

# Intra prediction for lossless coding (JCTVC-L0161)

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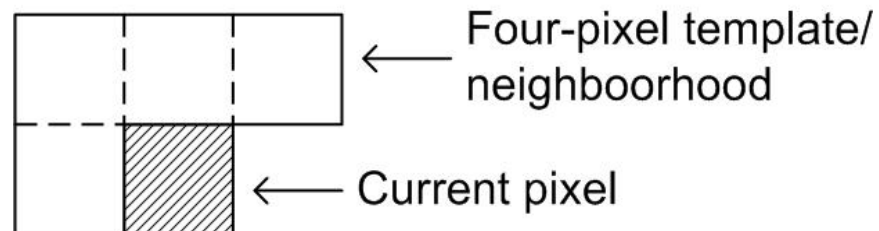
## Motivation

- Lossless image compression for professional applications required
- Example application: medical imaging
  - Coding artefacts might degrade the quality of a diagnosis  
→ Lossless compression is needed
  - Large amounts of medical image data that have to be archived in repositories (e.g., PACS – Picture Archiving and Communication System)  
→ High coding efficiency is important
- Other application examples (e.g., from JCTVC-K0199)
  - Automotive vision
  - Video conferencing
  - Long-distance education
  - ...

## Proposal

- Pixel-wise intra prediction mode replacing PLANAR mode for “transform skip”

- Four-pixel template and four pixel neighborhood



- Algorithm

- Similarity (i.e., SAD) between template around current pixel and neighborhood template:

$$SAD_{i,j} = \sum_{n \in N_0} |p[i-n] - p[j-n]|$$

- Weights (exponential decay):  $w_{i,j} = LUT[SAD_{i,j}]$

- Predictor for current pixel:  $\hat{p}[i] = \sum_{j \in i+N_0} w_{i,j} \cdot p[j]$

## Results

	All Intra Main		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA	-10.88	98.7	83.8
ClassB	-5.98	100.5	89.4
ClassC	-7.39	100.4	87.9
ClassD	-8.29	100.4	86.3
ClassE	-9.48	100.5	89.7
ClassF	-9.02	101.4	98.1
Overall (w/o F)	-8.40	100.1	87.4
Overall (w/ F)	-8.51	100.3	89.2

## Results (cont.)

	All Intra HE10		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA	-6.69	99.4	88.6
ClassB	-3.12	100.5	94.6
ClassC	-4.16	99.9	95.8
ClassD	-5.18	100.7	93.8
ClassE	-4.23	101.3	97.0
ClassF	-5.59	102.4	102.2
Overall (w/o F)	-4.67	100.4	93.9
Overall (w/ F)	-4.83	100.7	95.3

## Results (cont.)

	Low Delay B Main		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA			
ClassB	-0.90	102.2	97.4
ClassC	-1.33	100.9	97.8
ClassD	-1.40	100.3	98.6
ClassE	-1.77	100.9	99.2
ClassF	-3.13	100.5	99.6
Overall (w/o F)	-1.35	101.1	98.3
Overall (w/ F)	-1.71	101.0	98.5

## Results (cont.)

	Low Delay B HE10		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA			
ClassB	-0.47	101.4	100.3
ClassC	-0.70	100.4	99.9
ClassD	-0.78	100.1	100.0
ClassE	-0.46	100.3	102.1
ClassF	-1.89	100.3	101.1
Overall (w/o F)	-0.60	100.6	100.6
Overall (w/ F)	-0.86	100.5	100.7

## Results (cont.)

	Low Delay P Main		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA			
ClassB	-1.34	104.3	97.7
ClassC	-1.49	101.6	98.7
ClassD	-1.47	100.8	99.2
ClassE	-2.49	101.1	100.4
ClassF	-3.15	100.9	100.0
Overall (w/o F)	-1.70	101.9	99.0
Overall (w/ F)	-1.99	101.7	99.2



## Results (cont.)

	Low Delay P HE10		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA			
ClassB	-0.52	102.4	100.6
ClassC	-0.73	101.0	100.0
ClassD	-0.78	100.6	100.6
ClassE	-0.46	100.9	102.9
ClassF	-1.83	100.4	101.7
Overall (w/o F)	-0.62	101.2	101.0
Overall (w/ F)	-0.87	101.1	101.2

## Results (cont.)

	Random Access Main		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA	-3.97	101.7	96.2
ClassB	-1.23	102.8	97.6
ClassC	-1.78	101.1	97.8
ClassD	-1.99	100.9	98.3
ClassE			
ClassF	-4.19	100.3	99.6
Overall (w/o F)	-2.24	101.6	97.5
Overall (w/ F)	-2.63	101.4	97.9

## Results (cont.)

	Random Access HE10		
	Delta bitrate [%]	Enc time [%]	Dec time [%]
ClassA	-2.28	101.1	97.5
ClassB	-0.65	101.2	100.3
ClassC	-0.95	100.8	99.5
ClassD	-1.15	100.8	99.2
ClassE			
ClassF	-2.50	100.2	102.0
Overall (w/o F)	-1.25	100.9	99.1
Overall (w/ F)	-1.50	100.8	99.7

## Conclusions

- Pixel-wise intra prediction mode based on similarity within a small neighborhood
- Implementation in HEVC Test Model HM9.1 with “transform skip” enabled
- Summary of bit-rate savings (w/o F and w/ F)
  - AI-Main: 8.40% (8.51%)
  - RA-Main: 2.24% (2.63 %)
  - LB-Main: 1.35% (1.71%)
  - LP-Main: 1.70% (1.99%)
  - AI-HE10: 4.67% (4.83%)
  - RA-HE10: 1.50% (1.50%)
  - LB-HE10: 0.60% (0.86%)
  - LP-HE10: 0.62% (0.87%)
- Proposal: further evaluation of the presented technique for lossless coding (especially for all-intra coding and coding of still images)