Optimizing the Deblocking Algorithm for H.264 Decoder Implementation

By Ken Kin-Hung Lam

klam@mail.ece.utexas.edu

What is “deblocking” again?

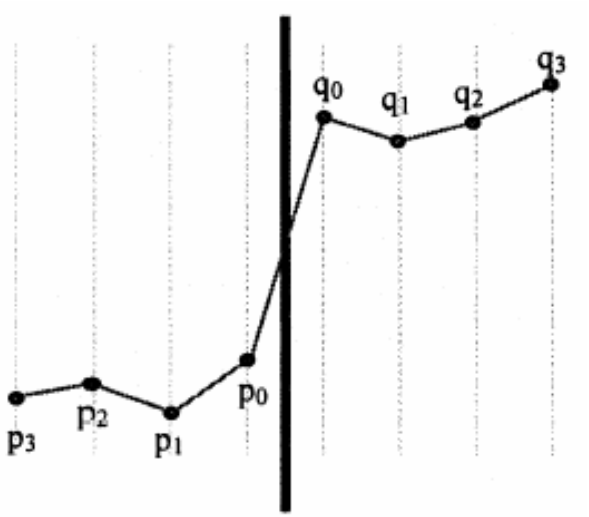
- Remove the discontinuity across block boundaries resulted from block-based DCT and coarse quantization steps in low bit rate encoding.

[List, Joch, Lainema, Bjøntegaard and Karczewicz, 2003]

Adaptive Deblocking Filter (Revisit)

[List, Joch, Lainema, Bjøntegaard and Karczewicz, 2003]

- An edge is associated to an ‘edge strength’ computed with a set of conditions on the data points *normal* to the edge. On each edges, there are 16 set of *normals*.
- Filters with different strength are applied to edge of different strength.
- The algorithm is adaptive because the conditions for edge strength computation are based on the quantization parameters included in the relevant blocks.



Where is the Bottleneck ?

- JM 9.3 - H.264 reference codec is instrumented to gather statistics on the operations performed by the deblocking filter.

No. of operations on edge strength computation	30966524
No. of operations on edge filtering	503132

- Edge strength computation weights more than 90% of the total number of operation. Obviously, we should focus on optimizing the edge strength computation algorithm.

