Example with SPECK algorithm

Figure 1 shows the example of data in a small pyramid structure, of the type resulting from an image wavelet sition, that was used by J.M. Shapiro in his paper "Embedded Image Coding Using Zerotrees of Wavelet Coefficie *Transactions on Signal Processing,*, vol. 41, Dec. 1993, to describe his EZW image coding algorithm.

	0	1	2	3	4	5	6	7
0	63	–34	49	10	7	13	–12	7
1	–31	23	14	–13	3	4	6	–1
2	15	14	3	–12	5	–7	3	9
3	–9	–7	–14	8	4	–2	3	2
4	–5	9	–1	47	4	6	–2	2
5	3	0	–3	2	3	–2	0	4
6	2	–3	6	–4	3	6	3	6
7	5	11	5	6	0	3	–4	4

Figure 1: Set of image wavelet coefficients used by example. The numbers outside the box indicate the set of co-ordi

Notational conventions:

- $S^k(i, j)$ under Point or Set denotes $2^k \times 2^k$ set with (i, j) upper left corner co-ordinate.

- $(i, j)\mathbf{k}$ under Control Lists denotes $2^k \times 2^k$ set with (i, j) upper left corner co-ordinate.

- (i, j) in LSP always a single point.

Comment	Point or Set	Output Bit	Action	Control Lists
n=5 Sorting $\mathcal{S}=S^1(0,0)$, $\mathcal{I}$ = rest				LIS = $\{(0,0)\mathbf{1}\}$ LSP = ϕ
	$S^1(0,0)$	1	quad split, add to LIS(0)	LIS =$\{ (0,0)\mathbf{0},(0,1)\mathbf{0},(1,0)\mathbf{0},(1,1)\mathbf{0}\}$ LSP = ϕ
	(0,0)	1+	(0,0) to LSP	LIS = $\{(0,1)\mathbf{0},(1,0)\mathbf{0},(1,1)\mathbf{0}\}$ LSP = $\{(0,0)\}$
	(0,1)	1-	(0,1) to LSP	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\}$ LSP = $\{(0,0),(0,1)\}$
	(1,0)	0	none	
	(1,1)	0	none	
Test $\mathcal{I}$	$\mathcal{S}(\mathcal{I})$	1	split to 3 $\mathcal{S}$'s, new $\mathcal{I}$	
	$S^1(0,2)$	1	quad split, add to LIS(0)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\},(0,2)\mathbf{0},(0,3)\mathbf{0}\}(1,2)\mathbf{0},($
	(0,2)	1+	(0,2) to LSP	LSP = $\{(0,0),(0,1),(0,2)\}$ LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\},(0,3)\mathbf{0}\}(1,2)\mathbf{0},(1,3)\mathbf{0}\}$
	(0,3)	0	none	
	(1,2)	0	none	
	(1,3)	0	none	
	$S^1(2,0)$	0	add to LIS(1)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\},(0,3)\mathbf{0}\}(1,2)\mathbf{0},(1,3)\mathbf{0},($
	$S^1(2,2)$	0	add to LIS(1)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\},(0,3)\mathbf{0}\}(1,2)\mathbf{0},(1,3)\mathbf{0},($
Test $\mathcal{I}$	$\mathcal{S}(\mathcal{I})$	1	split to 3 $\mathcal{S}$'s	
	$S^2(0,4)$	0	add to LIS(2)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0}\},(0,3)\mathbf{0}\}(1,2)\mathbf{0},(1,3)\mathbf{0},($
	$S^2(4,0)$	1	quad split, add to LIS(1)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0},(0,3)\mathbf{0},(1,2)\mathbf{0},(1,3)\mathbf{0},(2$
	$S^1(4,0)$	0	none	
	$S^1(4,2)$	1	quad split, add to LIS(0)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0},(0,3)\mathbf{0},(1,2)\mathbf{0},(1,3)\mathbf{0},(4$ $(4,0)\mathbf{1},(4,2)\mathbf{1},(6,0)\mathbf{1},(6,2)\mathbf{1},(0,4)\mathbf{2}\}$
	(4,2)	0	none	
	(4,3)	1+	move (4,3) to LSP	LSP = $\{(0,0),(0,1),(0,2),(4,3)\}$ LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0},(0,3)\mathbf{0}\}(1,2)\mathbf{0},(1,3)\mathbf{0},(4$ $(4,2)\mathbf{1},(6,0)\mathbf{1},(6,2)\mathbf{1},(0,4)\mathbf{2}\}$
	(5,2)	0	none	
	(5,3)	0	none	
	$S^1(6,0)$	0	none	
	$S^1(6,2)$	0	none	
End n=5 Sorting	$S^2(4,4)$	0	add to LIS(2)	LIS = $\{(1,0)\mathbf{0},(1,1)\mathbf{0},(0,3)\mathbf{0},(1,2)\mathbf{0},(1,3)\mathbf{0},(4$ $(4,2)\mathbf{1},(6,0)\mathbf{1},(6,2)\mathbf{1},(0,4)\mathbf{2}, (4,4)\mathbf{2}\}$ LSP = $\{(0,0),(0,1),(0,2),(4,3)\}$

Comment	Point or Set Tested	Output Bit	Action	Control Lists
n=4 Sorting				LIS = {(1,0)**0**,(1,1)**0**,(0,3)**0**,(1,2)**0**,(1,3
				(4,2)**1**,(6,0)**1**,(6,2)**1**,(0,4)**2**, (4,4)**2**}
				LSP = {(0,0),(0,1),(0,2),(4,3)}
Test LIS(0)	(1,0)	1-	(1,0) to LSP	
	(1,1)	1+	(1,1) to LSP	LIS = {(0,3)**0**,(1,2)**0**,(1,3)**0**,(4,2)**0**,(5,2
				(4,2)**1**,(6,0)**1**,(6,2)**1**,(0,4)**2**, (4,4)**2**}
				LSP = {(0,0),(0,1),(0,2),(4,3),(1,0),(1,
	(0,3)	0	none	
	(1,2)	0	none	
	(1,3)	0	none	
	(4,2)	0	none	
	(5,2)	0	none	
	(5,3)	0	none	
Test LIS(1)	$S^1(2,0)$	0	none	
	$S^1(2,2)$	0	none	
	$S^1(4,0)$	0	none	
	$S^1(6,0)$	0	none	
	$S^1(6,2)$	0	none	
Test LIS(2)	$S^2(0,4)$	0	none	
	$S^2(4,4)$	0	none	
Refinement	(0,0)	1	decoder adds 2^4	
	(0,1)	0	decoder subtracts 0	
	((0,2)	1	decoder adds 2^4	
	(4,3)	0	decoder adds 0	
End n=4				