

## CLAIMS:

1. A method (400) for filtering sample values associated with an image, the method comprising:

obtaining (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values  $B1_{i,k}$  for  $i=0-7$  and  $k=0-3$ , and the second block of sample values comprises a set of sample values  $B2_{i,k}$  for  $i=0-7$  and  $k=0-3$ ; and

deciding (s404) whether or not to use a long filter to filter at least a subset of the first set of sample values, wherein deciding whether or not to use a long filter to filter at least a subset of the first set of sample values comprises:

calculating (s502) a first gradient value,  $\maxGradB1_{6,0}$ , using sample value  $B1_{6,0}$ ;  
 calculating (s504) a first pq value,  $pq1_0$ , using  $\maxGradB1_{6,0}$ ; and  
 comparing (s508)  $pq1_0$  to a threshold.

2. The method of claim 1, wherein deciding whether or not to use a long filter to filter at least a subset of the first set of sample values further comprises:

calculating a second gradient value,  $\maxGradB1_{6,3}$ , using sample value  $B1_{6,3}$ ,  
 calculating a second pq value,  $pq1_3$ , using  $\maxGradB1_{6,3}$ , and  
 comparing (s508)  $pq1_3$  to the threshold.

3. The method of claim 1 or 2, wherein calculating  $pq1_0$  comprises calculating a value  $sp$ , calculating a value  $sq$ , and calculating  $sp + sq$ , wherein  $pq1_0 = (sp + sq)$ , and wherein calculating  $sp$  comprises calculating  $sp = (\text{Abs}(B1_{0,0} - B1_{3,0}) + \text{Abs}(B1_{3,0} - B1_{7,0}) + \maxGradB1_{6,0} + 1) \gg 1$ .

4. The method of claim 3, wherein  $\maxGradB1_{6,0}$  equals  $\text{Abs}(B1_{7,0} - B1_{6,0} - B1_{5,0} + B1_{4,0})$ .

5. The method of claim 3 or 4, wherein  
 the second block has a maximum filter length,  $\maxFilterLengthQ$ ,

if maxFilterLengthQ is equal to 7, then  $sq = (Abs(B2_{0,0} - B2_{3,0}) + Abs(B2_{3,0} - B2_{7,0}) + maxGradB2_{6,0} + 1) >> 1$ , where maxGradB2<sub>6,0</sub> is a third gradient value,

if maxFilterLengthQ is equal to 5, then  $sq = (Abs(B2_{0,0} - B2_{3,0}) + Abs(B2_{3,0} - B2_{5,0}) + 1) >> 1$ , and

if maxFilterLengthQ is not equal to 7 and is not equal to 5, then  $sq = Abs(B2_{0,0} - B2_{3,0})$ .

6. The method of claim 5, wherein maxGradB2<sub>6,0</sub> equals  $Abs(B2_{7,0} - B2_{6,0} - B2_{5,0} + B2_{4,0})$ .

7. The method of any one of claims 2-6, wherein calculating pq1<sub>3</sub> comprises calculating a value sp3, calculating a value sq3, and calculating  $sp3 + sq3$ , wherein  $pq1_3 = (sp3 + sq3)$ , and wherein calculating sp3 comprises calculating  $sp3 = (Abs(B1_{0,3} - B1_{3,3}) + Abs(B1_{3,3} - B1_{7,3}) + maxGradB1_{6,3} + 1) >> 1$ .

8. The method of claim 7, wherein maxGradB1<sub>6,3</sub> equals  $Abs(B1_{7,3} - B1_{6,3} - B1_{5,3} + B1_{4,3})$ .

9. The method of any one of claims 1-8, wherein  
the step of calculating pq1<sub>0</sub> using maxGradB1<sub>6,0</sub> is performed as a result of determining that a maximum filter length for the first block, maxFilterLengthP, is equal to 7.

10. The method of any one of claims 2-9, wherein  
the step of calculating pq1<sub>3</sub> using maxGradB1<sub>6,3</sub> is performed as a result of determining that a max filter length for the first block, maxFilterLengthP, is equal to 7.

