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| *Title:* | **SCE4: Crosschecking of SCE4.2.6 on adaptive up-sampling of base layer picture using bilateral filters (JCTVC-M0213)** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Proposal | | |
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# Abstract

This contribution reports crosschecking results of JCTVC-M0213 on adaptive up-sampling of base layer picture using bilateral filters. The simulation results reportedly matched those provided by the proponents.

# Introduction

In JCTVC-M0213, adaptive up-sampling with bilateral filters is proposed. For each CU coded with IntraBL mode, a flag is signaled to indicate whether the up-sampling filter in SHM-1.0 or the proposed bilateral filter is used.

The bilateral filter reduces the noise in the upsampled base layer while preserving edges. It is achieved by replacing the intensity value at each pixel by a weighted average of intensity values from nearby pixels within a window. The weight is based on a Gaussian distribution and relative pixel intensities.

# It is proposed to apply bilateral filtering to the upsampled base layer picture. A window size of 5x5 is used. For a pixel at location (x,y), the bilateral filtered output is then expressed as:

 (1)

where the summation is performed on pixels within a supporting window, *Ia,b* denotes the input pixel value at location (*a*,*b*), and *f(a,b, Ia,b, Ix,y )* is a function that maps the spatial distance and relative pixel intensity information at a location (*a*,*b*) to a weight value.

The design of the function *f()* provides the desirable non-linear and content adaptive properties. Traditionally, the function consists of two parts – a spatial kernel and a gradient kernel – and is expressed as:

 (2)

where *S*(*a*,*b*) denotes a two-dimensional Gaussian kernel with standard deviation σ*S*, *G(a,b,Ix,y)* denotes the absolute difference between *Ia,b,* and *Ix,y*, and σ*R* is a control parameter. In general, the larger difference between the two pixel values, the lower the weight value. This preserves edges and avoids over smoothing. In the proposal, a 5x5 spatial kernel LUT for is used S(a,b) as follows.

{ 4, 5, 6, 5, 4, },

{ 5, 6, 7, 6, 5, },

{ 6, 7, 8, 7, 6, },

{ 5, 6, 7, 6, 5, },

{ 4, 5, 6, 5, 4, },

For the Gradient kernel, a LUT { 16, 15, 12, 9, 6, 4, 2, 1, 0 } is employed and *min(G(Ia,b, I x,y)>>2, 8)* is used as the index to the LUT.

# Experimental results

We received the source code from the proponents, implemented in SHM-1.0, and did a quick code study to verify that the proposed method was implemented as described. We used the common conditions [2] in our experiments and ran simulations for the cases of AI, RA, and LDP.

The results match what was provided by the proponents and are summarized as follows:



# Conclusion

In this contribution, we have presented the results of our cross-check of JCTVC-M0213. The implemented algorithm is in line with the proponent’s description, and the simulation results also match that provided by the proponents.

# References

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