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| *Title:* | **Regional Disparity Derivation for Motion SKIP Mode** |
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| *Purpose:* | Proposal |

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# Abstract

This document describes a new method of regional disparity derivation for motion skip mode. The current motion skip mode in JMVM utilizes a global disparity of 16-pel accuracy to find the position of the corresponding macroblock for the current macroblock. However, since the multi-view scene consists of several objects and each object has its own disparity value, the global disparity is not enough to cover the disparity of the whole image. Thus, we propose to use regional disparities, instead of the global disparity, for motion skip mode. The proposed scheme generates the disparity map for each anchor frame considering its motion vectors and then derives disparity maps for non-anchor frames using both forward and backward disparity maps. The temporal movement is also considered. Compared to JMVM 6.0, the proposed scheme achieves a similar coding gain with the previous scheme.


# 1. Introduction

The previous motion skip mode [1] is proposed to reuse motion information of corresponding macroblock in previously coded neighboring view. Generally, the motion skip mode is divided into two stages [2]: finding the corresponding macroblock and sharing of motion information. In the first stage, global disparity is used to find the position of corresponding macroblock in the picture of neighboring view. The global disparity is calculated on every anchor frame and transmitted. In the second stage, motion information is inferred from the corresponding macroblock, and it is copied to apply to encoding of the current macroblock. If the motion skip mode is selected, no further motion information is transmitted, so the encoding bits can be saved [3]. However, one global disparity value can not cover whole macroblocks in non-anchor frames belonging to one GOP [4]. To solve above problem, the proposed scheme uses the regional disparity. The proposed scheme generates the disparity map for each non-anchor frame using forward disparity map and backward disparity map. The forward or backward disparity maps are calculated on anchor frame using its motion information. The anchor frame only allows inter-view prediction its motion vector is a kind of disparity between current view and its reference view.

# 2. Regional Disparity Derivation

## 2.1 Regional Disparity Derivation for Anchor Frame

Since anchor frame is coded only based on inter-view prediction, its motion vectors can be considered as disparities between the current view and its reference view. Thus, we can generate the disparity map for each anchor frame. However, some macroblocks are coded as intra mode and we compensate those regions using the disparity value for the closest non-intra macroblock. Figure 1 shows the disparity map for ballroom sequence. The left is the initial disparity map and the right is the final disparity map.

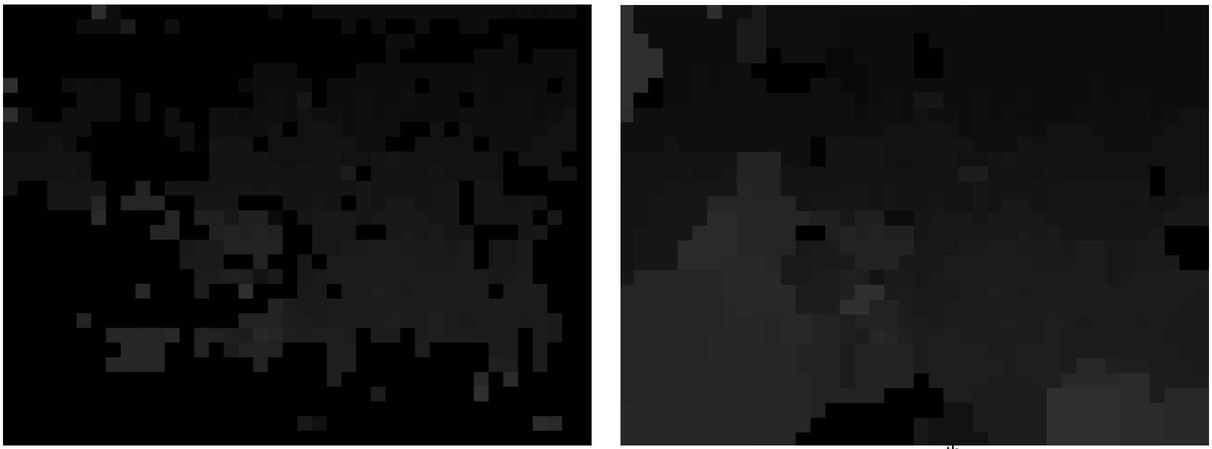

Fig. 1 Disparity Map for anchor frame (Ballroom view 2 and 13th frame)

## 2.2 Regional Disparity Derivation for Non-anchor Frame

To generate the disparity map for non-anchor frame, the temporal movement is considered. Figure 2 shows a situation that foreground (green triangle) and background (remaining part except for green triangle) have different A and B disparity value respectively. Though the time is changed, disparity value for each object is kept.

