

JCTVC-B078

Intra prediction by a linear combination of template matching predictors

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- Objective:

“To improve intra prediction when blocks to be predicted are highly textured or have directional textures”

- Idea:

- To take advantage of textures already in the picture
- predictor = average of weighted template matching predictors



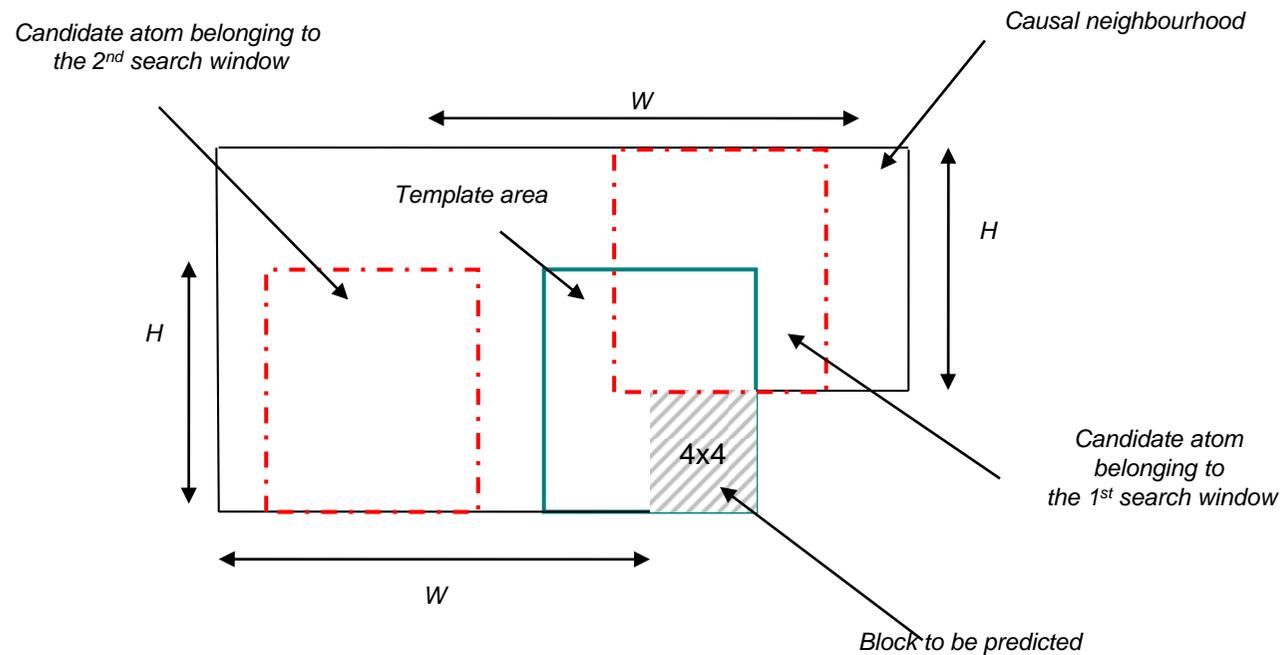
Outline

- Description of the algorithm
- Test conditions and results
- Ongoing and future works



