



JCTVC-G598

**Intra prediction based on weighted
template matching predictors (WTM)**

T. Guionnet (INRIA)

L. Guillo (Irisa/CNRS)

C. Guillemot (INRIA)

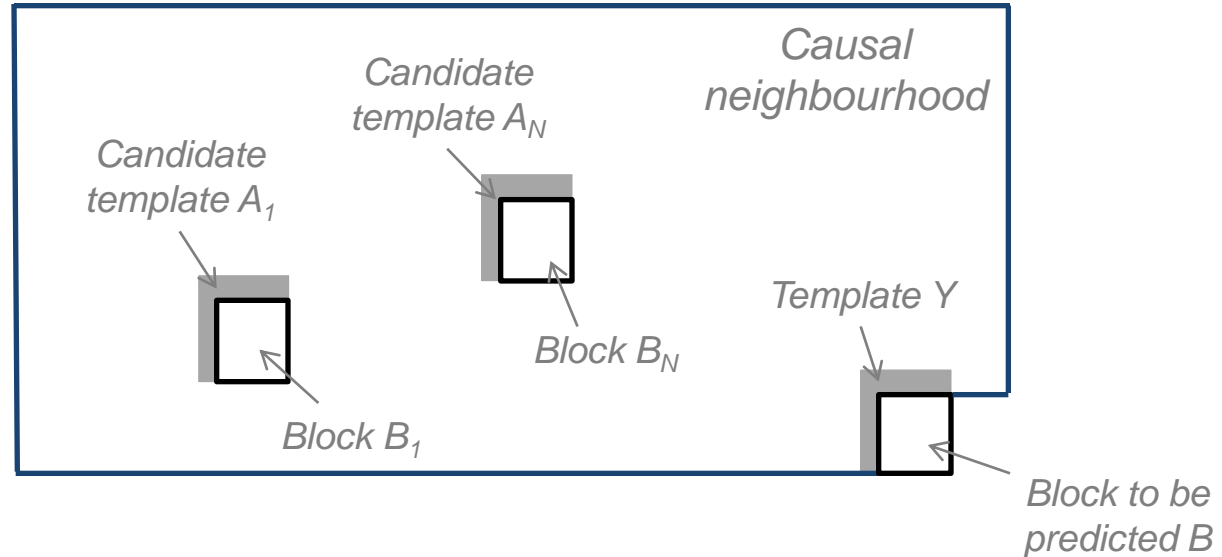
Outline

1. Key features of WTM

2. Integration in HM4.0

3. Results

Key features of WTM



3 step intra prediction method:

- Select the N best B_i such as the related A_i have the lowest SSD with Y
- Compute from each B_i a prediction P_i of B :

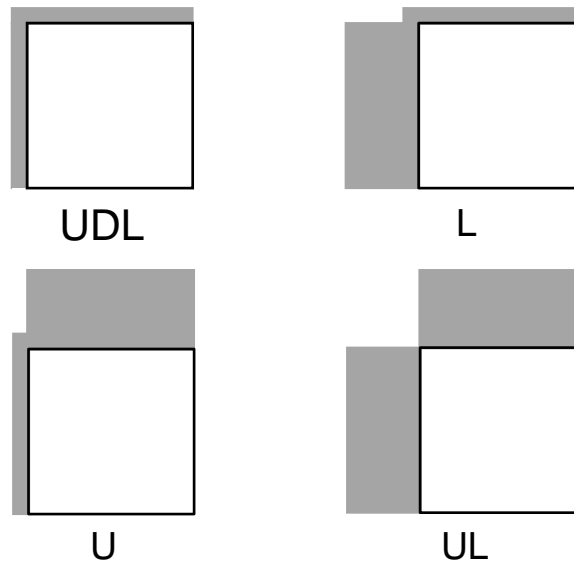
$$P_i = \rho_i \cdot B_i \quad \text{with} \quad \rho_i = \frac{A_i \cdot Y}{\|A_i\|}$$

- Average these N predictions to get a prediction P of B :

$$P = \frac{1}{N} \sum_{i=1}^N P_i$$

Key features of WTM

- WTM uses 4 shapes of template in competition
 - width and height of templates are 1 or 4 pixels large whatever the block size
 - a WTM predictor always uses the same shape of template



Integration into HM4.0

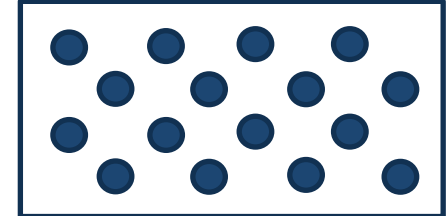
- WTM uses 4 shapes of template in competition
 - The chosen shape is signaled in the PU syntax
- WTM is activated according to configuration, class and block size