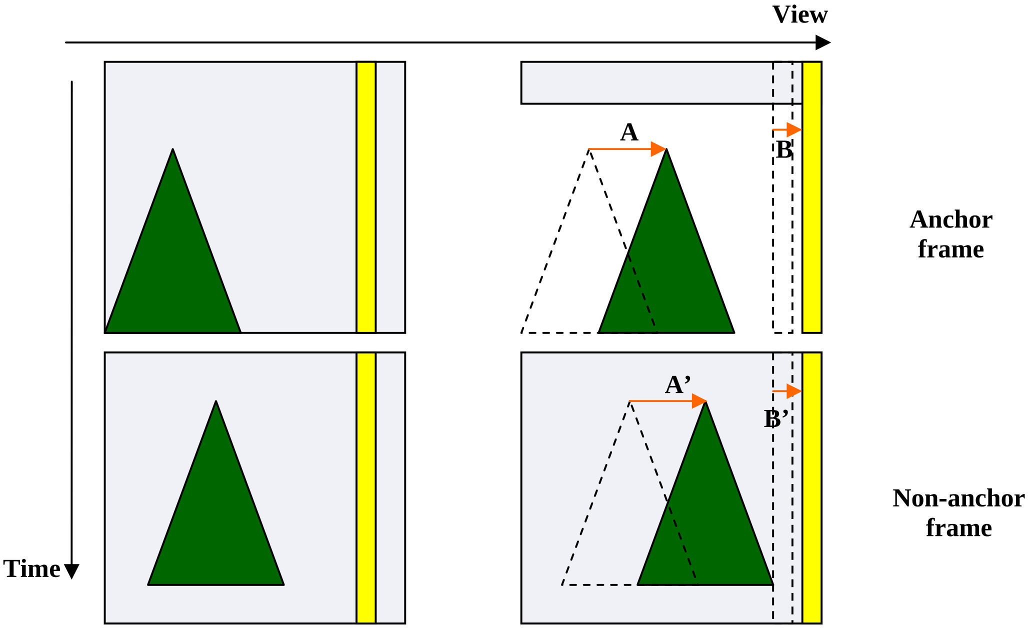


Fig. 2 Example for Regional Disparity

But since object (green triangle in Fig.2) moves, we have to consider temporal movement to make a disparity map for non-anchor frame. Figure 3 shows an example for derivation of regional disparity for moving object. The red block belongs to background at anchor frame and belongs to foreground at non-anchor frame. If the disparity value for red block is derived from collocated position at anchor frame, it has disparity value same with background's disparity. However, if we consider the temporal movement we can derive accurate disparity for red block. C and C' is a temporal movement for green triangle then we can find the blue block posing by considering C or C' value. Since the blue block is located on green triangle at anchor frame, we can derive accurate disparity for red block. The C and C' value is inferred from predicted motion vector for the current macroblock.