11. The method of claim 7, wherein  
the second block has a maximum filter length, maxFilterLengthQ,  
if maxFilterLengthQ is equal to 7, then  $sq3 = (Abs(B2_{0,3} - B2_{3,3}) + Abs(B2_{3,3} - B2_{7,3}) + maxGradB2_{6,3} + 1) >> 1$ , where maxGradB2<sub>6,3</sub> is a fourth gradient value,  
if maxFilterLengthQ is equal to 5, then  $sq3 = (Abs(B2_{0,3} - B2_{3,3}) + Abs(B2_{3,3} -$

$B2\_5,3) + 1) >> 1$ , and

if maxFilterLengthQ is not equal to 5 and not equal to 7, then  $sq3 = \text{Abs}(B2\_0,3 - B2\_3,3)$ .

12. The method of claim 11, wherein maxGradB2\_6,3 equals  $\text{Abs}(B2\_7,3 - B2\_6,3 - B2\_5,3 + B2\_4,3)$ .

13. The method of any one of claims 1-12, wherein

when deblocking a vertical boundary, the i value identifies a column of a block and the k value identifies a row of the block, and

when deblocking a horizontal boundary, the k value identifies a column of the block and the i value identifies a row of the block.

14. The method of any one of claims 1-13, wherein B1\_0,0 refers to the sample in the first block which is closest to a sample B2\_0,0 in the second block, wherein B1\_1,0 is closest to B1\_0,0, B1\_2,0 is closest to B1\_1,0, B1\_3,0 is closest to B1\_2,0, B1\_4,0 is closest to B1\_3,0, B1\_5,0 is closest to B1\_4,0, B1\_6,0 is closest to B1\_5,0, B1\_7,0 is closest to B1\_6,0, B2\_1,0 is closest to B2\_0,0, B2\_2,0 is closest to B2\_1,0, B2\_3,0 is closest to B2\_2,0, B2\_4,0 is closest to B2\_3,0, B2\_5,0 is closest to B2\_4,0, B2\_6,0 is closest to B2\_5,0, B2\_7,0 is closest to B2\_6,0, wherein B1\_0,3 refers to the sample in the first block which is closest to a sample B2\_0,3 in the second block, wherein B1\_1,3 is closest to B1\_0,3, B1\_2,3 is closest to B1\_1,3, B1\_3,3 is closest to B1\_2,3, B1\_4,3 is closest to B1\_3,3, B1\_5,3 is closest to B1\_4,3, B1\_6,3 is closest to B1\_5,3, B1\_7,3 is closest to B1\_6,3, B2\_1,3 is closest to B2\_0,3, B2\_2,3 is closest to B2\_1,3, B2\_3,3 is closest to B2\_2,3, B2\_4,3 is closest to B2\_3,3, B2\_5,3 is closest to B2\_4,3, B2\_6,3 is closest to B2\_5,3, B2\_7,3 is closest to B2\_6,3.

15. The method of any one of claims 1-14, wherein the samples to filter by the long filter when maxFilterLengthP is equal to 7 are B1\_0,0 to B1\_6,0, B1\_0,1 to B1\_6,1, B1\_0,2 to B1\_6,2 and B1\_0,3 to B1\_6,3.

16. The method of any one of claims 1-15, wherein the samples to filter by the long filter

when maxFilterLengthQ is equal to 7 are B2\_0,0 to B2\_6,0, B2\_0,1 to B2\_6,1, B2\_0,2 to B2\_6,2 and B2\_0,3 to B2\_6,3.

17. A method (400) for filtering sample values associated with an image, the method comprising:

obtaining (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values B1\_i,k for i=0-7 and k=0-3, and the second block of sample values comprises a set of sample values B2\_i,k for i=0-7 and k=0-3; and

selecting (s404) a filter, wherein selecting the filter comprises:

calculating (s504) a first pq value, pq2\_0, using at least a first value equal to  $\text{Abs}(B1_{2,0} - 2 * B1_{1,0} + B1_{0,0})$  and a second value equal to  $\text{Abs}(B2_{2,0} - 2 * B2_{1,0} + B2_{0,0})$ ; and

comparing (s508) pq2\_0 to a threshold, wherein the threshold is equal to  $\beta >> 4$ , and

$\beta$  is selected from a set of predetermined beta values based on a quantization parameter value, Q.