Step 1: Selection of atoms

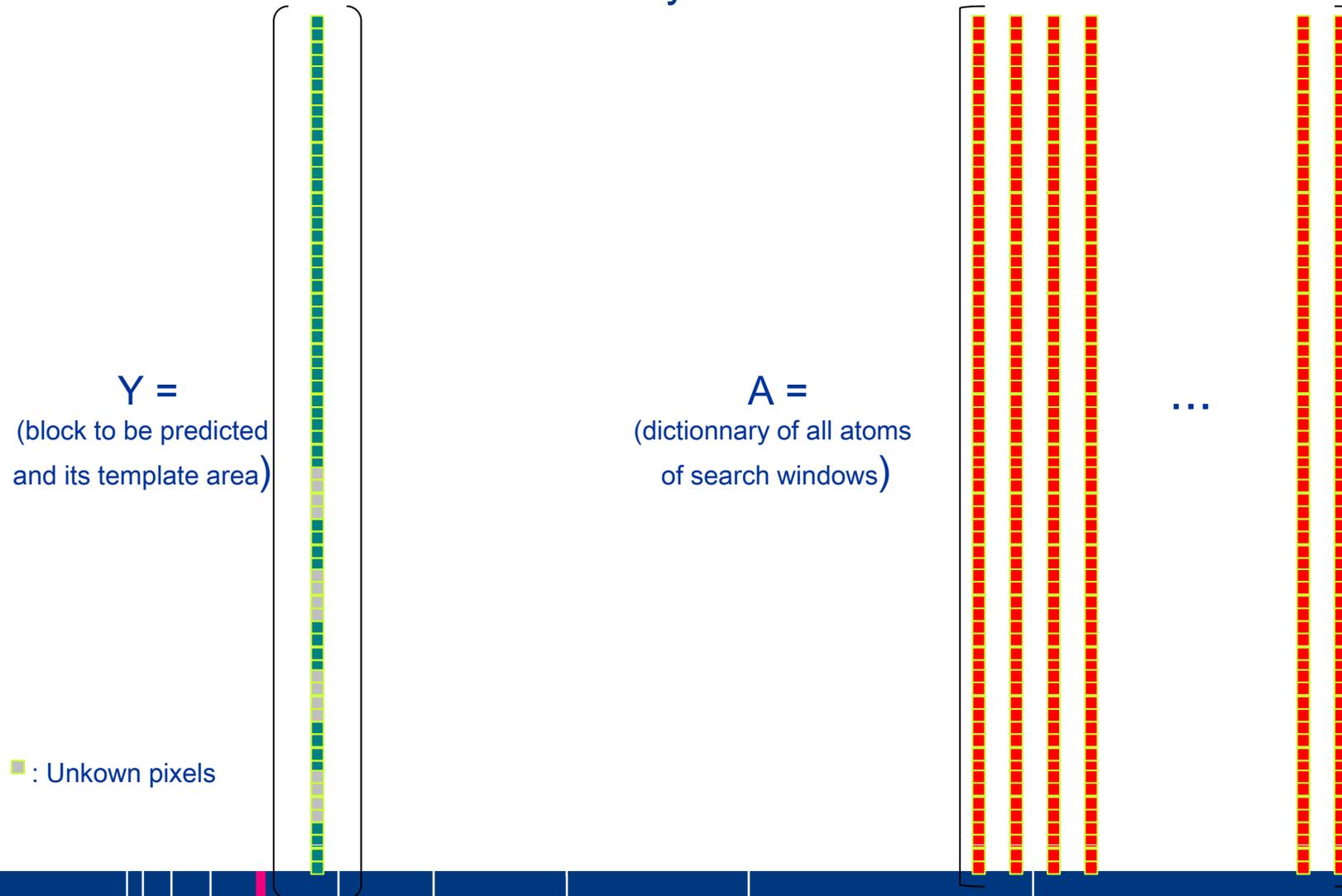
- Atoms are extracted from causal neighbourhood *:



(*) : 4x4 prediction example.

Step 2: Linearization

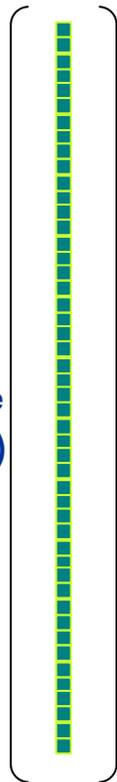
- Blocks are scanned row by row and turned into vectors:



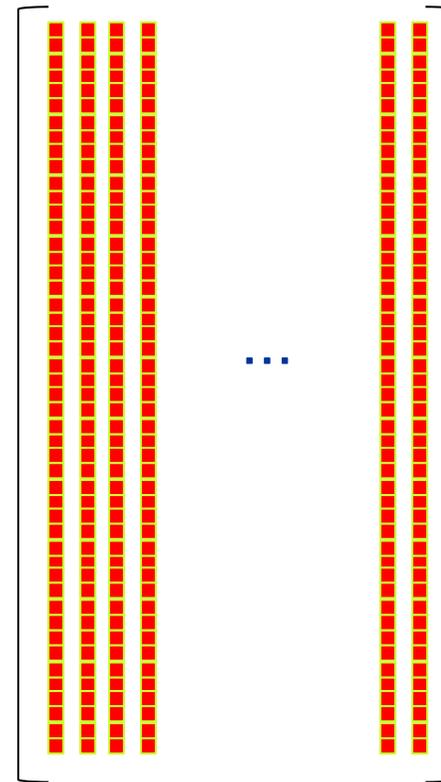
Step 3: Compacting vectors

- Lines corresponding to unknown pixels are removed

$Y_C =$
(template area of the
block to be predicted)



$A_C =$
(dictionary of all atoms
without components
corresponding to unknown
pixels in Y)



Step 4: Prediction

- Select the most correlated atom a_j to Y_C such that:

$$j = \arg \max_i (a_i^T Y_C)^2 / a_i^T a_i$$

- Compute its weighting factor w_j :

$$w_j = (a_j^T Y_C) / a_j^T a_j$$

- Multiply the whole atom a_j to get a value for unknown pixels
- Average the predictions got in this way for the best three correlations



Test conditions and results (1/3)

- Implemented in KTA2.7
 - For 4x4, 8x8 and 16x16 blocks
 - Source code modified as specified in Intra AhG report
 - MDDT and ALF turned off
- Compared with KTA 2.7 with same configuration as above
- Used with classes, videos and QP specified in Intra AhG report
- Only « all intra » mode tested



Test conditions and results (2/3)

- Improvements are not significant for classes A, B1 and D ...