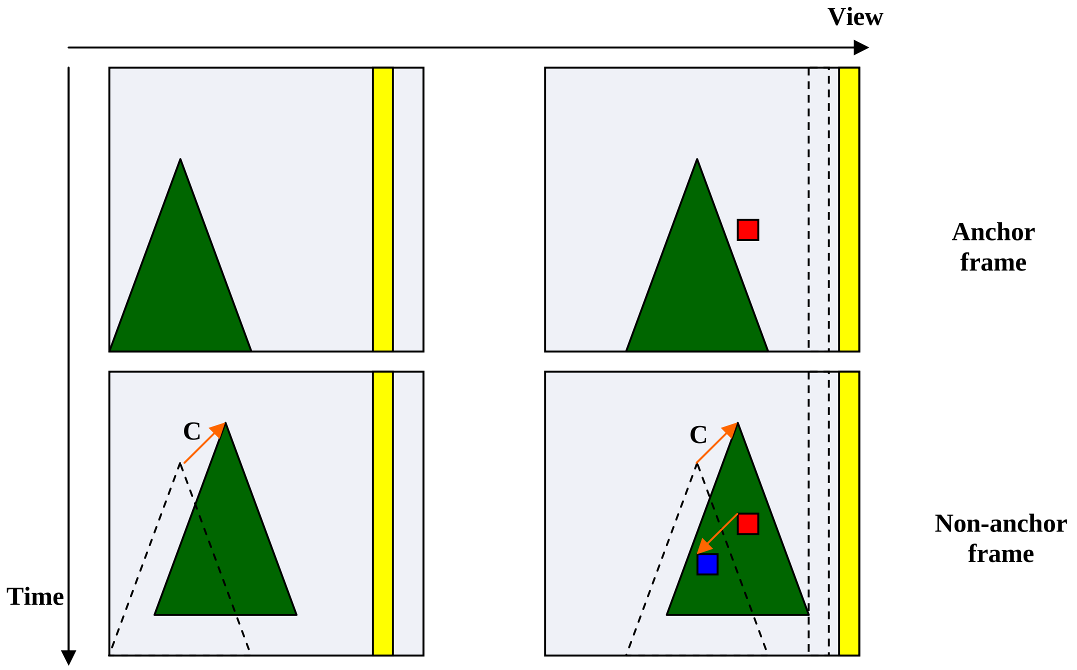


Fig. 3 Derivation of Regional Disparity Considering Temporal Movement

## 3. Experimental Results

The proposed scheme is implemented on JMVM 6.0 software. The average PSNR and bitrate for each basic QP are presented, and the gain and bit saving of the proposed method are compared with the JMVM 6.0 and previous motion skip mode scheme. Inter-view prediction for P-view is allowed and just two GOP frames are encoded. Following tables and figures show the experimental results.

Table 1. Performance Evaluation for “Ballroom” sequence

| Basic QP | Avg. PSNR (dB) | | | Avg. Bitrate (kbps) | | | Gain | | Bit saving | |
|---|---|---|---|---|---|---|---|---|---|---|
| | JMVM | Prop. | Previous | JMVM | Prop. | Previous | Previous | Prop. | Previous | Prop. |
| 37 | 31.90 | 31.88 | 31.88 | 242.77 | 237.75 | 239.42 | 0.03dB | 0.04dB | -0.64% | -1.04% |
| 32 | 34.62 | 34.61 | 34.61 | 429.90 | 424.13 | 425.87 | | | | |
| 27 | 37.23 | 37.23 | 37.23 | 817.80 | 811.80 | 813.86 | | | | |
| 22 | 39.42 | 39.43 | 39.42 | 1628.90 | 1620.53 | 1621.65 | | | | |

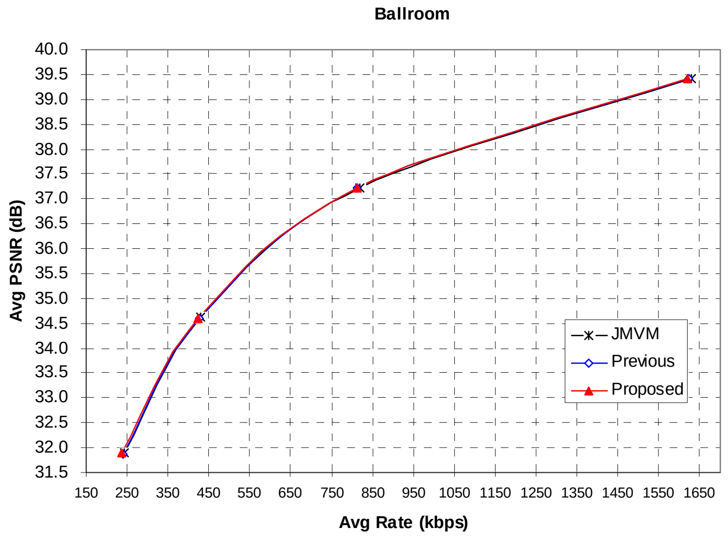


Fig. 4 Rate-Distortion Curves for “Ballroom”

Table 2. Performance Evaluation for “Exit” sequence

| Basic QP | Avg. PSNR (dB) | | | Avg. Bitrate (kbps) | | | Gain | | Bit saving | |
|---|---|---|---|---|---|---|---|---|---|---|
| | JMVM | Prop. | Previous | JMVM | Prop. | Previous | Previous | Prop. | Previous | Prop. |
| 37 | 34.41 | 34.41 | 34.42 | 130.14 | 126.06 | 126.77 | 0.04dB | 0.05dB | -1.50% | -1.69% |
| 32 | 36.71 | 36.70 | 36.70 | 222.69 | 217.96 | 218.44 | | | | |
| 27 | 38.57 | 38.57 | 38.57 | 433.46 | 428.78 | 429.43 | | | | |
| 22 | 40.08 | 40.08 | 40.08 | 1007.69 | 1002.36 | 1001.98 | | | | |

