



Non-CE11: Context reduction for coding transform coefficients

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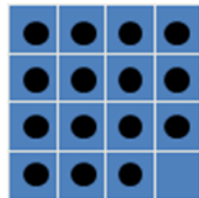
Presented by Shih-Ta Hsiang
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Overall Summary

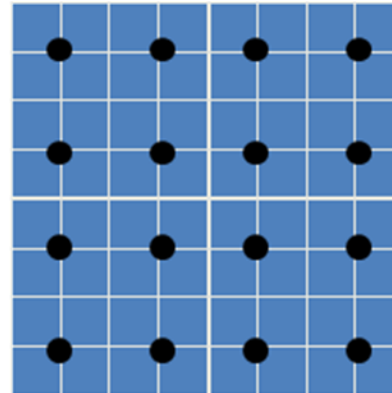
- Method for reducing the number of contexts used for coding significant_coeff_flag in 4x4 and 8x8 transform blocks
- Two proposed context configurations
 - Configuration BR6
 - Save 18 contexts per slice, or 29.0 % for 4x4 & 8x8 blocks
 - Y BD-rate increases 0.03%, 0.04% and 0.06% for HE-AI, HE-RA and HE-LDB, respectively
 - Configuration BR4
 - Save 10 contexts per slice, or 16.1 % for 4x4 & 8x8 blocks
 - Y BD-rate increases 0.01%, 0.01%, and 0.02% for HE-AI, HE-RA and HE-LDB, respectively
- Related contributions G366 and G781

Current Method in WD 4

- 62 contexts per slices used for 4x4 & 8x8 blocks
- More than 70% of total contexts used for coding `significant_coeff_flag`



4x4



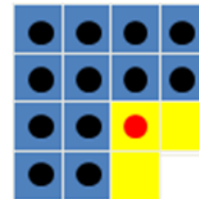
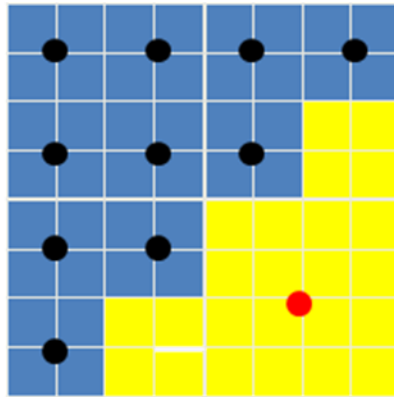
8x8

Proposed Method

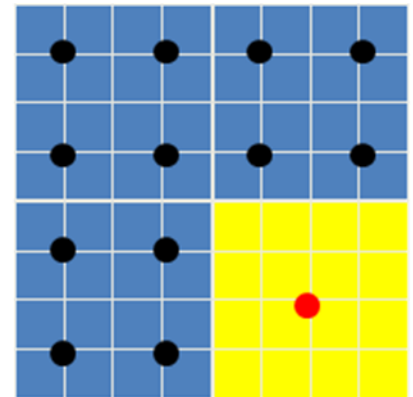
- Having the coefficients from the highest frequency region share the same context.
- Two proposed configurations
 - BR6 saves 9 contexts for Luma, 9 contexts for Chroma
 - BR4 saves 5 contexts for Luma and 5 contexts for Chroma



BR6



BR4



Experimental Results:

Common Test Conditions

- Anchor results by HM4.0

BR6

| | All Intra HE | | |
|----------------|------------------|--------|--------|
| | Y | U | V |
| Class A | 0.00% | -0.07% | -0.02% |
| Class B | 0.04% | 0.04% | 0.02% |
| Class C | 0.04% | 0.05% | 0.06% |
| Class D | 0.03% | 0.01% | 0.08% |
| Class E | 0.01% | -0.03% | 0.06% |
| Overall | 0.03% | 0.01% | 0.04% |
| | 0.03% | 0.01% | 0.03% |
| | Random Access HE | | |
| | Y | U | V |
| Class A | 0.02% | -0.09% | -0.14% |
| Class B | 0.02% | 0.20% | -0.03% |
| Class C | 0.05% | 0.09% | 0.04% |
| Class D | 0.07% | 0.13% | -0.07% |
| Class E | | | |
| Overall | 0.04% | 0.09% | -0.05% |
| | 0.04% | 0.08% | -0.03% |
| | Low delay B HE | | |
| | Y | U | V |
| Class A | | | |
| Class B | 0.02% | -0.15% | -0.34% |
| Class C | 0.06% | -0.19% | -0.09% |
| Class D | 0.09% | 0.33% | 0.23% |
| Class E | 0.10% | -0.01% | 0.05% |
| Overall | 0.06% | -0.01% | -0.06% |
| | 0.06% | -0.01% | -0.14% |