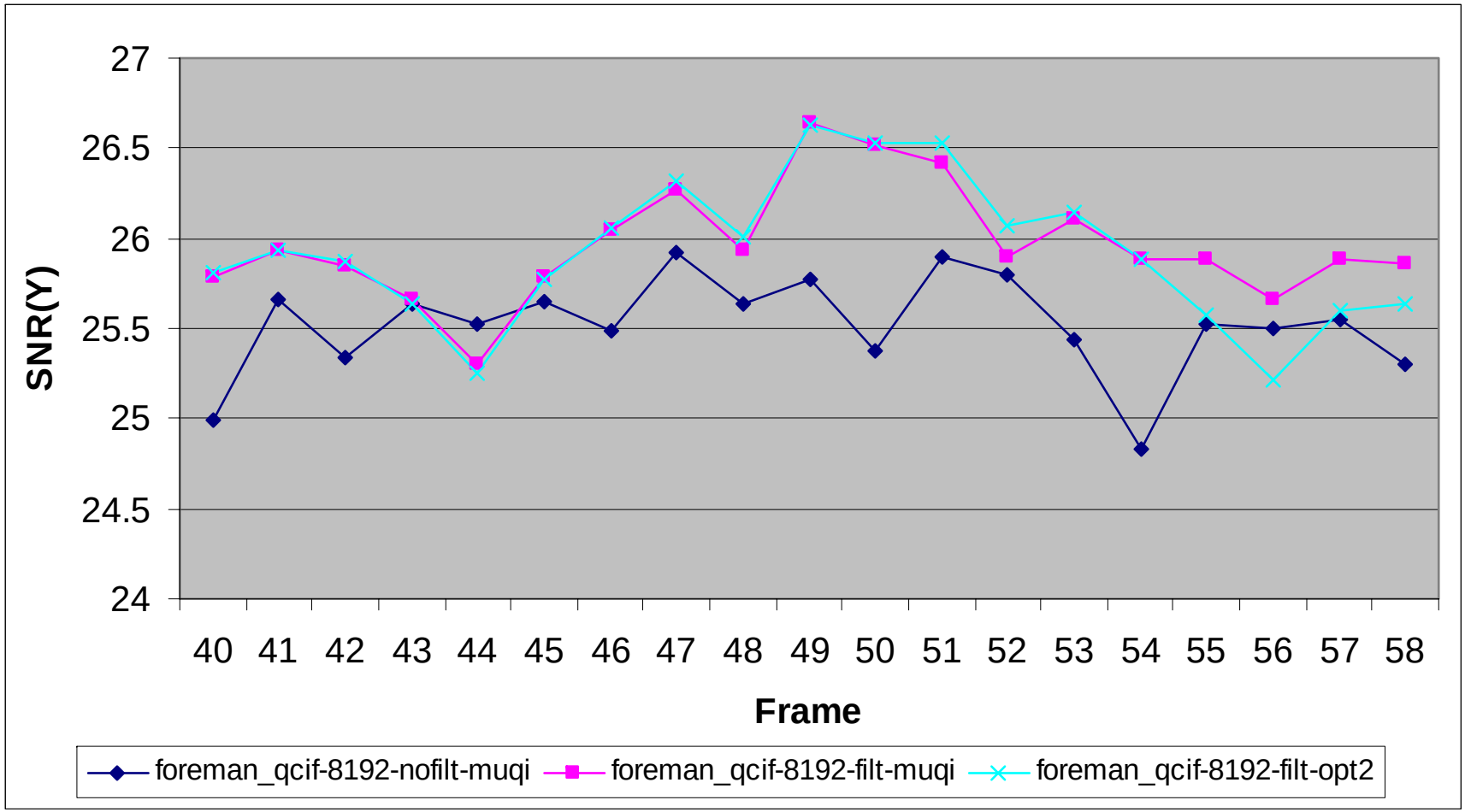
Optimizations

- Adjacent *normals* on an edge may result into similar edge strengths.
- Skipping some of the edge strength computations by taking the results from adjacent strength computations.
- Basically a ‘subsampling’ of edge strength computations, and ‘upsample’ the results by speculating the skipped strength computations with the adjacent edge strength computation results.

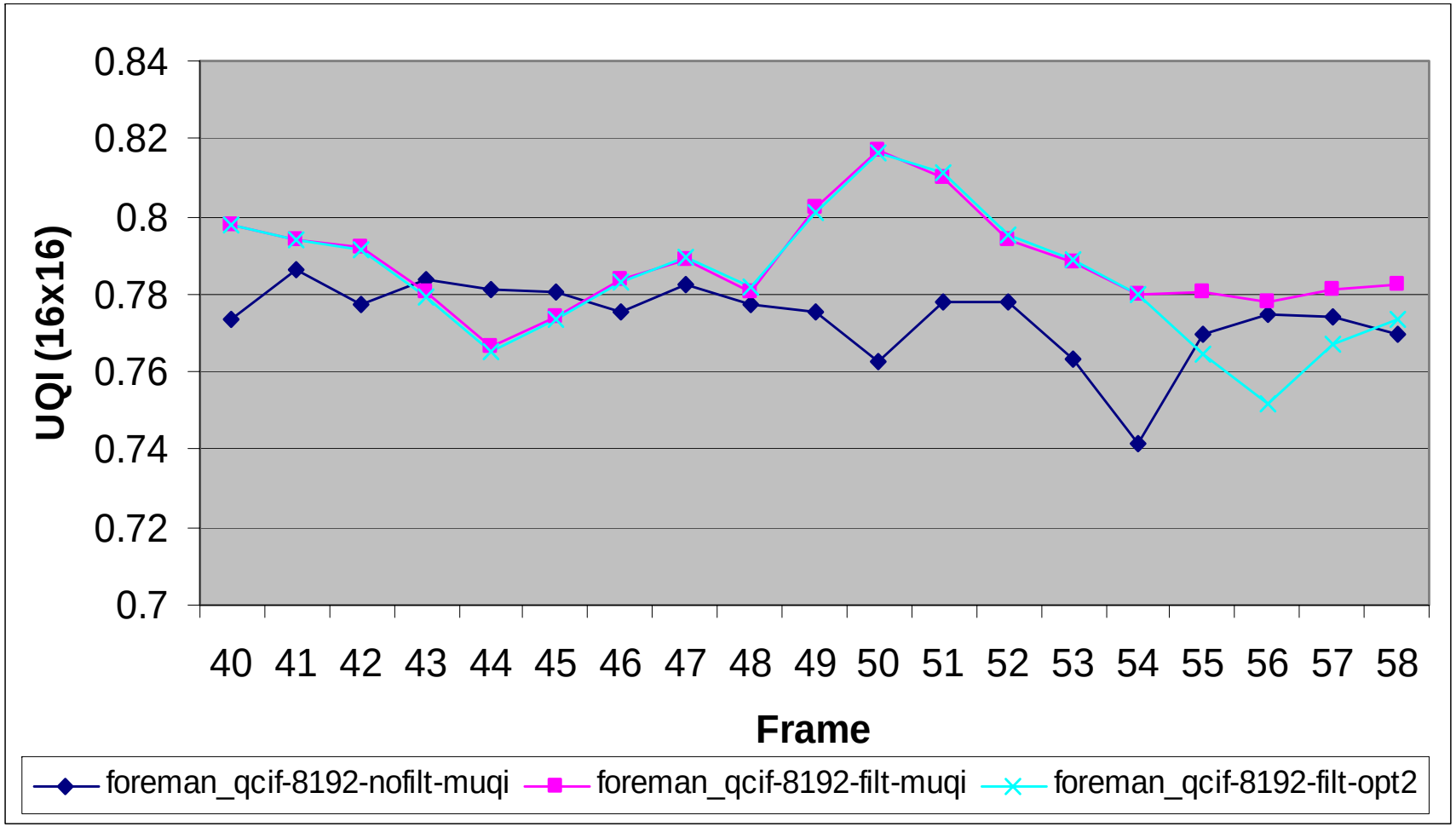
Some Results

	Original Algorithm	Optimized Algorithm
No. of operations on edge strength computation	30966524	15483262
No. of operations on edge filtering	503132	503388
Total no. of operations	31469656	15986650

Some Results (SNR)



Some Results (UQI)



Conclusions

- Operations on edge strength computation is reduced by half approximately. Operations on edge filtering remains more or less the same as the original algorithm. The overall saving in total number of operations is close to 50%.
- SNR(Y) and UQI achieved by the optimized algorithm closely approximate those achieved by the original algorithm.
- More savings may be possible with even more aggressive approach.