

# Non-directional intra prediction for coding efficiency improvement

**JCTVC-D083**

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# Introduction

- **Intra prediction of HM**
  - Up to 33 directional modes
  - Only 1 non-directional mode (DC mode)
  
- **DC mode**
  - Efficient for static background images regions
  - Not efficient for gradient image regions as much as Plane or Planar mode

# Introduction

- **Having only DC mode for non-directional intra prediction may be insufficient**
  - Need for additional non-directional intra predictors
    - Integration of Plane mode into HM (JCTVC-D026)
    - Planar mode of TMuC (JCTVC-D326)

# Proposed method

- **ND(Non-Directional) mode**
  - Modification of Planar mode
  - Optimized to maximize coding efficiency
    - Signaling overhead is minimized while keeping the advantage of Planar mode

# Proposed method

## ■ Planar prediction

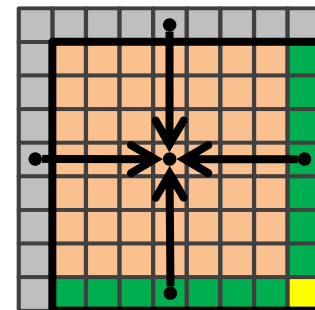
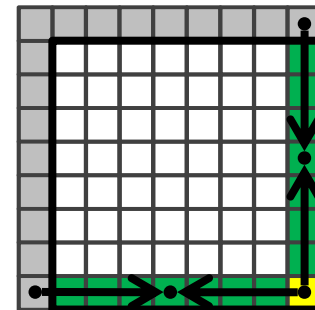
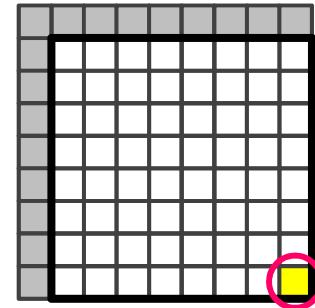
1. Set the right-bottom sample

$$\mathbf{BR} = \mathbf{DC}_{\text{pred}} + \mathbf{planar\_delta}$$

\* planar\_delta is derived from the decoded syntax elements (planar\_qp\_delta\_indicator, planar\_sign)

2. Interpolate rightmost and bottom samples

3. Bi-linear interpolation of middle samples



# Proposed method

## ■ Proposed method (ND mode)

1. Set the right-bottom sample

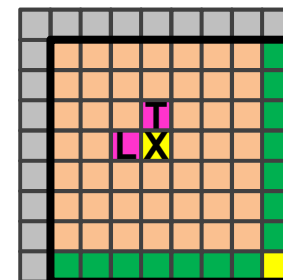
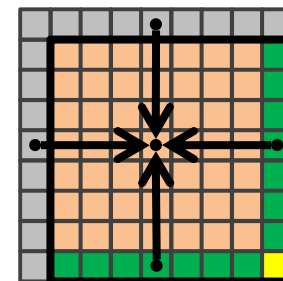
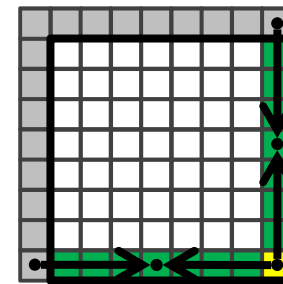
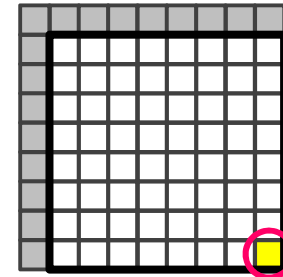
$$\mathbf{BR} = \mathbf{DC}_{\text{pred}}$$

2. Interpolate rightmost and bottom samples

3. Bi-linear interpolation of middle samples

4. Refine predicted samples by the weighted sum of the current and its neighboring (left and top) samples

$$X' = \{ (X \ll 1) + L + T + 1 \} \gg 1$$



# Proposed method

- ND mode minimize signaling overhead for prediction

Planar mode	ND mode
<pre>planar_flag if( planar flag ){ planar_delta_uv_present_flag planar_qp_delta_indicator planar_sign }</pre>	<b>No additional overhead needed</b>

# Proposed method

- **ND mode replaces DC mode optimize the combination of intra predictors**
  - DC mode is efficient in static background image regions
  - Those regions can also be predicted well by ND mode
    - ND mode covers DC mode
  - Having both modes is redundant and only increases signaling overhead