18. The method of claim 17, wherein selecting the filter further comprises calculating a second pq value, pq2\_3, using at least a first value equal to  $\text{Abs}(B1_{2,3} - 2 * B1_{1,3} + B1_{0,3})$  and a second value equal to  $\text{Abs}(B2_{2,3} - 2 * B2_{1,3} + B2_{0,3})$ ; and comparing pq2\_3 to the threshold.

19. A method for filtering sample values associated with an image, the method comprising:

1) obtaining (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values B1\_i,k for i=0-7 and k=0-3, and the second block of sample values comprises a set of sample values B2\_i,k for i=0-7 and k=0-3; and

2) selecting (s404) a filter, wherein selecting the filter comprises:

i) calculating a first pq value, pq1\_0, wherein calculating pq1\_0 comprises

calculating a value  $sp$ , calculating a value  $sq$ , and calculating  $sp + sq$ , wherein  $pq1\_0 = (sp + sq)$ ;

ii) comparing  $pq1\_0$  to a first threshold;

iii) calculating (s504) a second pq value,  $pq2\_0$ , using at least a first value equal to  $Abs(B1\_2,0 - 2 * B1\_1,0 + B1\_0,0)$  and a second value equal to  $Abs(B2\_2,0 - 2 * B2\_1,0 + B2\_0,0)$ ; and

iv) comparing (s508)  $pq2\_0$  to a second threshold, wherein the second threshold is equal to  $\beta >> 4$ , and  $\beta$  is selected from a set of predetermined beta values based on a quantization parameter value,  $Q$ .

20. The method as in claim 19 wherein selecting the filter further comprises:

calculating a third pq value,  $pq3\_0$ , wherein  $pq3\_0 = Abs(B1\_0,0 - B2\_0,0)$ ; and

comparing  $pq3\_0$  with a third threshold, wherein

the third threshold is equal to  $(5*tC+1) >> 1$ , wherein  $tC$  is selected from a set of predetermined values based on a quantization parameter value,  $Q$ .

21. The method as in claim 19 or 20, wherein selecting the filter further comprises:

calculating a fourth pq value,  $pq2\_3$ ;

comparing  $pq2\_3$  to the second threshold;

calculating a fifth pq value,  $pq1\_3$ ; and

comparing  $pq1\_3$  to the first threshold, wherein

the step of calculating  $pq2\_3$  comprises calculating  $pq2\_3$  using at least a first value equal to  $Abs(B1\_2,3 - 2 * B1\_1,3 + B1\_0,3)$  and a second value equal to  $Abs(B2\_2,3 - 2 * B2\_1,3 + B2\_0,3)$ , and when  $maxFilterLengthP$  is greater than 3 also using a third value  $Abs(B1\_5,3 - 2*B1\_4,3 + B1\_3,3)$  and when  $maxFilterLengthQ$  is greater than 3 also using a fourth value  $Abs(B2\_5,3 - 2*B2\_4,3 + B2\_3,3)$ ,

the step of calculating  $pq1\_3$  comprises: calculating a value  $sp3$ , calculating a value  $sq3$ , and calculating  $sp3 + sq3$ , where  $pq1\_3 = (sp3 + sq3)$ .

22. The method as in claim 21, wherein selecting the filter further comprises:

calculating a sixth pq value,  $pq3\_3$ , wherein  $pq3\_3 = Abs(B1\_0,3 - B2\_0,3)$ ; and

comparing  $pq3\_3$  with the third threshold.

23. The method of any one of claims 19-22, wherein the filter is used to modify 7 samples on each of lines 0 to line 3 in block B1 when conditions for line 0 and line 3 are less than a respective threshold (e.g. for line 0  $pq1\_0 < thr1$  and  $pq2\_0 < thr2$  and  $pq3\_0 < thr3$  and line 3  $pq1\_3 < thr1$  and  $pq2\_3 < thr2$  and  $pq3\_3 < thr3$ ).

24. The method as in claim 23, wherein  $thr1$  is equal to  $3 * \beta \gg 5$ ,  $thr2$  is equal to  $\beta \gg 4$  and  $thr3$  is equal to  $(5 * tC + 1) \gg 1$ .