| Class | Video | Lower QP | | Upper QP | |
|----------|------------------|--------------|--------------|--------------|--------------|
| | | BD-PSNR(dB) | BD-Rate(%) | BD-PSNR(dB) | BD-Rate(%) |
| Class A | Traffic | +0.07 | -1.18 | +0.07 | -1.25 |
| | People on Street | +0.09 | -1.46 | +0.10 | -1.79 |
| | Average | +0.08 | -1.32 | +0.09 | -1.52 |
| Class B1 | Kimono | +0.03 | -0.96 | +0.04 | -1.04 |
| | ParkScene | +0.01 | -0.29 | +0.01 | -0.26 |
| | Average | +0.02 | -0.63 | +0.03 | -0.65 |
| Class D | BasketballPass | +0.19 | -3.05 | +0.15 | -2.80 |
| | BQSquare | +0.05 | -0.54 | +0.04 | -0.47 |
| | BlowingBubbles | +0.05 | -0.68 | +0.04 | -0.69 |
| | RaceHorses | +0.06 | -0.74 | +0.05 | -0.83 |
| | Average | +0.09 | -1.25 | +0.07 | -1.20 |



Test conditions and results (3/3)

- ... but are much better for classes B2, C and E:

| Class | Video | Lower QP | | Upper QP | |
|----------|-----------------|--------------|--------------|--------------|--------------|
| | | BD-PSNR(dB) | BD-Rate(%) | BD-PSNR(dB) | BD-Rate(%) |
| Class B2 | Cactus | +0.14 | -3.35 | +0.18 | -4.31 |
| | BasketballDrive | +0.07 | -2.46 | +0.09 | -3.04 |
| | BQTerrace | +0.27 | -4.25 | +0.28 | -5.31 |
| | Average | +0.16 | -3.35 | +0.18 | -4.22 |
| Class C | BasketballDrill | +0.24 | -4.71 | +0.20 | -4.43 |
| | BQMall | +0.25 | -4.00 | +0.26 | -4.40 |
| | PartyScene | +0.04 | -0.48 | +0.03 | -0.49 |
| | RaceHorses | +0.07 | -0.88 | +0.06 | -1.06 |
| | Average | +0.15 | -2.52 | +0.14 | -2.60 |
| Class E | Vidyo1 | +0.25 | -4.61 | +0.22 | -3.82 |
| | Vidyo3 | +0.20 | -3.42 | +0.23 | -3.84 |
| | Vidyo4 | +0.11 | -2.11 | +0.11 | -2.18 |
| | Average | +0.19 | -3.38 | +0.19 | -3.28 |



Ongoing and future works

- Improve the current signalling
- Extension of the current solution
 - To be able to specify the number of atoms used in the linear combination
 - To take advantage of different shapes for the template area
 - To determine which iteration of matching pursuit is the best
- Integration in the TMuC



Thank you.



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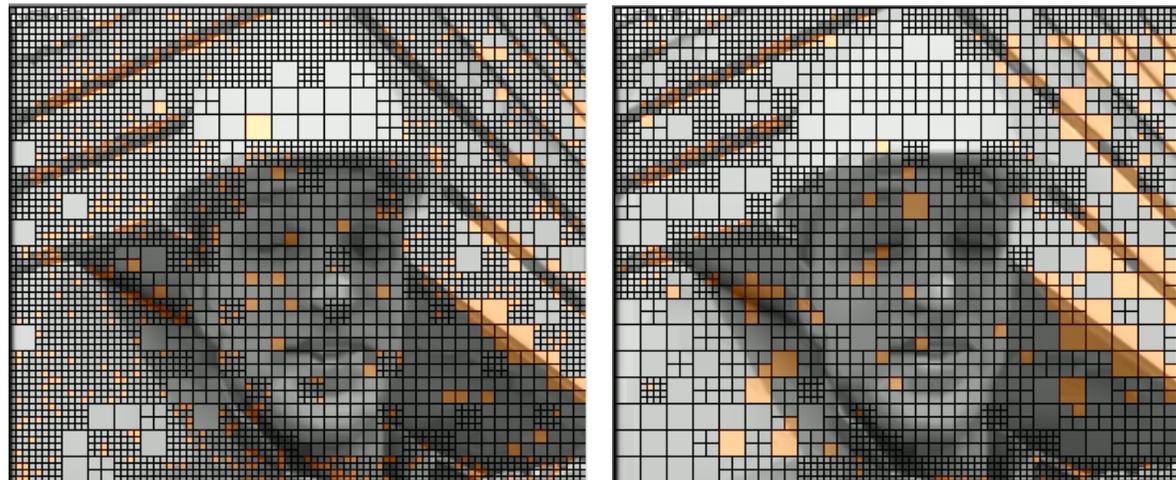


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First application

- Integrated in KTA2.7, MDDT and ALF turned off
- % of predicted blocks with the new method

| | QP = 22 | QP = 34 |
|-----------|---------|---------|
| 4x4 (%) | 11.8 | 7.4 |
| 8x8 (%) | 10.6 | 11.6 |
| 16x16 (%) | 9.4 | 25.8 |



Example of 4x4, 8x8 and 16x16 blocks predicted when QP=22 (left) and QP=34(right)