

AVC based intra prediction for improved visual quality

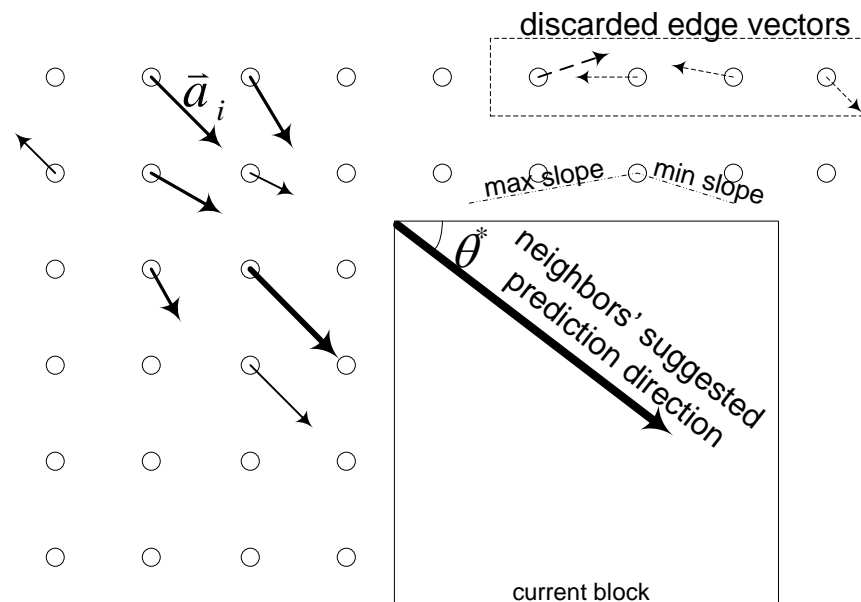
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Overview

- Additional new tool to JCTVC-A103
- Motivation:
 - Current AVC intra prediction has coarsely quantized prediction direction (i.e., 8)
 - More precision in the prediction direction results in better prediction
 - However, the bit overhead for signaling directions may be significant
- Proposal:
 - Derive a neighbor's suggested direction using edge detection
 - Edge in natural images are commonly continuous
 - Allow the suggested direction to be adjusted by the encoder
 - Account curved edge

Edge-Based Intra Prediction (EBIP)

- Get edge vectors from neighbors together with a confidence measure:
 - In a neighborhood, perform edge detection for each pixel using for example Sobel operators;
 - Discard edge vectors that do not cross the block boundary;
 - Can be easily done with a lookup table.
 - Discard edge vectors that have small norms.



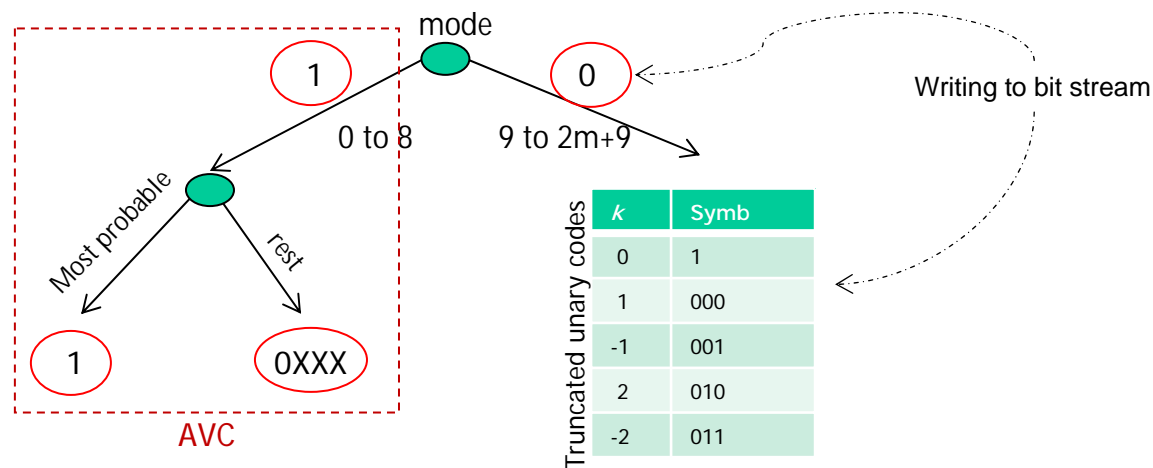
EBIP (continued)

- Direction adjustment:
 - Based on the confidence measure s we introduce $2m+1$ new modes:

$$\left\{ \begin{array}{ll} \theta^* + k\delta\theta_1 & \text{if } (s < s_0) \\ \theta^* + k\delta\theta_2 & \text{otherwise} \end{array} \right\} \quad k = 0, \pm 1, \pm 2, \dots$$

$\delta\theta_2 < \delta\theta_1$

- The following signaling is used for the $2m+10$ modes



Experiment

- Implemented in the KTA 2.6r1 software for 4x4 and 8x8 blocks
 - although this method can be directly applied to arbitrary block sizes
- All frames (entire sequence) are intra-coded
- 5 different QPs (23, 27, 31, 35, 39)
 - Low BD Rate (largest 4 QPs)
 - High (smallest 4 QPs)

Results

Sequence/Resolution		Low Bitrate %	High Bitrate %
CIF	Foreman (300 frames)	-5.85	-5.18
CIF average		-5.85	-5.18
Class D	Basketball Pass	-3.13	-3.27
	Blowing Bubbles	-2.70	-2.66
	Race Horse	-3.54	-3.34
	BQ Square	-3.28	-3.30
Class D average		-3.16	-3.14
Class C	Basketball Drill	-9.38	-9.97
	BQ Mall	-3.06	-3.18
	Party Scene	-1.56	-1.54
	Race Horse	-3.28	-2.87
Class C average		-4.32	-4.39
Class B	BQ Terrace	-5.83	-4.45
	Park Scene	-0.75	-0.78
	Kimono	-0.95	-1.26
	Basketball Drive	-4.86	-4.63
	Cactus	-4.26	-3.98
Class B average		-3.33	-3.02
AVERAGE		-3.75	-3.60

Summary

- Edge-based intra prediction is proposed
 - Additional modes are added to AVC intra prediction
 - The gain is up to -10%
 - The average gain is -3.75% (low), -3.60% (high)
- Propose to study by CE