

Non-CE3: Simplified context derivation for significance map

JCTVC-I0296

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1. Overview

Overview

- Proposed technique
 - Simplified context derivation for significance map
- Algorithm
 - Position based context derivation by `significant_coeff_group_flag`
- Benefit
 - Context dependency entirely removed for large TUs
- Crosscheck
 - JCTVC-I0367 by Sharp
- Simulation results
 - Average 0.1% coding loss



2. Algorithm

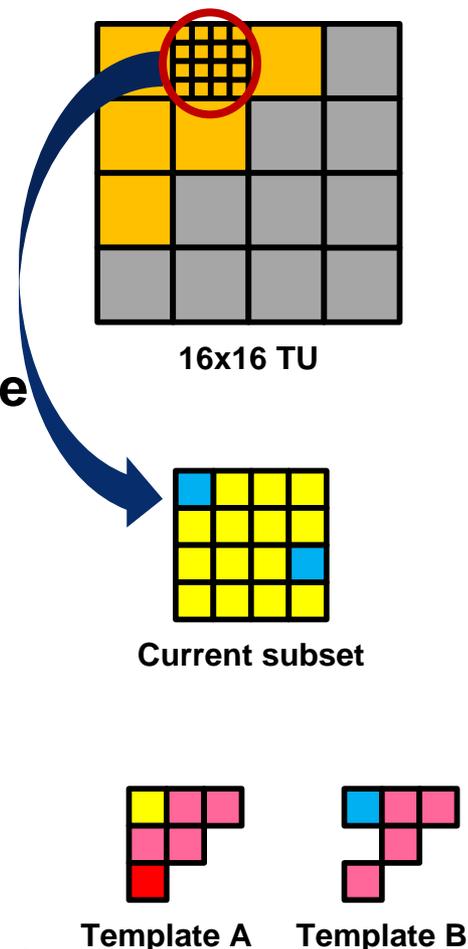
HM6.0 - Context index derivation process for significance map for large TU

- Fixed context for high frequency area
- Template based for **low frequency area**

- **Step1. count up non-zero coeffs in the template**
 - Template A for **yellow** coeffs
 - Template B for **blue** coeffs

- **Step2. derive the context index**
 - Context index = (**min(count,4)** + 1) >> 1

- Need template hole calculation (2 bin parallel)
- Depends on previous coeffs in the same subset



Proposed algorithm - Context index derivation process for significance map for large TU

Step1. determine the pattern

- pattern = significant_coeff_group_flag(right) + (significant_coeff_group_flag(bottom) << 1)

1 time for 1 subset

Similar derivation process for context index of 'significant_coeff_group_flag'

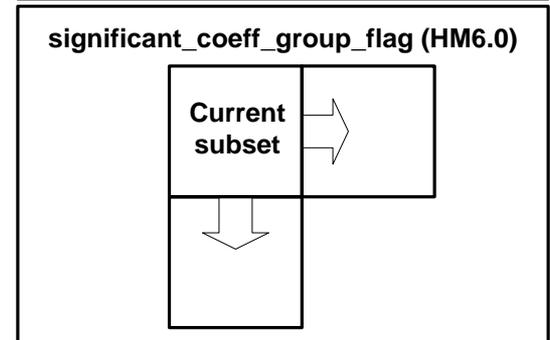
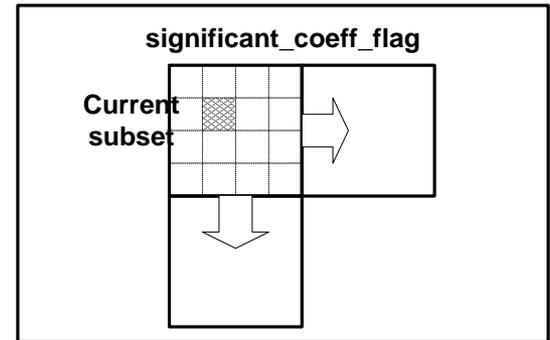
Step2. derive the context index

- based on the pattern and the position

- (a) $X + Y \leq 2 ? 1 : 0$
- (b) $Y \leq 1 ? 1 : 0$
- (c) $X \leq 1 ? 1 : 0$
- (d) $X + Y \leq 4 ? 2 : 1$