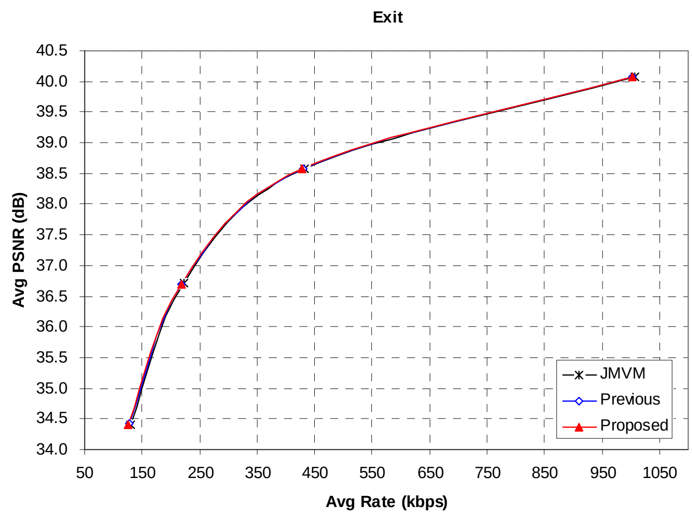


Fig. 5 Rate-Distortion Curves for “Exit”

Table 3. Performance Evaluation for “Flamenco2” sequence

| Basic | Avg. PSNR (dB) | | | Avg. Bitrate (kbps) | | | Gain | | Bit saving | |
|---|---|---|---|---|---|---|---|---|---|---|
| QP | JMVM | Prop. | Previous | JMVM | Prop. | Previous | Previous | Prop. | Previous | Prop. |
| 37 | 32.39 | 32.35 | 32.35 | 336.35 | 326.63 | 326.96 | 0.06dB | 0.05dB | -1.17% | -1.08% |
| 32 | 35.42 | 35.37 | 35.38 | 619.19 | 605.36 | 605.62 | | | | |
| 27 | 38.42 | 38.40 | 38.40 | 1155.62 | 1141.85 | 1140.71 | | | | |
| 22 | 41.26 | 41.25 | 41.25 | 2133.17 | 2119.36 | 2119.01 | | | | |

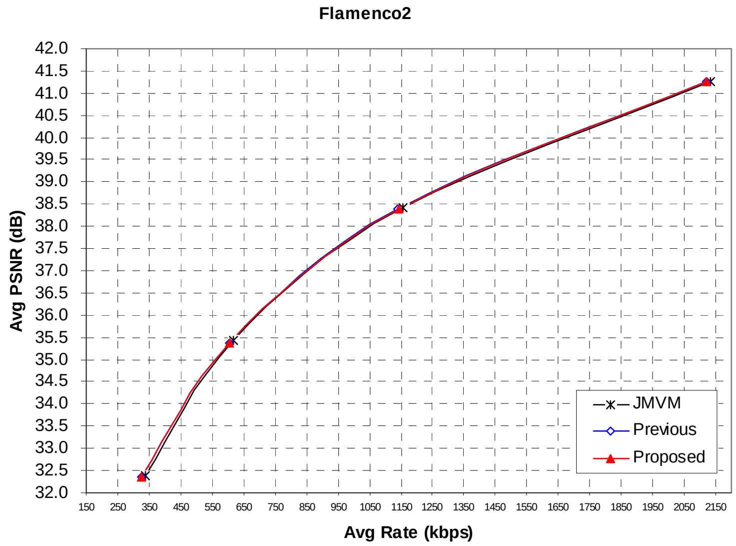


Fig. 6 Rate-Distortion Curves for “Flamenco2”

Table 4. Performance Evaluation for “Rena” sequence

| Basic | Avg. PSNR (dB) | | | Avg. Bitrate (kbps) | | | Gain | | Bit saving | |
|---|---|---|---|---|---|---|---|---|---|---|
| QP | JMVM | Prop. | Previous | JMVM | Prop. | Previous | Previous | Prop. | Previous | Prop. |
| 37 | 35.76 | 35.72 | 35.72 | 131.78 | 124.48 | 122.48 | 0.23dB | 0.21dB | -4.87% | -4.37% |
| 32 | 38.77 | 38.74 | 38.73 | 227.22 | 214.63 | 213.14 | | | | |
| 27 | 41.93 | 41.89 | 41.88 | 438.18 | 416.88 | 414.82 | | | | |
| 22 | 44.75 | 44.71 | 44.71 | 896.10 | 860.45 | 857.45 | | | | |

