

m26973/JCT3V-B0129: 3DV-ATM: Adaptive directional depth map smoothing and structure based hole filling for in-loop view-synthesis based inter-view prediction

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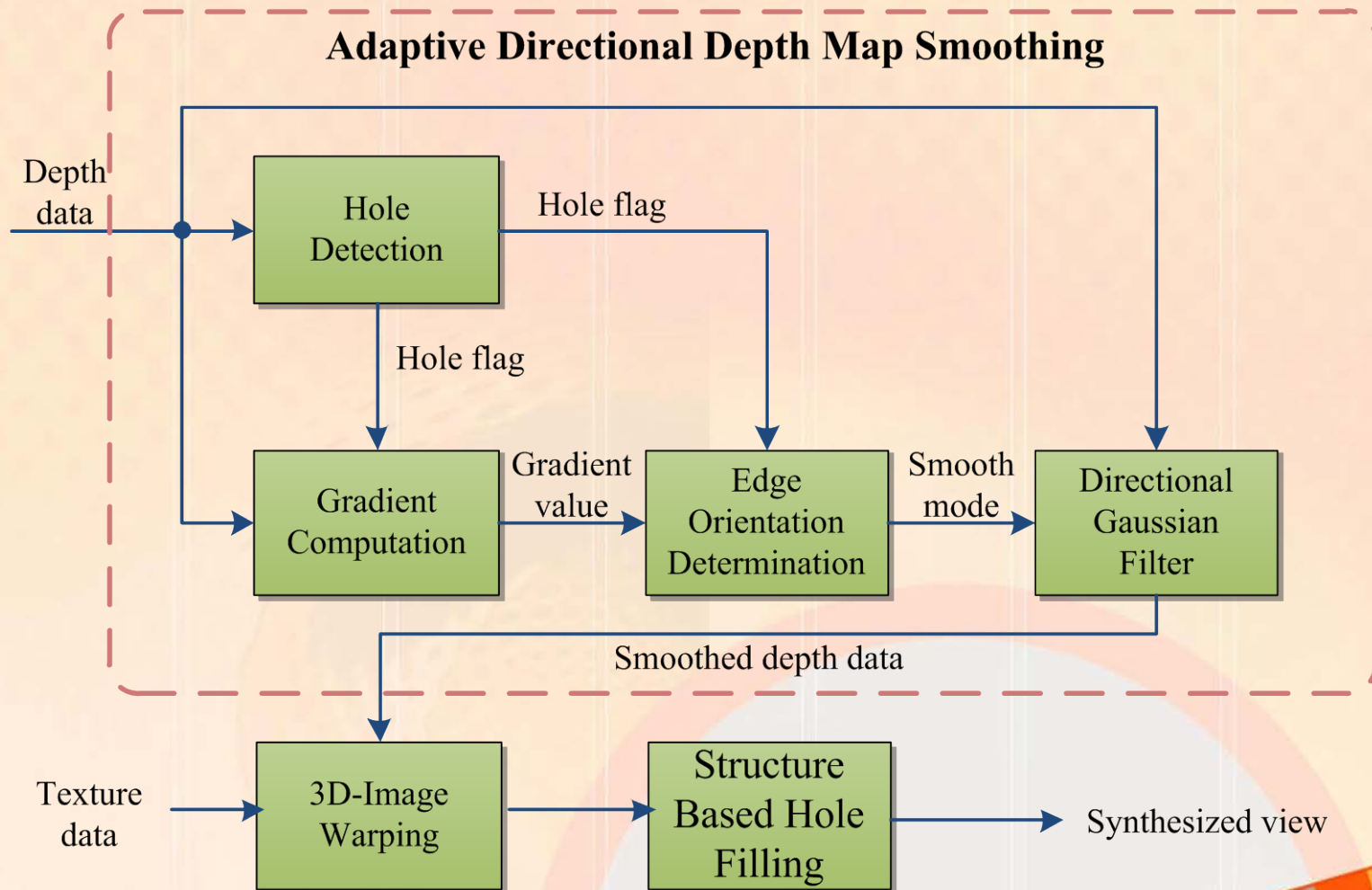
Outline