No need to refer previous coefficients in the subset

No need of template hole calculation



| | | | |
|---|---|---|---|
| 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |

(a) No coeff

| | | | |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 |

(b) Coeff in only right

| | | | |
|---|---|---|---|
| 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 0 | 0 |

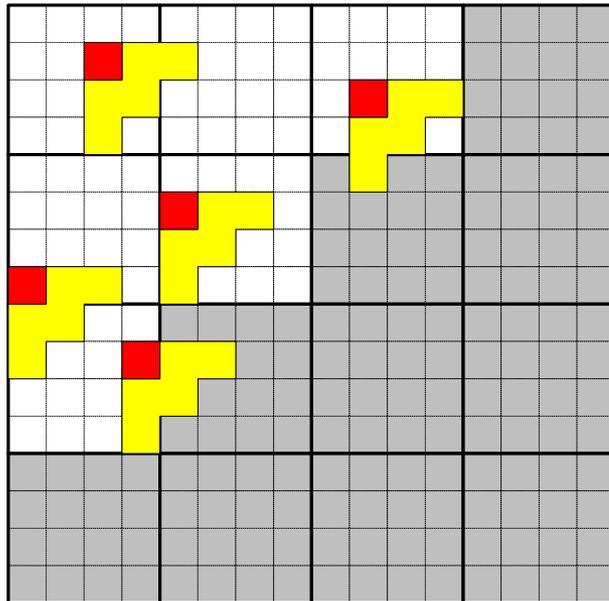
(c) Coeff in only bottom

| | | | |
|---|---|---|---|
| 2 | 2 | 2 | 2 |
| 2 | 2 | 2 | 2 |
| 2 | 2 | 2 | 1 |
| 2 | 2 | 1 | 1 |

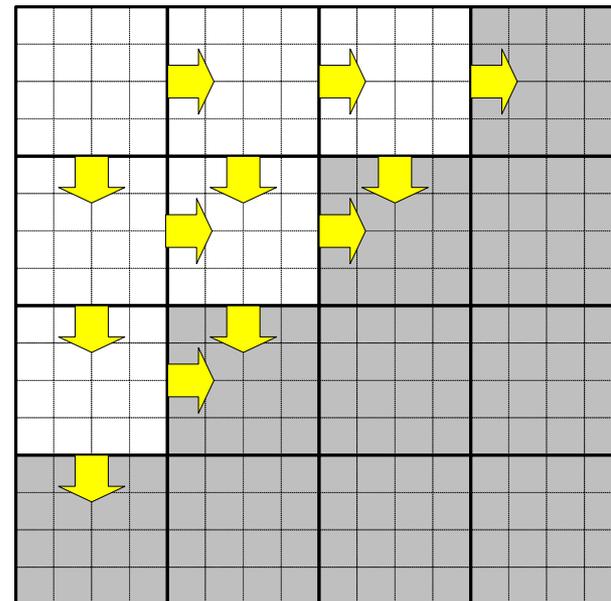
(d) Coeff in right and bottom

Benefits

- **Context dependency entirely removed**
- **No need of template hole calculation**
- **Share logic with significant_coeff_group_flag context derivation**
- **Throughput improvement for various implementation**



HM6.0



Proposal

3

3. Experiments

Experimental results

| | All Intra Main | | | Random Access Main | | | Low delay B Main | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.2% | 0.2% | 0.2% | 0.2% | 0.1% | 0.4% | | | |
| Class B | 0.2% | 0.2% | 0.3% | 0.2% | 0.2% | 0.2% | 0.1% | 0.5% | 0.2% |
| Class C | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.4% | 0.2% |
| Class D | 0.1% | 0.2% | 0.1% | 0.1% | -0.2% | 0.3% | 0.1% | 0.3% | 0.4% |
| Class E | 0.2% | 0.2% | 0.3% | | | | 0.2% | -0.7% | -0.9% |
| Overall | 0.1% | 0.2% | 0.2% | 0.1% | 0.0% | 0.3% | 0.1% | 0.2% | 0.1% |
| | 0.1% | 0.2% | 0.2% | 0.2% | 0.0% | 0.3% | 0.1% | 0.3% | 0.1% |
| Class F | 0.0% | 0.2% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | -0.3% | 0.4% |
| Enc Time[%] | | 99% | | | 99% | | | 100% | |
| Dec Time[%] | | 100% | | | 101% | | | 101% | |