25. The method of any one of claims 19-24, wherein  
the first block has a maximum filter length,  $maxFilterLengthP$ ,  
if  $maxFilterLengthP$  is equal to 7, then calculating  $sp$  comprises calculating  $sp = (Abs(B1\_0,0 - B1\_3,0) + Abs(B1\_3,0 - B1\_7,0) + maxGradB1\_6,0 + 1) \gg 1$ , where  $maxGradB1\_6,0$  is a gradient value,  
if  $maxFilterLengthP$  is 5, then calculating  $sp$  comprises calculating  $sp = (Abs(B1\_0,0 - B1\_3,0) + Abs(B1\_3,0 - B1\_5,0) + 1) \gg 1$ , and  
if  $maxFilterLengthP$  is equal to 3, then calculating  $sp$  comprises calculating  $sp = Abs(B1\_0,0 - B1\_3,0)$ .

26. The method of claim 25, wherein  $maxGradB1\_6,0$  equals  $Abs(B1\_7,0 - B1\_6,0 - B1\_5,0 + B1\_4,0)$ .

27. The method of any one of claims 19-26, wherein  
the second block has a maximum filter length,  $maxFilterLengthQ$ ,  
if  $maxFilterLengthQ$  is equal to 7, then calculating  $sq$  comprises calculating  $sq = (Abs(B2\_0,0 - B2\_3,0) + Abs(B2\_3,0 - B2\_7,0) + maxGradB2\_6,0 + 1) \gg 1$ , where  $maxGradB2\_6,0$  is a gradient value,  
if  $maxFilterLengthQ$  is equal to 5, then calculating  $sq$  comprises calculating  $sq = (Abs(B2\_0,0 - B2\_3,0) + Abs(B2\_3,0 - B2\_5,0) + 1) \gg 1$ , and  
if  $maxFilterLengthQ$  is equal to 3, then calculating  $sq$  comprises calculating  $sq =$

$\text{Abs}(\text{B2\_0,0} - \text{B2\_3,0})$ .

28. The method of claim 27, wherein  $\text{maxGradB2\_6,0}$  equals  $\text{Abs}(\text{B2\_7,0} - \text{B2\_6,0} - \text{B2\_5,0} + \text{B2\_4,0})$ .

29. The method of any one of claims 19-28, wherein  
and when  $\text{maxFilterLengthP}$  is greater than 3 also using a third value  $\text{Abs}(\text{B1\_5,0} - 2*\text{B1\_4,0} + \text{B1\_3,0})$  and wherein the second block has a maximum filter length,  $\text{maxFilterLengthQ}$ , and when  $\text{maxFilterLengthQ}$  is greater than 3 also using a fourth value  $\text{Abs}(\text{B2\_5,0} - 2*\text{B2\_4,0} + \text{B2\_3,0})$ .

30. The method of claim 21 or 22, wherein  
if  $\text{maxFilterLengthP}$  is equal to 7, then calculating  $\text{sp3}$  comprises calculating  $\text{sp3} = (\text{Abs}(\text{B1\_0,3} - \text{B1\_3,3}) + \text{Abs}(\text{B1\_3,3} - \text{B1\_7,3}) + \text{maxGradB1\_6,3} + 1) >> 1$ , where  $\text{maxGradB1\_6,3}$  is a gradient value,  
if  $\text{maxFilterLengthP}$  is equal to 5, then calculating  $\text{sp3}$  comprises calculating  $\text{sp3} = (\text{Abs}(\text{B1\_0,3} - \text{B1\_3,3}) + \text{Abs}(\text{B1\_3,3} - \text{B1\_5,3}) + 1) >> 1$ ,  
if  $\text{maxFilterLengthP}$  is equal to 3, then calculating  $\text{sp3}$  comprises calculating  $\text{sp3} = \text{Abs}(\text{B1\_0,3} - \text{B1\_3,3})$ ,  
if  $\text{maxFilterLengthQ}$  is equal to 7, then calculating  $\text{sq3}$  comprises calculating  $\text{sq3} = (\text{Abs}(\text{B2\_0,3} - \text{B2\_3,3}) + \text{Abs}(\text{B2\_3,3} - \text{B2\_7,3}) + \text{maxGradB2\_6,3} + 1) >> 1$ , where  $\text{maxGradB2\_6,3}$  is a gradient value,  
if  $\text{maxFilterLengthQ}$  is equal to 5, then calculating  $\text{sq3}$  comprises calculating  $\text{sq3} = (\text{Abs}(\text{B2\_0,3} - \text{B2\_3,3}) + \text{Abs}(\text{B2\_3,3} - \text{B2\_5,3}) + 1) >> 1$ , and  
if  $\text{maxFilterLengthQ}$  is equal to 3, then calculating  $\text{sq3}$  comprises calculating  $\text{sq3} = \text{Abs}(\text{B2\_0,3} - \text{B2\_3,3})$ .

