Edge Detection

6.344 Final Project

Michael Mekonnen

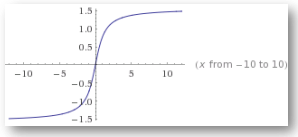
Outline

- Gradient-based method
  - Description
  - Examples
- Laplacian-based method
  - Description
  - Examples
- Comparison

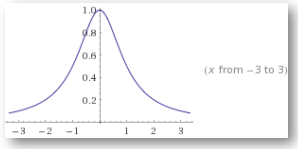
Gradient-based method

Gradient-based method

Motivation



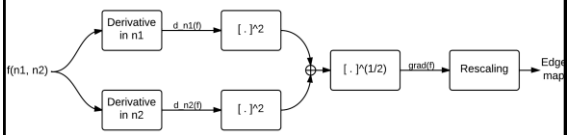
f(x)



df(x)/dx

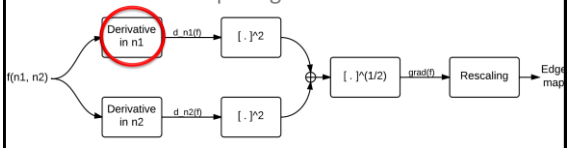
Gradient-based method

Steps



Gradient-based method

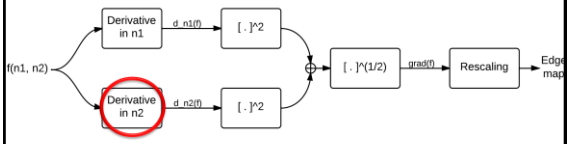
Computing Derivatives



1	-1	0	1
0	-1	0	1
-1	-1	0	1
	-1	0	1

Gradient-based method

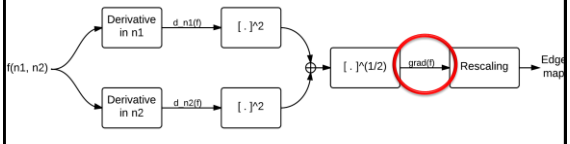
Computing Derivatives



1	1	1	1
0	0	0	0
-1	-1	-1	-1
	-1	0	1

Gradient-based method

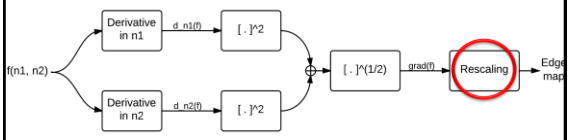
Computing Derivatives



$$|\nabla f| = \sqrt{(\frac{\partial f}{\partial x})^2 + (\frac{\partial f}{\partial y})^2}$$

Gradient-based method

Computing Derivatives



The brightness at pixel (n_1, n_2):

$$255\left(1 - \left(\frac{|\nabla f(n_1, n_2)|}{M}\right)^{\alpha}\right)$$

M: 95^{th} percentile gradient magnitude.
$\alpha > 0$: a tuning parameter.

Gradient-based method

Example 1

Gradient-based method

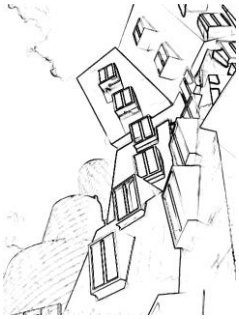
Example 1

Gradient-based method

Example 2

Gradient-based method

Example 2

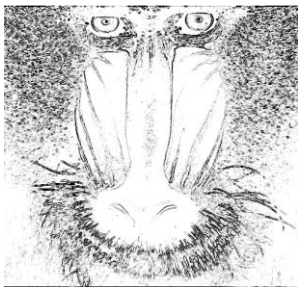


Gradient-based method

Example 3

Gradient-based method

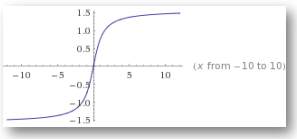
Example 3



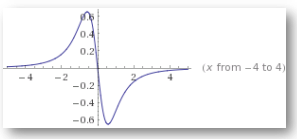
Laplacian-based method

Laplacian-based method

Motivation



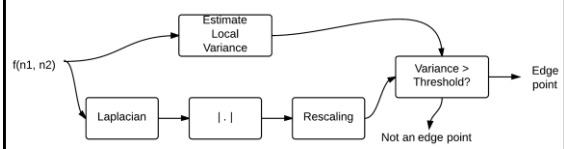
f(x)