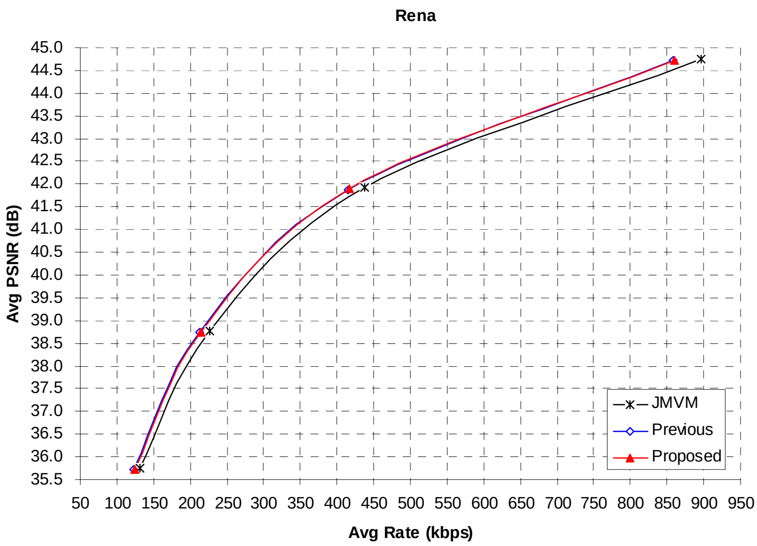


Fig. 7 Rate-Distortion Curves for “Rena”

Table 5. Performance Evaluation for “Race1” sequence

| Basic | Avg. PSNR (dB) | | | Avg. Bitrate (kbps) | | | Gain | | Bit saving | |
|---|---|---|---|---|---|---|---|---|---|---|
| QP | JMVM | Prop. | Previous | JMVM | Prop. | Previous | Previous | Prop. | Previous | Prop. |
| 37 | 31.99 | 32.13 | 32.15 | 254.93 | 233.46 | 233.37 | 0.32dB | 0.31dB | -7.20% | -7.07% |
| 32 | 34.82 | 34.94 | 34.93 | 443.58 | 418.27 | 417.63 | | | | |
| 27 | 37.58 | 37.65 | 37.66 | 864.80 | 830.73 | 830.72 | | | | |
| 22 | 40.26 | 40.29 | 40.29 | 1758.26 | 1714.55 | 1712.12 | | | | |

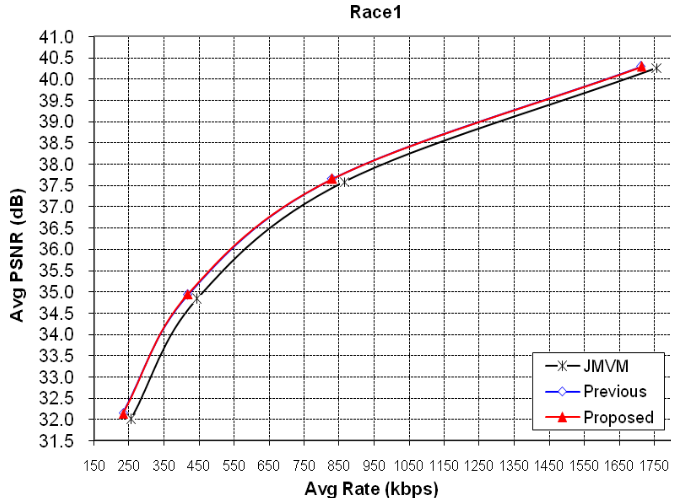


Fig. 8 Rate-Distortion Curves for “Race1”

# 4. Conclusion

In this document, the regional disparity derivation for motion skip mode is proposed. The proposed method generate the disparity map for each anchor frame and then generate the disparity map for non-anchor frame by using forward and backward disparity map. To derive accurate disparity map for non-anchor frame, temporal movement which is inferred from predicted motion vector for current macroblock is also considered. Compared to JMVM 6.0, the proposed scheme achieves a similar coding gain with the previous scheme. However, regional disparity has advantages for residual prediction and depth based motion skip mode. We recommend the further study for motion skip mode.

# 5. Acknowledgements

This work was supported in part by the Information Technology Research Center (ITRC) through the Realistic Broadcasting Research Center (RBRC) at Gwangju Institute of Science and Technology (GIST), and in part by the Ministry of Education (MOE) through the Brain Korea 21 (BK21) project.

# 6. References

[1] H. S. Koo, Y. J. Jeon, and B. M. Jeon, “MVC Motion Skip Mode,” ITU-T and ISO/IEC JTC1, JVT-W081, San Jose, California, USA, April 2006.
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[3] Y. Chen, Y. K. Wang, M. M. Hannuksela, “Single-loop decoding and motion skip study in JMVM,” ITU-T and ISO/IEC JTC1, JVT-Y053, Shenzhen, China, October 2007.
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(Append for Proposal Documents)

# JVT Patent Disclosure Form

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