How Quantization Based Schemes can be Used in Steganographic Context

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The quantization based embedding systems are usually used in the information hiding domain, thanks to their efficiency and simplicity. In other hand, they are known to be detectable then insecure in steganography context because they distort the stego-signal density function. In this work, we show that it is possible to make the quantization based stego-systems not stego-secure.

What happen when the Spread Transform is used?

- The synthetic image is composed by 16 blocs, the pixels gray level evolve along the diagonal.
- Each bloc contains one information bit and the document-to-watermark ratio : dwr = 900B.
- We insert the message given by the following matrix: m =

\[
\begin{pmatrix}
1 & 0 & 1 & 1 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0
\end{pmatrix}
\]

- The first effect is the “packetization” of the stego-image pixels provided by the quantizers.
- The second effects is that the warden is able to make the difference between the hidden bits of the stego-messages and she can read the transmitted message.
- With Spread Transform the variation of the marked bloc pixels is smoother than the QIM.

Stego-message embedding effects on the stego-image. (a) Cover-image, (b) Stego-image with QIM, (c) Histogram of the cover and stego-image with QIM, (d) Stego-image with ST-QIM, (e) Histogram of the cover and stego-image with ST-QIM.

Kullback-Leibler (KL) distance as an undetectability metric

- The Kullback-Leibler (KL) distance \( D(\mu_1, \mu_2) \) measure the distance between the probability density function (p.d.f) of cover-content and the stego-content.
- We use 100 different real images of size 350 x 350 pixels to compute the KL distance.
- The computation of the Kullback-Leibler distance confirms that the Spread Transform enhances the undetectability level of the quantization based systems.

Contributions

- We prove that the spread transform enhances the stego-message undetectability without any constrains as in Guillon et al scheme [2].
- We shall evaluate the resistance of the steganographic quantization based systems combined with the spread transform with other adapted steganalysis methods.

References