- Abstract
- Block Diagram of Proposed Algorithm
 - Adaptive Directional Depth Map Smoothing
 - Structure Based Hole Filling
- Experimental Results
- Conclusion

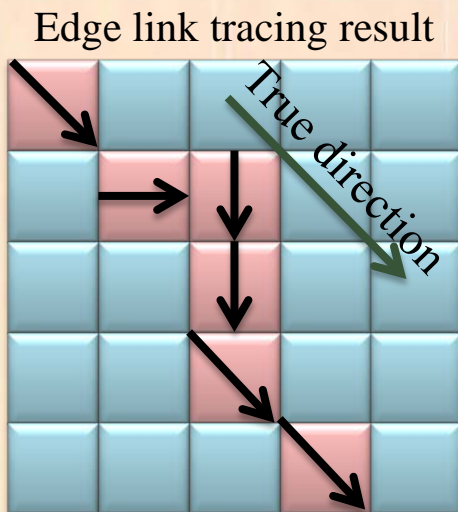
Abstract

- Adaptive directional depth map smoothing
 - Smooth sharp depth transition region
 - Preserve the quality at non-hole regions
- Structure based hole filling
 - Build the reference structure by using spatial and temporal information to fill the holes.
- Experimental results
 - 0.08% BD-rate increasing on texture data and 0.26% BD-rate increasing on synthesized data and 35 % decoding time increasing in average
 - 0.33% BD-rate decreasing on texture data and 0.06% BD-rate decreasing on synthesized data and 30 % decoding time increasing in average for full-HD videos

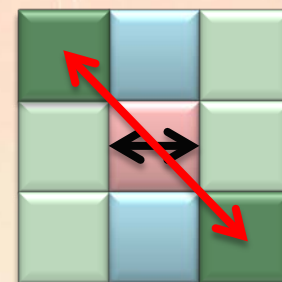
Algorithmic Block diagram



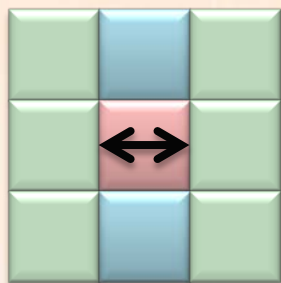
Adaptive Directional Depth Map Smoothing



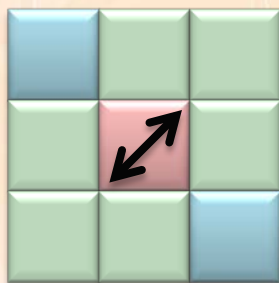
- Direction of one pixel can't represent the whole local regions.
- Sobel mask to extract the edge strength and direction of each pixel.
- A 3x3 local region is applied to determine edge orientation.