	HE					LC				
	4x4	8x8	16x16	32x32	64x64	4x4	8x8	16x16	32x32	64x64
Class A	-	√	√	√	-	-	√	√	-	-
Class B	√	√	√	√	-	√	√	√	-	-
Class C	√	√	√	-	-	√	√	-	-	-
Class D	√	√	√	-	-	√	√	-	-	-
Class E	√	√	√	√	-	√	√	√	-	-
Class F	√	√	√	√	-	√	√	√	-	-

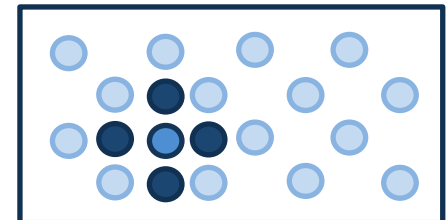
Integration into HM4.0

- WTM first step: SSD computation for N best B_i selection
 - Most time consuming
- Contribution
 - Reduced size search windows
 - Subsampled search
 - Factorization of the four shapes search
- Parallelization is possible
- WTM: template matching without high computing cost penalty

Subsampled search:
1 - Search half the data



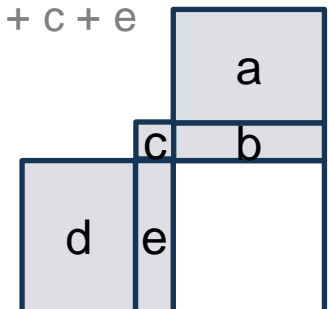
2 - Refine the N bests



Shapes factorization:

$$\text{UDL} = b + c + e$$

...



Results : HM4.0+WTM vs HM4.0

Cross-check: JCTVC-G604

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0,0%	-2,0%	-2,6%	-0,1%	-1,4%	-2,0%
Class B	-0,8%	-0,9%	-0,8%	-0,9%	-0,7%	-0,6%
Class C	-0,9%	-0,5%	-0,7%	-1,0%	-0,6%	-0,8%
Class D	-0,4%	-0,3%	-0,4%	-0,5%	-0,4%	-0,4%
Class E	-0,5%	-0,4%	-0,4%	-0,7%	-0,6%	-0,2%
Class F	-3,1%	-2,9%	-2,8%	-3,5%	-3,5%	-3,4%
Overall	-1,0%	-1,2%	-1,3%	-1,1%	-1,2%	-1,2%
	-1,0%	-1,2%	-1,3%	-1,1%	-1,2%	-1,2%
Enc Time[%]	115%			121%		
Dec Time[%]	104%			106%		

Max BD-rate gains with SlideEditing : 5.8% in HE, 6.9% in LC

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0,0%	-2,0%	-2,6%	-0,1%	-1,4%	-2,0%
Class B	-0,8%	-0,9%	-0,8%	-0,9%	-0,7%	-0,6%
Class C	-0,9%	-0,5%	-0,7%	-1,0%	-0,6%	-0,8%
Class D	-0,4%	-0,3%	-0,4%	-0,5%	-0,4%	-0,4%
Class E	-0,5%	-0,4%	-0,4%	-0,7%	-0,6%	-0,2%
Overall	-0,5%	-0,8%	-1,0%	-0,7%	-0,7%	-0,8%
	-0,5%	-0,8%	-1,0%	-0,7%	-0,7%	-0,8%
Enc Time[%]	114%			121%		
Dec Time[%]	104%			105%		

Max BD-rate gains with BasketballDrill : 2.6% in HE, 2.3% in LC

Preliminary tests with SDIP (CE6): HM4.0+WTM+SDIP vs HM4.0

		All Intra HE			All Intra LC		
		Y	U	V	Y	U	V
WTM	Overall	-1,0%	-1,2%	-1,3%	-1,1%	-1,2%	-1,2%
	Enc Time[%]	115%			121%		
	Dec Time [%]	104%			106%		
SDIP	Overall	-2,1%	-2,7%	-2,8%	-3,0%	-3,3%	-3,4%
	Enc Time[%]	124%			138%		
	Dec Time [%]	100%			100%		
WTM+SDIP	Overall	-2,9%	-3,1%	-3,3%	-3,6%	-3,7%	-3,9%
	Enc Time[%]	141%			160%		
	Dec Time [%]	105%			108%		

- Max BD-rate gains for WTM+SDIP

- All classes:

SlideEditing 15.3% in HE, 15.9% in LC

- All classes except F:

BasketBallDrive 3.7% in HE, 5.8% in LC

Conclusion

- High gains for class F (3.1% AI-HE) while preserving interesting gains for the other classes (e.g. 0.9% class C AI-HE)
- WTM performs better when videos contain non natural content (text, logos, scenes from video games)
- Average times in AI-HE mode is 115% for encoding and 104% for decoding
- Gains of WTM are largely added when SDIP is activated
- Further studies on WTM, especially for screen content videos, within a CE (e.g. CE6) would be relevant

Thank you