Visible Watermarking Algorithm

The steps for watermark insertion are discussed below:

- The original image **I** (one to be watermarked) and the watermark image W are divided into blocks of size 8*8. (both the images may not be of equal size).

- For each block of the original image **I** the mean gray value $\boldsymbol{\mu_n}$ is computed.

- The DCT for each block of the original image are found.

- The DCT of watermark image blocks are found out.

- For AC DCT co-efficient of each original image block, variance $\boldsymbol{\sigma_n}$ is found out.

- The block means $\boldsymbol{\mu_n}$ scaled to the range 0.1 to 1.0.

- The log of the variance $\boldsymbol{\sigma_n}$ are scaled to the range 0.1 to 1.0.

- The image mean $\boldsymbol{\mu}$ is found out which the mean of block means $\boldsymbol{\mu_n}$.

- Let in denote the nth DCT block of original image **I**, and $\mathbf{w_n}$ denote the nth DCT block of watermark image **W**. Denoting the nth block of watermarked image by $\mathbf{i_n'}$, we have,

$$\mathbf{i_n' = \alpha_n . i_n + \beta n\ w_n} \qquad \mathbf{n = 1,2,\ldots\ldots\ldots\ldots} \qquad \text{eqn. (1)}$$

The $\boldsymbol{\alpha_n}$ and $\boldsymbol{\beta_n}$ are classified and Gaussian random numbers are added where $\boldsymbol{\alpha_n}$ and $\boldsymbol{\beta_n}$ are scaling and embedding factors respectively for each block computed as described. They are computed using eqn. (2) and eqn. (3). (if required).

- The IDCT of $\mathbf{i_n'}$ are found out which give the watermarked image **I'**.

- Basing on the above discussion we propose the following mathematical model.

  $$\alpha_n = \alpha_{max} + (\sigma_n (\alpha_{max} - \alpha_{min})/ \sigma_{max}) \exp. (- (\mu_n - \mu)^2/2),$$

  $$\beta_n = \beta_{min} + (\sigma_{min} (\beta_{max} - \beta_{min})/ \sigma_n) [1 - \exp (- (\mu_n - \mu)^2/2],$$

  Where,

  α_{min} and α_{max} are respectively minimum and maximum values of scaling factor,

  β_{min} and β_{max} are respectively minimum and maximum values of embedding factor,

  μ_n is normalized mean for each block,

  σ_n is normalized variance of each DCT blocks,

  σ_{min} and σ_{max} are respectively minimum and maximum values of DCT block variances,

  μ is the normalized image mean.

This algorithm is implemented by Rajan Sheth, Adrain Pinto and Nitesh Chawada.
http://www.geocities.com/gwatermarker

Source: Suraju Mohanty's Thesis.