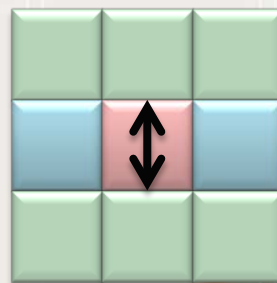
135°, Diagonal



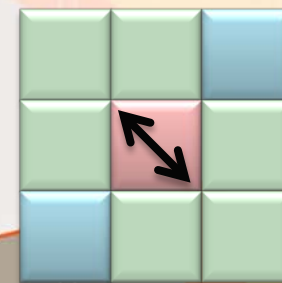
0°, Horizontal



45°, Diagonal



90°, Vertical



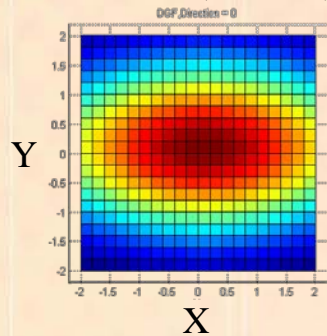
135°, Diagonal

Directional Gaussian filter

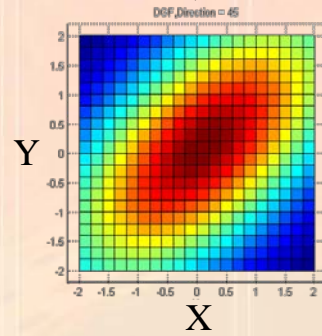
- Original directional Gaussian filters

$$\sigma_x=3, \sigma_y=1.5$$

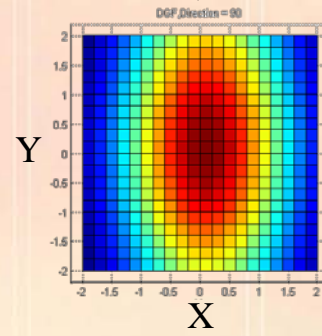
DGF-0 ($\theta = 0^\circ$)



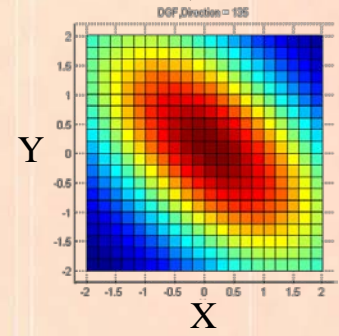
DGF-1 ($\theta = 45^\circ$)



DGF-2 ($\theta = 90^\circ$)



DGF-3 ($\theta = 135^\circ$)



- Simplified directional Gaussian filters

0° , Horizontal

$$\frac{1}{14} \times \begin{array}{|c|c|c|} \hline 1 & 1 & 1 \\ \hline 2 & 4 & 2 \\ \hline 1 & 1 & 1 \\ \hline \end{array}$$

45° , Diagonal

$$\frac{1}{18} \times \begin{array}{|c|c|c|} \hline 1 & 2 & 2 \\ \hline 2 & 4 & 2 \\ \hline 2 & 2 & 1 \\ \hline \end{array}$$