$d^2f(x)/dx^2$

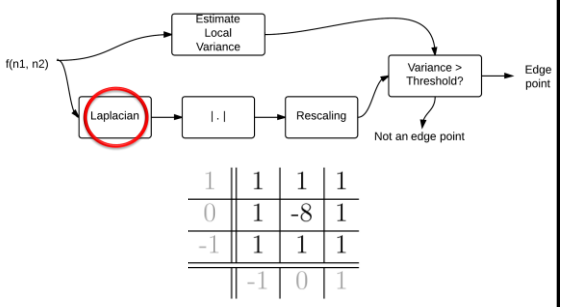
Laplacian-based method

Steps



Laplacian-based method

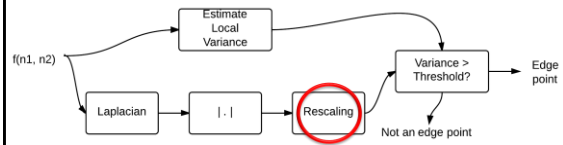
Steps



1	1	1	1
0	1	-8	1
-1	1	1	1
	-1	0	1

Laplacian-based method

Steps



The brightness at pixel (n_1, n_2):

$$255\left(1-\left(\frac{|\nabla^2 f(n_1,n_2)|}{M}\right)^{\alpha}\right)$$

M: 95^{th} percentile laplacian magnitude.
$\alpha > 0$: a tuning parameter.

Laplacian-based method

Example 1

Laplacian-based method

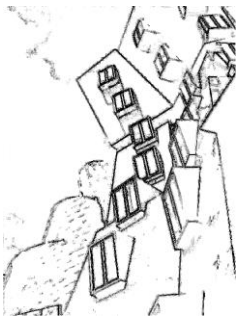
Example 1

Laplacian-based method

Example 2

Laplacian-based method

Example 2

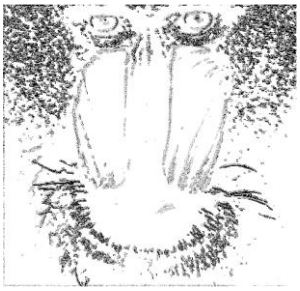


Laplacian-based method

Example 3

Laplacian-based method

Example 3



Comparison

Comparison

Original

Comparison

Gradient-based

Comparison

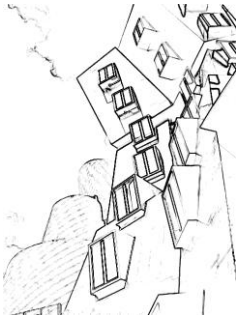
Laplacian-based

Comparison

Original

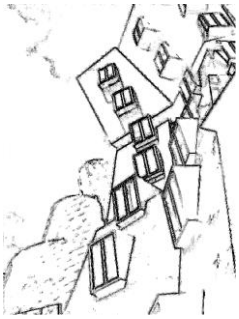
Comparison

Gradient-based



Comparison

Laplacian-based

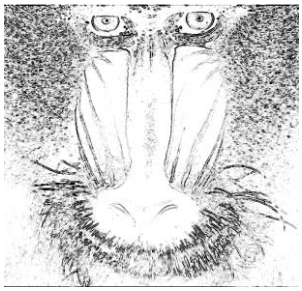


Comparison

Original

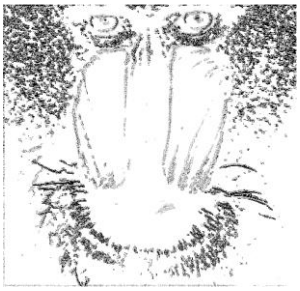
Comparison

Gradient-based



Comparison

Laplacian-based

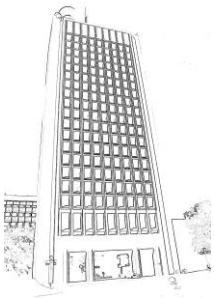


Comparison

Original

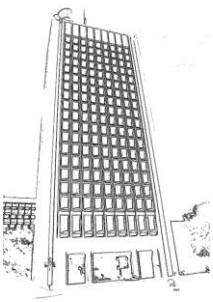
Comparison

Gradient-based



Comparison

Laplacian-based



Source

https://github.com/mikemeko/6.344-Project