

REDEFINING MOBILITY



# JCT3V-D0176: CE2.h: Enhanced disparity vector derivation

Jewon Kang, Ying Chen, Li Zhang, and Marta Karczewicz

# Summary

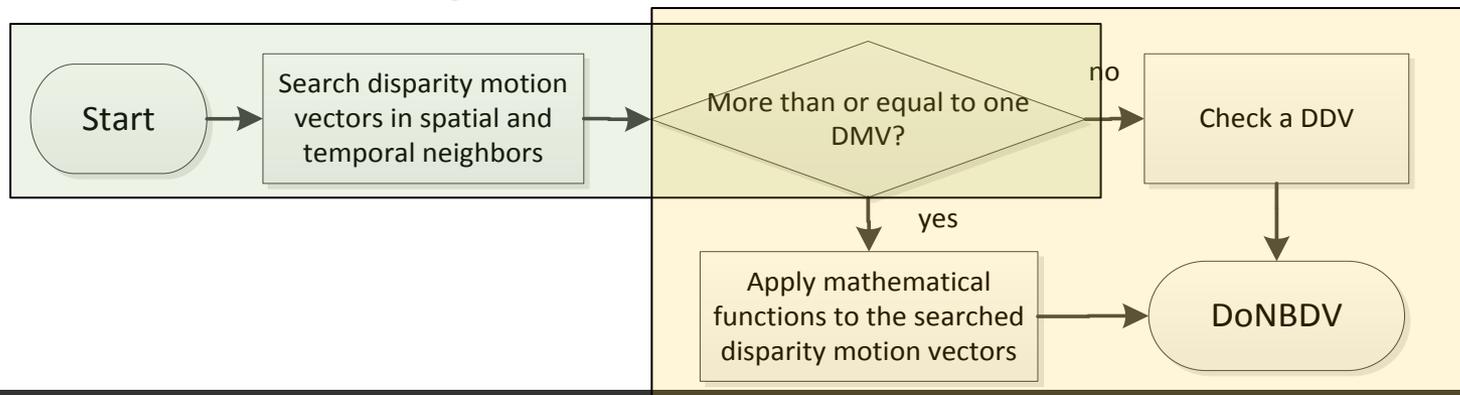
- Enhance the NBDV using disparity information conveyed in the only texture component
  - Use multiple disparity motion vectors (DMV) for NBDV
  - Prevent an outlier DMV from the early termination of the NBDV
- Take two step derivation (Searching & Decision phases)
  - Searching phase: a certain number of DMV in spatially and temporally neighboring blocks are stored to lists
  - Decision phase: a NBDV is derived using the DMV in the lists
- Follow-up Results
  - Method1:0.1% BD-rate saving for synthesized views in CTC
  - Method2:0.2% BD-rate saving in video only when BVSP & DoNBDV Off.

# Introduction

- Disparity Vector (DV) Derivation Process in 3D-HEVC
  - Search out a disparity motion vector from pre-defined spatially and temporally neighboring blocks, and derived disparity vectors in DV-MCP block. (called NBDV process)
  - If found, the NBDV process is finished, and the DV is refined using depth information when accessing depth view is enabled. (called DoNBDV process)
- The proposed method is applied to the NBDV process
  - Method 1 (JCT3V-C0050): Parallel searching fashion (i.e., two different lists to collect DMV categorized with block positions)
  - Method 2: Serial searching fashion (i.e., one list for DMVs)

# Method 1 (JCT3V-C0050)

- Search phase (parallel searching fashion)
  - Check the same pre-defined positions as the current design to search DMV (the same worst case as the current design).
  - Store the DMV to two lists (namely, SDC and TDC), respectively, for the spatial and temporal DMV.
    - If the number of stored DMV in each list is equal to 3, the search phase finishes (early termination).
    - If no searched DMV, continue checking the DDV (the same as the current design)



# Method 1 (JCT3V-C0050)

- Decision phase
  - When the total number of DMV in SDC and TDC is more than or equal to 3, median function with three inputs is applied.
    - Two candidates from TDC and one from SDC are considered. If the number in one list is insufficient, the motions in the other list are used.
  - When the total number of DMV is equal to 2
    - Basically, one from TDC and one from SDC are used, but if the number in one list is insufficient, the motion in the other list are used.
  - If there is one DMV searched, it becomes the DV.
  - Once a horizontal component is decided, the vertical component becomes the one along with the horizontal comp.

# Method 2

- Search phase (serial searching fashion)
  - Store the DMV to the only one list (no categorization of SDC and TDC).
    - If the number of stored DMV in the list is equal to 3, the search phase finishes (early termination).
    - If no searched DMV, continue checking the DDV (the same as the current design)
- Decision phase
  - The same rule in Method 1 applied to the one list.
    - Median function for three candidates
    - Max function for two candidates

# Experimental Results

- In CTC (Crosscheck results in JCT3V-D0087)