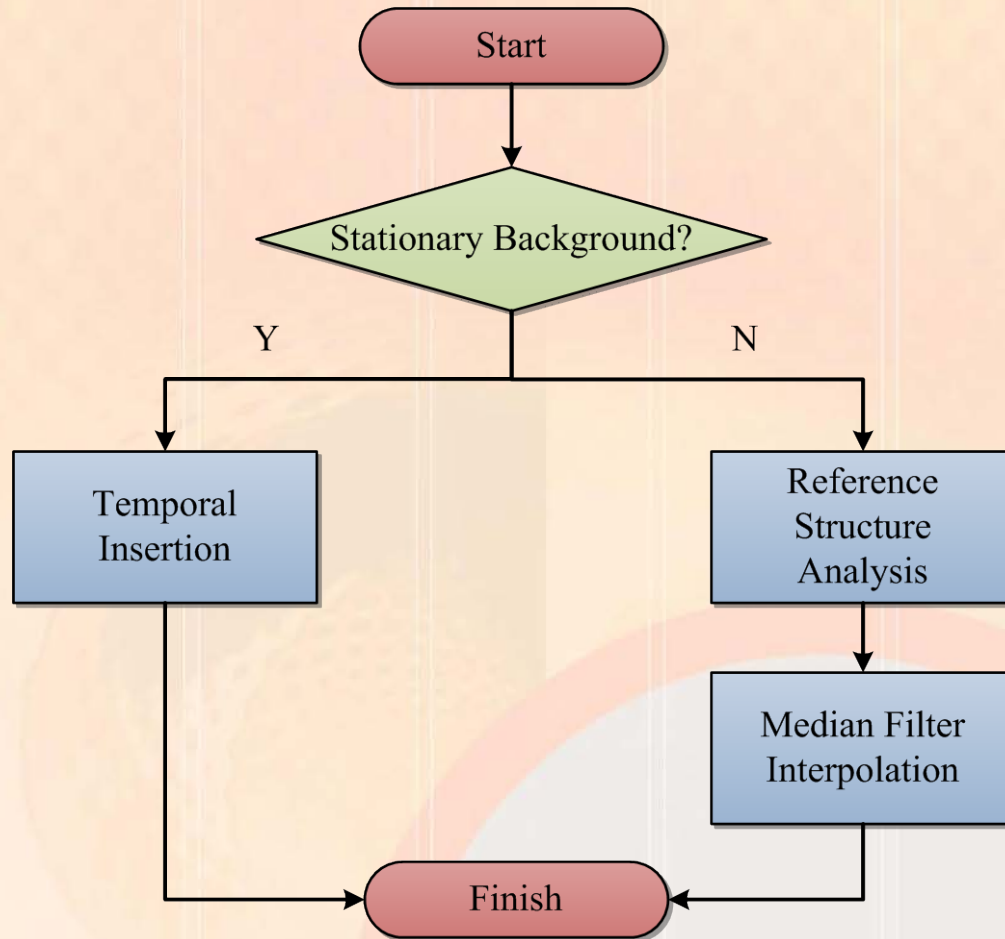
90° , Vertical

$$\frac{1}{14} \times \begin{array}{|c|c|c|} \hline 1 & 2 & 1 \\ \hline 1 & 4 & 1 \\ \hline 1 & 2 & 1 \\ \hline \end{array}$$

135° , Diagonal

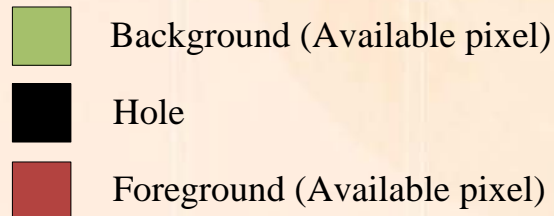
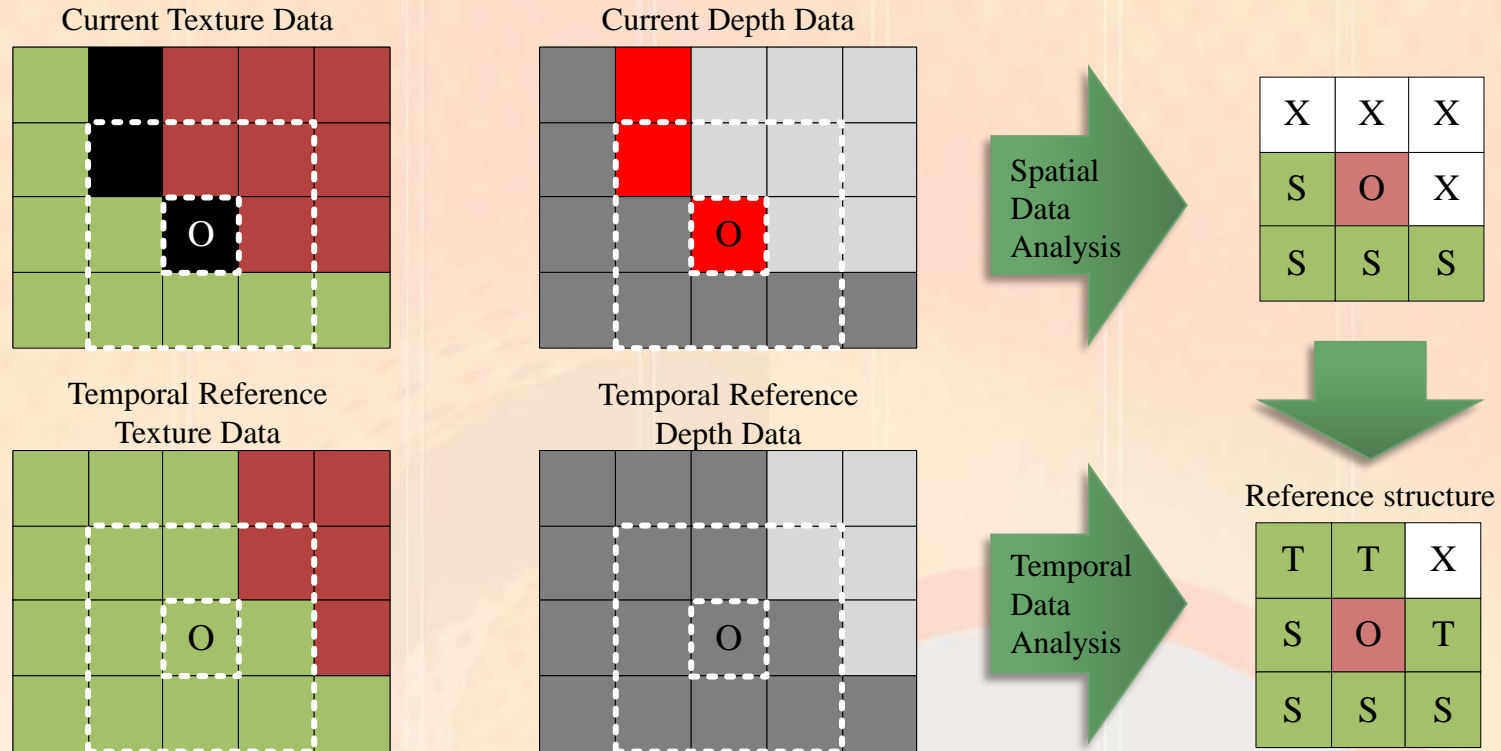
$$\frac{1}{18} \times \begin{array}{|c|c|c|} \hline 2 & 2 & 1 \\ \hline 2 & 4 & 2 \\ \hline 1 & 2 & 2 \\ \hline \end{array}$$