| | All Intra HE10 | | | Random Access HE10 | | | Low delay B HE10 | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.1% | 0.1% | 0.2% | 0.1% | 0.3% | 0.0% | | | |
| Class B | 0.1% | 0.1% | 0.1% | 0.2% | 0.2% | 0.1% | 0.1% | 0.0% | 0.5% |
| Class C | 0.1% | 0.1% | 0.2% | 0.1% | 0.2% | 0.1% | 0.1% | 0.4% | 0.5% |
| Class D | 0.1% | 0.1% | 0.1% | 0.1% | 0.2% | 0.2% | 0.2% | -0.1% | 0.0% |
| Class E | 0.2% | 0.1% | 0.2% | | | | 0.1% | 0.1% | -0.9% |
| Overall | 0.1% | 0.1% | 0.2% | 0.1% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% |
| | 0.1% | 0.1% | 0.2% | 0.1% | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% |
| Class F | 0.1% | 0.0% | 0.0% | 0.1% | 0.1% | 0.1% | 0.2% | 0.0% | 1.0% |
| Enc Time[%] | | 98% | | | 99% | | | 99% | |
| Dec Time[%] | | 100% | | | 101% | | | 98% | |

Experimental results (lowQP)

| | All Intra Main | | | Random Access Main | | | Low delay B Main | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|--------------|--------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.0% | | | |
| Class B | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | -0.2% |
| Class D | 0.0% | 0.1% | 0.0% | 0.0% | -0.1% | 0.1% | 0.1% | 0.1% | 0.2% |
| Class E | 0.1% | 0.2% | 0.1% | | | | 0.0% | -0.9% | -0.6% |
| Overall | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.1% | 0.0% | -0.1% | -0.1% |
| | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.1% | 0.0% | -0.1% | -0.1% |
| Class F | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | | 99% | | | 99% | | | 99% | |
| Dec Time[%] | | 100% | | | 100% | | | 100% | |

| | All Intra HE10 | | | Random Access HE10 | | | Low delay B HE10 | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | -0.1% | | | |
| Class B | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.2% |
| Class C | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.2% |
| Class D | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | 0.1% | 0.1% | 0.1% |
| Class E | 0.1% | 0.1% | 0.1% | | | | 0.0% | -0.5% | 0.8% |
| Overall | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 0.0% | 0.1% | 0.0% | 0.3% |
| | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 0.0% | 0.1% | 0.0% | 0.4% |
| Class F | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.0% | 0.0% | 0.1% | 0.4% |
| Enc Time[%] | | 99% | | | 101% | | | 103% | |
| Dec Time[%] | | 100% | | | 102% | | | 103% | |

Experimental results (RDOQ off)

| | All Intra Main | | | Random Access Main | | | Low delay B Main | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.2% | 0.5% | 0.6% | 0.0% | 0.3% | 0.2% | | | |
| Class B | 0.1% | 0.4% | 0.4% | 0.1% | 0.3% | 0.3% | 0.1% | 0.1% | 0.3% |
| Class C | 0.1% | 0.2% | 0.2% | 0.1% | 0.0% | 0.2% | 0.1% | 0.0% | 0.3% |
| Class D | 0.0% | 0.1% | 0.1% | 0.0% | 0.3% | 0.4% | 0.0% | 0.2% | 0.2% |
| Class E | 0.3% | 0.6% | 0.7% | | | | -0.1% | 0.4% | 0.7% |
| Overall | 0.1% | 0.3% | 0.4% | 0.1% | 0.2% | 0.3% | 0.0% | 0.2% | 0.4% |
| | 0.1% | 0.3% | 0.4% | 0.1% | 0.2% | 0.2% | 0.0% | 0.2% | 0.4% |
| Class F | 0.0% | 0.2% | 0.0% | 0.1% | 0.1% | 0.3% | 0.2% | 1.5% | 0.3% |
| Enc Time[%] | | | | | | | | | |
| Dec Time[%] | | | | | | | | | |

