator enhances the low intensity pixel values, while compressing high intensity values into a relatively small pixel range. **So what happen if an image contains some important high intensity information?**

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Logarithm Operator

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The logarithmic operator enhances the low intensity pixel values, while compressing high intensity values into a relatively small pixel range. **So what happen if an image contains some important high intensity information?**

Applying the logarithmic operator might lead to loss of information.

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Logarithm Operator

Problem

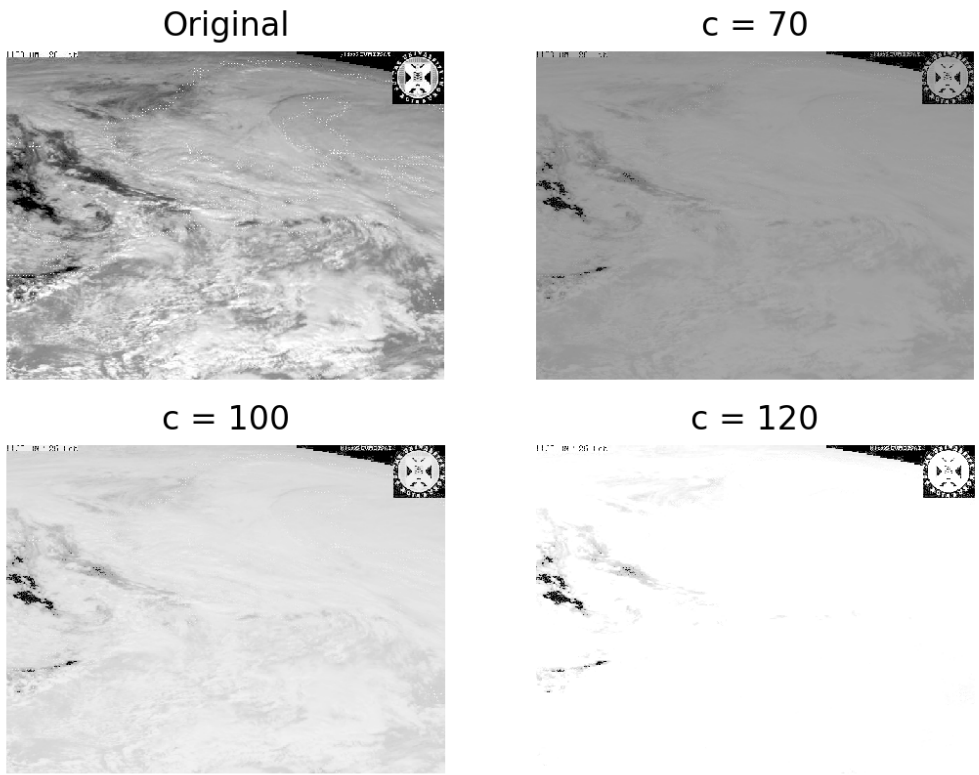

Figure: Example of lose of information after the application of Logarithm Operator

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Logarithm Operator

Objetive

In which cases should we use the logarithm operator?

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Logarithm Operator

Objetive

In which cases should we use the logarithm operator?

A logarithmic transform is appropriate when we want to enhance the low pixel values at the expense of loss of information in the high pixel values.

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Logarithm Operator

Applications

Figure: Image

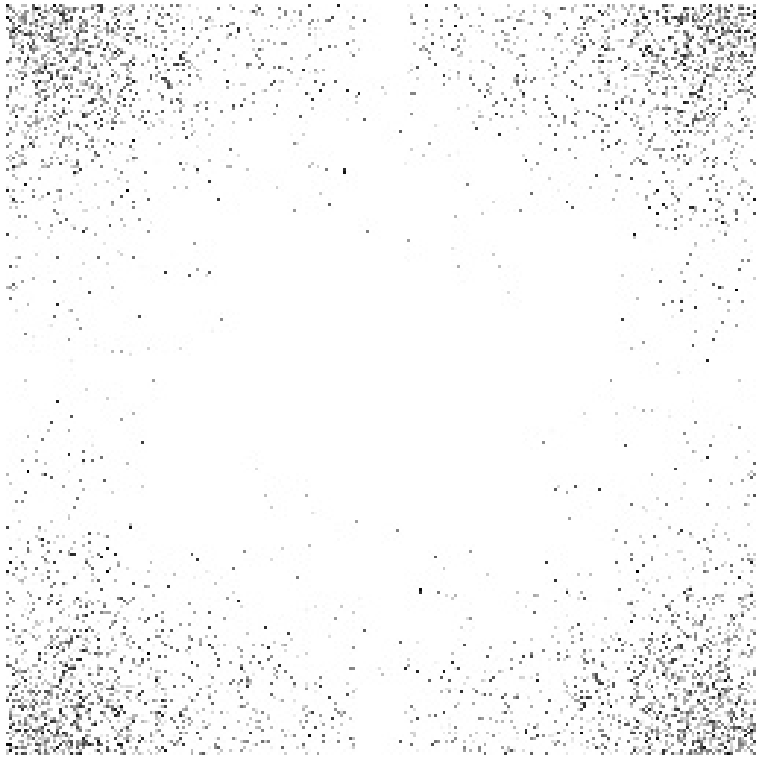

Figure: Fourier transform.

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Logarithm Operator

Applications

Figure: Image

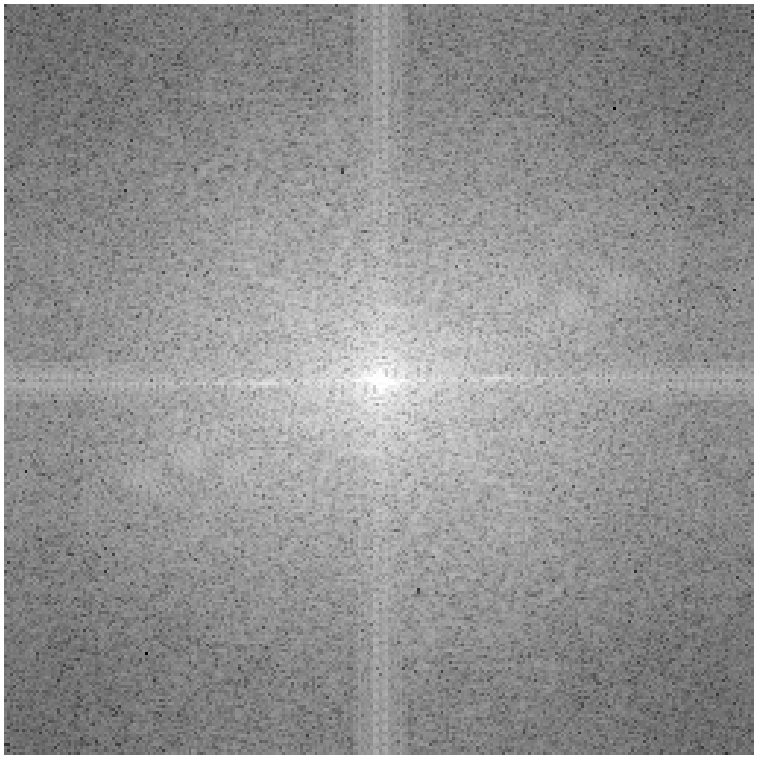

Figure: Fourier transform after logarithm operator.

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Questions?

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