Structure Based Hole Filling



Structure Based Hole Filling

- Reference structure analysis



O	Processing point
S	Reference point from spatial
T	Reference point from temporal
X	No reference

Experimental results

- Based on CTC
- Turn off the opinion, NOKIA_USTC_B_VSP_M26069

	Texture Coding		Total (Coded PSNR)		Total (Synthesed PSNR)		Complexity estimate	Complexity estimate
	dBR(%)	dPSNR(dB)	dBR(%)	dPSNR(dB)	dBR(%)	dPSNR(dB)	Encoding time(%)	Decoding time(%)
S01	-0.25	0.01	-0.23	0.01	-0.08	0.00	102.08%	132.70%
S02	-0.25	0.01	-0.24	0.01	-0.04	0.00	103.59%	134.11%
S03	-0.48	0.02	-0.46	0.02	-0.05	0.00	102.64%	124.05%
S05	0.60	-0.03	0.44	-0.02	0.59	-0.02	101.55%	132.83%
S06	0.67	-0.03	0.52	-0.02	0.89	-0.04	103.54%	135.64%
S08	0.18	-0.01	0.12	0.00	0.24	-0.01	103.04%	151.27%
Ave.	0.08	-0.01	0.02	0.00	0.26	-0.01	102.74%	135.10%
Ave. (full HD video)	-0.33	0.01	-0.31	0.01	-0.06	0.00	102.77%	130.28%

Conclusion

- By providing better visual quality of synthesized view based on proposed algorithm, the coding gain on full-HD video is obtained.
- Experimental results on texture coding
 - 0.08% BD-rate increasing on texture data and 0.26% BD-rate increasing on synthesized data and 35 % decoding time increasing in average
 - 0.33% BD-rate decreasing on texture data and 0.06% BD-rate decreasing on synthesized data and 30 % decoding time increasing in average for full-HD videos

THANKS!