BR4

| | All Intra HE | | |
|----------------|------------------|--------|--------|
| | Y | U | V |
| Class A | 0.00% | -0.03% | 0.01% |
| Class B | 0.02% | 0.01% | -0.01% |
| Class C | 0.01% | 0.05% | -0.03% |
| Class D | 0.01% | 0.00% | -0.01% |
| Class E | 0.00% | 0.01% | 0.00% |
| Overall | 0.01% | 0.01% | -0.01% |
| | 0.01% | 0.01% | -0.01% |
| | Random Access HE | | |
| | Y | U | V |
| Class A | 0.01% | -0.17% | 0.02% |
| Class B | -0.03% | 0.10% | -0.04% |
| Class C | 0.02% | 0.09% | -0.06% |
| Class D | 0.04% | 0.07% | 0.01% |
| Class E | | | |
| Overall | 0.01% | 0.03% | -0.02% |
| | 0.01% | 0.00% | -0.03% |
| | Low delay B HE | | |
| | Y | U | V |
| Class A | | | |
| Class B | 0.01% | -0.10% | -0.21% |
| Class C | 0.04% | 0.08% | -0.02% |
| Class D | 0.01% | 0.12% | -0.15% |
| Class E | 0.04% | 0.16% | 1.06% |
| Overall | 0.02% | 0.05% | 0.09% |
| | 0.02% | 0.02% | 0.06% |

Experimental Results:

QP = 12, 17, 22, 27

BR6

| | All Intra HE | | |
|----------------|------------------|--------|--------|
| | Y | U | V |
| Class A | 0.02% | 0.02% | 0.01% |
| Class B | 0.05% | 0.06% | 0.07% |
| Class C | 0.06% | 0.11% | 0.12% |
| Class D | 0.07% | 0.15% | 0.11% |
| Class E | 0.01% | -0.04% | -0.02% |
| Overall | 0.05% | 0.06% | 0.06% |
| | 0.05% | 0.06% | 0.06% |
| | Random Access HE | | |
| | Y | U | V |
| Class A | 0.01% | -0.02% | -0.11% |
| Class B | 0.02% | 0.06% | 0.05% |
| Class C | 0.07% | 0.14% | 0.12% |
| Class D | 0.14% | 0.24% | 0.02% |
| Class E | | | |
| Overall | 0.06% | 0.10% | 0.02% |
| | 0.06% | 0.09% | 0.01% |
| | Low delay B HE | | |
| | Y | U | V |
| Class A | | | |
| Class B | 0.03% | 0.05% | 0.11% |
| Class C | 0.08% | 0.05% | 0.09% |
| Class D | 0.10% | 0.04% | 0.18% |
| Class E | 0.03% | -0.24% | 0.30% |
| Overall | 0.06% | -0.01% | 0.16% |
| | 0.06% | 0.00% | 0.13% |

BR4

| | All Intra HE | | |
|----------------|------------------|--------|--------|
| | Y | U | V |
| Class A | 0.00% | 0.00% | 0.01% |
| Class B | 0.05% | 0.03% | 0.01% |
| Class C | 0.01% | 0.02% | 0.03% |
| Class D | 0.00% | -0.01% | -0.02% |
| Class E | 0.01% | 0.00% | 0.01% |
| Overall | 0.02% | 0.01% | 0.01% |
| | 0.02% | 0.01% | 0.00% |
| | Random Access HE | | |
| | Y | U | V |
| Class A | 0.01% | 0.05% | 0.04% |
| Class B | 0.03% | 0.00% | -0.06% |
| Class C | 0.03% | 0.03% | 0.04% |
| Class D | 0.02% | 0.15% | -0.07% |
| Class E | | | |
| Overall | 0.02% | 0.05% | -0.02% |
| | 0.02% | 0.05% | -0.01% |
| | Low delay B HE | | |
| | Y | U | V |
| Class A | | | |
| Class B | 0.03% | 0.00% | -0.03% |
| Class C | 0.03% | -0.01% | -0.04% |
| Class D | 0.01% | -0.03% | 0.01% |
| Class E | 0.01% | -0.56% | 0.13% |
| Overall | 0.02% | -0.12% | 0.01% |
| | 0.02% | -0.14% | -0.03% |

Conclusions

- Two proposed context configurations
 - Configuration BR6
 - Save 18 contexts per slice, or 29.0 % for 4x4 & 8x8 blocks
 - Overall average Y BD-rate increases 0.03 - 0.06% under common test conditions
 - Overall average Y BD-rate increases 0.05 – 0.06 % with low QP values
 - Configuration BR4
 - Save 10 contexts per slice, or 16.1 % for 4x4 & 8x8 blocks
 - Overall average Y BD-rate increases 0.01 - 0.02% under common test conditions
 - Overall average Y BD-rate increases 0.02 % with low QP values
- Recommend further study in the CE with other related contributions