## Coding gain of the Method 1

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time
Balloons	0.0%	-0.2%	0.2%	0.0%	0.0%	0.0%	98.7%	98.8%
Kendo	0.0%	0.4%	-0.2%	0.0%	0.0%	0.0%	100.7%	102.5%
Newspaper_CC	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	96.1%	101.2%
GT_Fly	0.0%	-0.3%	-0.1%	0.0%	0.0%	-0.1%	99.1%	99.6%
Poznan_Hall2	0.0%	-0.3%	0.2%	0.0%	0.0%	0.0%	97.3%	104.4%
Poznan_Street	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	99.4%	100.9%
Undo_Dancer	0.0%	-0.1%	-0.1%	0.0%	0.0%	-0.4%	94.2%	95.9%
1024x768	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	98.5%	100.8%
1920x1088	0.0%	-0.2%	0.0%	0.0%	0.0%	-0.1%	97.5%	100.2%
<b>average</b>	<b>0.0%</b>	<b>-0.1%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>-0.1%</b>	<b>97.9%</b>	<b>100.5%</b>

## Coding gain of the Method 2

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time
Balloons	0.0%	-0.1%	0.2%	0.0%	0.0%	0.0%	103.2%	92.9%
Kendo	0.0%	0.4%	-0.1%	0.0%	0.0%	0.0%	108.2%	102.2%
Newspaper_CC	0.0%	-0.1%	0.1%	0.0%	0.0%	0.0%	101.2%	97.9%
GT_Fly	0.0%	-0.1%	-0.1%	0.0%	0.0%	0.0%	99.9%	100.3%
Poznan_Hall2	0.0%	-0.5%	0.3%	0.0%	0.0%	0.0%	99.2%	102.1%
Poznan_Street	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%	103.9%	101.5%
Undo_Dancer	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.4%	92.2%	102.5%
1024x768	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	104.2%	97.7%
1920x1088	0.0%	-0.2%	0.0%	0.0%	0.0%	-0.1%	98.8%	101.6%
<b>average</b>	<b>0.0%</b>	<b>-0.1%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>101.1%</b>	<b>99.9%</b>

# Experimental Results

- DoNBDV and BVSP off (Crosscheck results by Sony)

## Coding gain of the Method 1

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time
Balloons	0.0%	-0.3%	-0.3%	-0.1%	-0.1%	-0.1%	101.8%	100.0%
Kendo	0.0%	-0.1%	-0.6%	-0.2%	-0.2%	-0.2%	96.2%	99.9%
Newspaper_CC	0.0%	-0.4%	-0.4%	-0.1%	-0.2%	-0.2%	96.8%	99.6%
GT_Fly	0.0%	-0.7%	-0.7%	-0.2%	-0.2%	-0.2%	99.7%	103.1%
Poznan_Hall2	0.0%	-0.6%	-0.1%	-0.1%	-0.1%	-0.1%	102.4%	99.3%
Poznan_Street	0.0%	0.1%	-0.2%	0.0%	0.0%	0.0%	103.2%	100.0%
Undo_Dancer	0.0%	-0.4%	-0.7%	-0.2%	-0.2%	0.1%	100.8%	102.2%
1024x768	0.0%	-0.3%	-0.4%	-0.1%	-0.1%	-0.1%	98.3%	99.8%
1920x1088	0.0%	-0.4%	-0.4%	-0.1%	-0.1%	0.0%	101.5%	101.1%
<b>average</b>	<b>0.0%</b>	<b>-0.3%</b>	<b>-0.4%</b>	<b>-0.1%</b>	<b>-0.1%</b>	<b>-0.1%</b>	<b>100.1%</b>	<b>100.6%</b>

## Coding gain of the Method 2

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time
Balloons	0.0%	-0.4%	-0.2%	-0.1%	-0.1%	0.0%	100.7%	97.0%
Kendo	0.0%	-0.1%	-0.6%	-0.2%	-0.2%	-0.2%	96.4%	93.9%
Newspaper_CC	0.0%	-0.3%	-0.3%	-0.1%	-0.1%	-0.1%	102.6%	103.3%
GT_Fly	0.0%	-0.8%	-0.5%	-0.2%	-0.2%	-0.2%	107.0%	111.2%
Poznan_Hall2	0.0%	-0.6%	-0.4%	-0.2%	-0.2%	-0.2%	104.6%	102.8%
Poznan_Street	0.0%	0.1%	-0.2%	0.0%	0.0%	0.0%	101.0%	101.0%
Undo_Dancer	0.0%	-0.4%	-0.6%	-0.2%	-0.2%	0.3%	91.4%	94.8%
1024x768	0.0%	-0.3%	-0.4%	-0.1%	-0.1%	-0.1%	99.9%	98.1%
1920x1088	0.0%	-0.4%	-0.4%	-0.2%	-0.1%	0.0%	101.0%	102.4%
<b>average</b>	<b>0.0%</b>	<b>-0.4%</b>	<b>-0.4%</b>	<b>-0.2%</b>	<b>-0.1%</b>	<b>-0.1%</b>	<b>100.5%</b>	<b>100.6%</b>

# Conclusion

- DV enhancement
  - Provide an enhanced DV by using multiple DV candidates from spatial and temporal neighboring blocks.
  - Up to 0.1% BD-rate reduction for synthesized videos in CTC, and up to 0.2% BD-rate reduction for texture components in Method 2 when accessing depth view is not allowed.

# Thank you!

Special thank you LG & Sharp for  
cross-checking