Compression Patents

- Compression has many patents
  - [www.faqs.org/faqs/compression-faq/part1/section-7.html]
- There are notable non-patented algorithms
  - gzip is the most famous
- Pros
  - Make money on a good idea
- Cons
  - Many patents are for trivial improvements
  - Patents may impede progress
  - Patents can be ignored or researched

Lapped Transform Artifacts

Original

DCT

LBT

SPIHT Decoding

- The decoder emulates the encoder.
  - The decoder maintains exactly the same data structures as the encoder.
  - When the decoder has popped the Z stack to examine a zero tree it receives a bit telling it whether the tree is significant. The decoder can then do the right thing.
  - If it is significant then it does the decomposition.
  - If it is not significant then it deduces a number of zeros in the current bit plane.

SPIHT Decoder

\[ \text{k-th iteration} \]
\[ \text{We have list S of significant values and a stack Z of zero trees from the previous pass or the initialization.} \]
\[ \text{Significance Pass:} \]
\[ \text{while Z is not empty do} \]
\[ T \leftarrow \text{pop}(Z); \]
\[ \text{input} \leftarrow \text{read}; \]
\[ \text{if input} = 1 \text{ then decompose}(T); \]
\[ \text{else push T on } Z'. \]
\[ Z \leftarrow Z'; \text{ (At this point all indices in zero trees in Z are insignificant)} \]
\[ \text{Refinement Pass:} \]
\[ \text{for each } (i,j) \text{ in S do } C[i,j,k] \leftarrow \text{read.} \]

In decompose the signs of coefficients are input

SPIHT Decoding Example

Initial data structure:
\[ S = (0,0), (0,1), (1,0), (1,1) \]
\[ Z = (R,0,1), (R,1,0), (R,1,1) \]
\[ \text{sign}(0,0) = - \text{ sign}(0,1) = + \]
\[ \text{sign}(1,0) = + \text{ sign}(1,1) = + \]

in S
SPIHT Decoding Example

01111101101100101100001011000100000010

S = (0,0), (0,1), (1,0), (1,1),
(0,2), (0,3), (1,2), (1,3)

Z = (R,0,1), (R,1,0), (R,1,1)

(R,0,1) is significant

S = (0,0), (0,1), (1,0), (1,1),
(0,2), (0,3), (1,2), (1,3)

sign(0,2) = +  sign(0,3) = +

sign(1,2) = -  sign(1,3) = +

Z = (RC,0,1), (R,1,0), (R,1,1)

Z' = (RC,0,1) in S

0 1 1 1 1 1 0 1 1 0 1 1 0 0 1 0 1 1 0 1 0 1 0 0 0 0 0 0 0 0 0 1 0

SPIHT Decoding Example

01111101101100101100001011000100000010

S = (0,0), (0,1), (1,0), (1,1),
(0,2), (0,3), (1,2), (1,3)

Z = (R,0,1), (R,1,0), (R,1,1)

(R,0,1) is significant

S = (0,0), (0,1), (1,0), (1,1),
(0,2), (0,3), (1,2), (1,3)

sign(0,2) = +  sign(0,3) = +

sign(1,2) = -  sign(1,3) = -

Z = (RC,1,0), (R,1,1)

Z' = (RC,0,1) in S

0 1 1 1 1 1 1 0 1 0 1 1 1 0 0 1 0 1 1 0 1 0 0 0 0 1 0 1 1 0 0 0 1 0 0 0 0 0 0 1 0
SPIHT Decoding Example

0111110101111001011110010110001000000010

S = (0,0), (0,1), (1,0), (1,1), (0,2), (0,3), (1,2), (1,3), (2,0), (2,1), (3,0), (3,1), (4,2), (4,3), (5,2), (5,3)
Z = (R,1,1), (R,3,0), (R,2,0), (RC,0,1)

(R,3,0) is insignificant
S = (0,0), (0,1), (1,0), (1,1), (0,2), (0,3), (1,2), (1,3), (2,0), (2,1), (3,0), (3,1), (4,2), (4,3), (5,2), (5,3)
Z = (R,3,1), (R,1,1)
Z' = (R,3,0), (R,2,0), (RC,0,1)

in S

0 1 1 1 1 1 0 1 1 1 1 0 0 1 0 1 1 1 0 1 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 0 1 0

SPIHT Decoding Example

0111110101111001011110010110001000000010

S = (0,0), (0,1), (1,0), (1,1), (0,2), (0,3), (1,2), (1,3), (2,0), (2,1), (3,0), (3,1), (4,2), (4,3), (5,2), (5,3)
Z = (R,3,1), (R,1,1)
Z' = (R,3,0), (R,2,0), (RC,0,1)

(R,3,1) is insignificant
S = (0,0), (0,1), (1,0), (1,1), (0,2), (0,3), (1,2), (1,3), (2,0), (2,1), (3,0), (3,1), (4,2), (4,3), (5,2), (5,3)
Z = (R,1,1), (R,3,1), (R,3,0), (R,2,0), (RC,0,1)

in S

0 1 1 1 1 1 0 1 1 1 1 0 0 1 0 1 1 1 0 1 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 0 1 0