Université de Genève

Chosen Chapter
14x060

TP 3 : Color Image Steganalysis Based on Steerable Gaussian Filters Banks

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1 Task1: Learn the procedure of feature extraction based on steerable Gaussian filters banks

When we use filters with image derivatives in only two directions, the gradient estimation might not be accurate. That's why we will use an orientation filter bank which improve the quality of the gradient estimation. The use of multiple orientations with filter banks allows us to easily detect features such as edges. In this work, we will do a color image steganalysis based on steerable Gaussian filters banks. The idea is to compute different directional Gaussian derivative depending on an angle θ which is a linear combination of a rotation of the basic derivatives of isotropic and σ the standard-deviation of the Gaussian filter. We obtain the image derivative by simply convolving the original grayscale image with the corresponding oriented Gaussian kernel, then we can compute the gradient magnitude by taking the absolute value response to the oriented operator. So we will have a kernel angle θ and a gradient angle which is equal to $\theta + 90$.

To compute accurately the gradient magnitude and the corresponding kernel angle, we angle the Gaussian filters in different directions. We apply this method to the three color channels to obtain three gradient magnitude images. The idea is to detect variation in the textures and edge areas so we will consider the orthogonal vector to the gradient, the tangent vector. This derivative corresponds to the convolution of the image with the steerable kernel angled at $\theta + 90$.

Here we can observe the result of this method on an image:

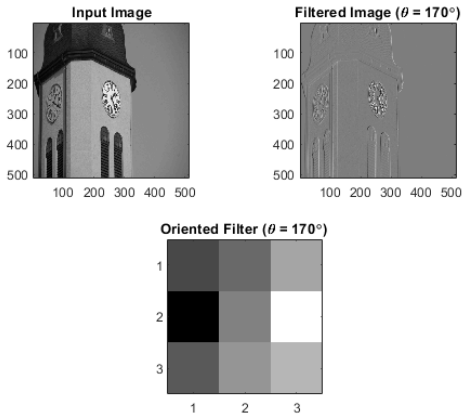

Figure 1: Oriented filtering (One of the used angles)

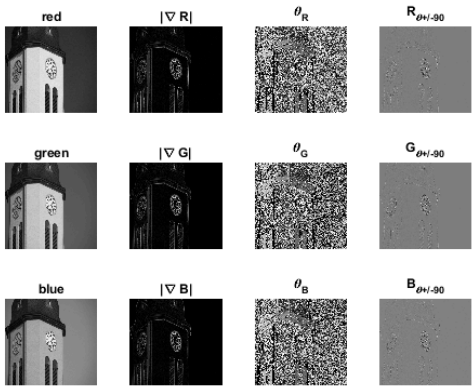

Figure 2: Each channel analysis

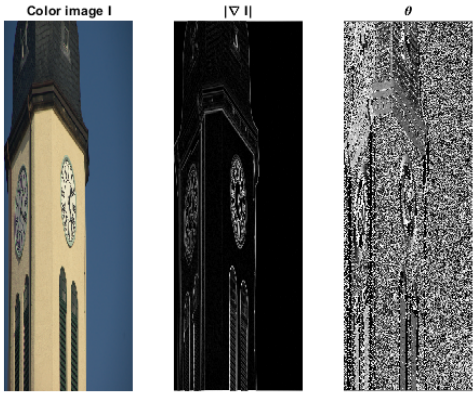

Figure 3: Global analysis

2 Task2: Generation of stego images

Here we will simply generate LSB stego images using two different images in which we have stored the message "Help me" a hundred time in the green channel:

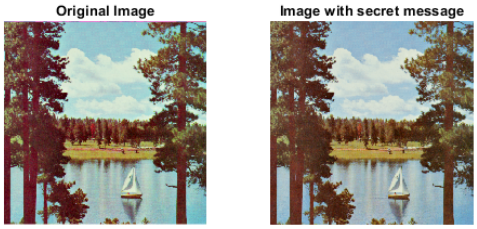

Figure 4: First image

Figure 5: Second image

3 Task3: Generation of stego images

Now we will use the steerable Gaussian filters banks to detect the presence of stego message by comparison of the extracted by steerable Gaussian filter bank features.

First, we will compare the original tower image and the corresponding stego:

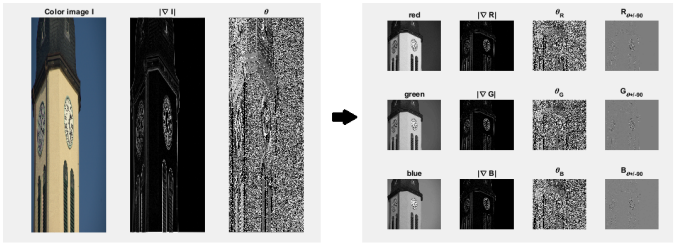

Figure 6: Original Analysis

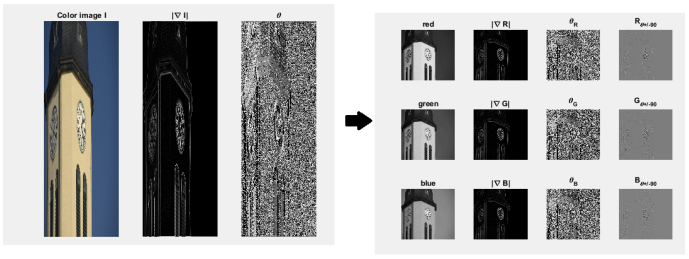

Figure 7: Stego Analysis

Then, we will compare the original lake image and the corresponding stego:

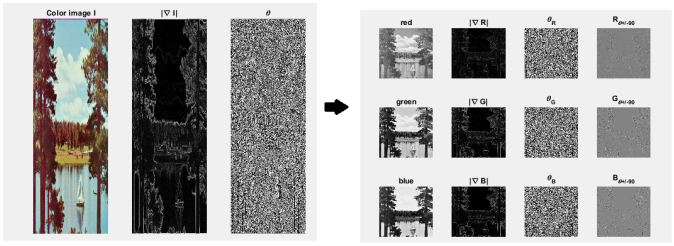

Figure 8: Original Analysis

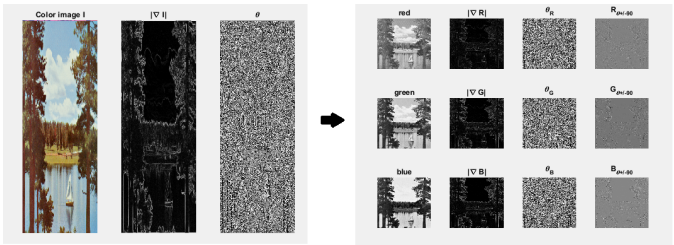

Figure 9: Stego Analysis

Visually, it's very hard to see the difference between both analysis because the secret is only an encoded string with small information in the LSB but if we look carefully we can detect some changes in the Green channel for the gradient angle $(\theta + 90)$.