| | All Intra HE10 | | | Random Access HE10 | | | Low delay B HE10 | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.2% | 0.5% | 0.4% | 0.0% | 0.4% | 0.4% | | | |
| Class B | 0.1% | 0.4% | 0.4% | 0.2% | 0.3% | 0.2% | 0.1% | 0.1% | 0.9% |
| Class C | 0.1% | 0.2% | 0.2% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% | -0.1% |
| Class D | 0.0% | 0.1% | 0.1% | 0.1% | -0.2% | 0.0% | 0.1% | 0.4% | 0.0% |
| Class E | 0.3% | 0.6% | 0.7% | | | | 0.1% | 0.1% | 0.7% |
| Overall | 0.1% | 0.3% | 0.4% | 0.1% | 0.2% | 0.2% | 0.1% | 0.2% | 0.4% |
| | 0.1% | 0.3% | 0.4% | 0.1% | 0.2% | 0.2% | 0.1% | 0.1% | 0.5% |
| Class F | 0.0% | -0.1% | 0.1% | 0.1% | 0.2% | -0.2% | 0.2% | 2.0% | -2.7% |
| Enc Time[%] | | | | | | | | | |
| Dec Time[%] | | | | | | | | | |

Experimental results

(SIGMAP_CONST AT HIGH FREQUENCY off)

| | All Intra Main | | | Random Access Main | | | Low delay B Main | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|--------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.2% | 0.1% | 0.1% | 0.1% | 0.1% | 0.3% | | | |
| Class B | 0.2% | 0.0% | 0.1% | 0.1% | 0.1% | 0.3% | 0.1% | 0.4% | 0.3% |
| Class C | 0.0% | 0.0% | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% | 0.1% | 0.2% |
| Class D | 0.0% | 0.1% | 0.0% | 0.0% | -0.2% | 0.2% | 0.1% | -0.3% | 0.3% |
| Class E | 0.2% | 0.2% | 0.2% | | | | 0.0% | -0.8% | -0.7% |
| Overall | 0.1% | 0.1% | 0.1% | 0.1% | 0.0% | 0.2% | 0.1% | -0.1% | 0.1% |
| | 0.1% | 0.1% | 0.1% | 0.1% | 0.0% | 0.2% | 0.1% | 0.0% | 0.1% |
| Class F | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% | 0.1% | 0.0% | -0.1% | 0.2% |
| Enc Time[%] | 98% | | | 100% | | | 100% | | |
| Dec Time[%] | 100% | | | 98% | | | 98% | | |

| | All Intra HE10 | | | Random Access HE10 | | | Low delay B HE10 | | |
|----------------|----------------|-------------|-------------|--------------------|-------------|-------------|------------------|-------------|-------------|
| | Y | U | V | Y | U | V | Y | U | V |
| Class A | 0.1% | 0.0% | 0.1% | 0.1% | 0.5% | 0.0% | | | |
| Class B | 0.1% | -0.1% | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.4% |
| Class C | 0.0% | 0.1% | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% | 0.4% | 0.2% |
| Class D | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | -0.3% | -0.1% |
| Class E | 0.2% | 0.0% | 0.1% | | | | 0.2% | -0.1% | 1.4% |
| Overall | 0.1% | 0.0% | 0.0% | 0.1% | 0.2% | 0.1% | 0.1% | 0.0% | 0.4% |
| | 0.1% | 0.0% | 0.0% | 0.1% | 0.2% | 0.1% | 0.1% | 0.1% | 0.4% |
| Class F | 0.0% | 0.0% | -0.1% | 0.1% | 0.1% | 0.2% | 0.2% | -1.0% | 1.3% |
| Enc Time[%] | 98% | | | 100% | | | 100% | | |
| Dec Time[%] | 99% | | | 100% | | | 100% | | |

4. Conclusion

Conclusion

■ Benefits

- **Context dependency entirely removed**
- No need of template hole calculation
- Share logic with significant_coeff_group_flag context derivation
- Throughput improvement for various implementation

■ Recommendation

- Adopted to DIS and HM

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