

CSEP 590P 590

Assignment 7

Due Thursday, November 29, 2007

The actual SPIHT algorithm behaves slightly different than the one described in class. In the actual algorithm, there are two lists of coefficients instead of one. Call the lists I and S for insignificant and significant, respectively. The list I contains the coefficients that are not part of zero-trees that are still insignificant and S contains the coefficients that are significant. The initialization is to put all the lowest subband coefficients into I and set S to be empty. The stack of zero-trees is identical to the class version. The significance pass has two parts.

- For each coefficient in I check for significance. If significant output 1 and the sign, then add the coefficient to the temporary list S' . If insignificant output 0.
- This part is identical to the significance pass in the class algorithm, except for the decomposition. In the class version of the decomposition of an R-tree we declare the children of the R-tree to be significant and output their signs and add them to S . In the actual SPIHT version we check each of the children for significance. If significant we output 1 plus the sign, and add the coefficient to the list S' . If insignificant we output 0 and add the coefficient to I .

At the end of the refinement pass we append S' to S .

One advantage of the actual version of SPIHT over the class version is that fewer sign bits are transmitted because sign bits are only transmitted in the actual version when a coefficient becomes significant. In the class version sign bits are transmitted when an R-tree is decomposed.

Consider the 8×8 wavelet transformed image with 3 levels of transform. Assume all coefficients are normalized to be in the interval $(-1, 1)$. The coefficients $c(0, 0) = .1 \dots$, $c(0, 1) = .1 \dots$, $c(1, 0) = .1 \dots$, $c(1, 1) = .1 \dots$, $c(6, 6) = -.1 \dots$, and all other coefficients have 0 in the first bit plane.

1. Run the first pass of the class version of SPIHT assuming that any coefficients that are declared to be significant have positive sign. Show the major steps. How many bits are produced?
2. Run the first pass of actual SPIHT. Show the major steps. How many bits are produced?