31. A computer program (643) comprising instructions (644) which when executed by processing circuitry (602) causes the processing circuitry (602) to perform the method of any one of claims 1-30.

32. A carrier containing the computer program of claim 31, wherein the carrier is one of an electronic signal, an optical signal, a radio signal, and a computer readable storage medium (642).

33. An apparatus (600), the apparatus (600) being configured to:

obtain (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values  $B1_{i,k}$  for  $i=0-7$  and  $k=0-3$ , and the second block of sample values comprises a set of sample values  $B2_{i,k}$  for  $i=0-7$  and  $k=0-3$ ; and

decide (s404) whether or not to use a long filter to filter at least a subset of the first set of sample values, wherein the apparatus is configured to decide whether or not to use a long filter to filter at least a subset of the first set of sample values by performing a process that includes:

calculating (s502) a first gradient value,  $\maxGradB1_{6,0}$ , using sample value  $B1_{6,0}$ ;

calculating (s504) a first pq value,  $pq1_0$ , using  $\maxGradB1_{6,0}$ ; and

comparing (s508)  $pq1_0$  to a threshold

34. The apparatus of claim 33, wherein the apparatus is further configured to perform the method of any one of claims 2-16.

35. An apparatus (600), the apparatus (600) being configured to:

obtain (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values  $B1_{i,k}$  for  $i=0-7$  and  $k=0-3$ , and the second block of sample values comprises a set of sample values  $B2_{i,k}$  for  $i=0-7$  and  $k=0-3$ ; and

select (s404) a filter, wherein the apparatus is configured to select the filter by performing a process that comprises:

calculating (s504) a first pq value,  $pq2_0$ , using at least a first value equal to  $Abs(B1_{2,0} - 2 * B1_{1,0} + B1_{0,0})$  and a second value equal to  $Abs(B2_{2,0} - 2 * B2_{1,0} + B2_{0,0})$ ; and

comparing (s508)  $pq2_0$  to a threshold, wherein the threshold is equal to  $\beta >> 4$ , and

$\beta$  is selected from a set of predetermined beta values based on a quantization parameter value, Q

36. The apparatus of claim 35, wherein the apparatus is further configured to perform the method of claim 18.

37. An apparatus (600), the apparatus (600) being configured to:

obtain (s402) a first set of sample values comprising a first block of sample values and a second block of sample values, wherein the first block of sample values comprises a set of sample values  $B1_{i,k}$  for  $i=0-7$  and  $k=0-3$ , and the second block of sample values comprises a set of sample values  $B2_{i,k}$  for  $i=0-7$  and  $k=0-3$ ; and

select (s404) a filter, wherein the apparatus is configured to select the filter by performing a process that comprises:

i) calculating a first pq value,  $pq1\_0$ , wherein calculating  $pq1\_0$  comprises calculating a value  $sp$ , calculating a value  $sq$ , and calculating  $sp + sq$ , wherein  $pq1\_0 = (sp + sq)$ ;

ii) comparing  $pq1\_0$  to a first threshold;

iii) calculating (s504) a second pq value,  $pq2\_0$ , using at least a first value equal to  $Abs(B1_{2,0} - 2 * B1_{1,0} + B1_{0,0})$  and a second value equal to  $Abs(B2_{2,0} - 2 * B2_{1,0} + B2_{0,0})$ ; and

iv) comparing (s508)  $pq2\_0$  to a second threshold, wherein the second threshold is equal to  $\beta >> 4$ , and  $\beta$  is selected from a set of predetermined beta values based on a quantization parameter value, Q.

38. The apparatus of claim 37, wherein the apparatus is further configured to perform the method of any one of claims 20-30.