# Proposed method

## ▪ Summary

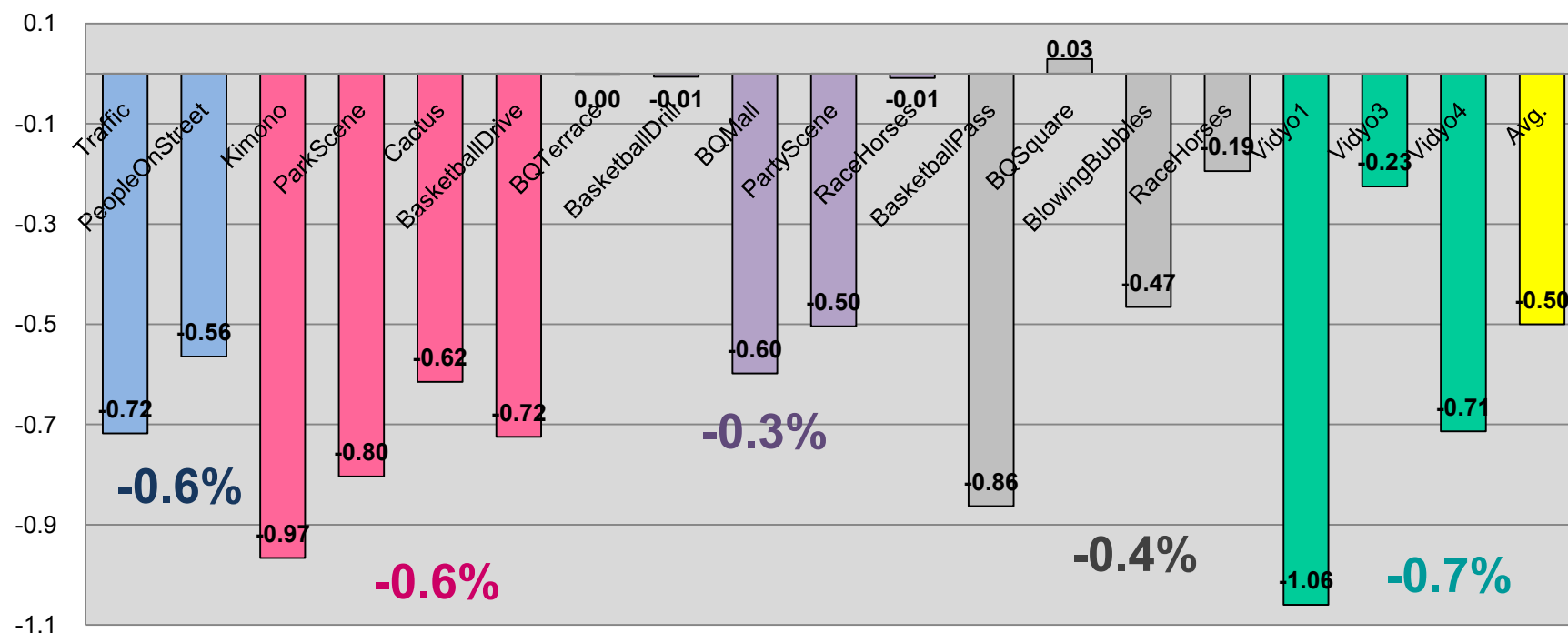
- ND(Non-Directional) mode
- Modification of Planar prediction to improve coding efficiency
- No signaling overhead needed
- Replace DC mode

# Test condition

- Anchor – TMuC0.9
- Implemented in the same software
- All coding configurations of JCTVC-C500 are tested

# Objective Results (Intra HE)

- Efficient for most sequences
- Gain is more significant on large resolution seq.



**Avg. : -0.5%, Max. : -1.1%**

# Test Results (Intra LC)

- Efficient for most sequences
- Gain is more significant on large resolution seq.



**Avg. : -0.7%, Max. : -1.5%**

# Objective results

## ▪ Summary

- Efficient for all coding configurations

Coding Config.	Y BD-rate (%)	EncT (%)	DecT (%)
Intra HE	-0.5	101	102
Intra LC	-0.7	102	103
Random Access HE	-0.3	100	100
Random Access LC	-0.2	100	99
Low delay HE	-0.1	100	100
Low delay LC	-0.0	99	101

**Subjective results - Kimono, frame147, Intra LC QP37**

**HM**



**Prop.**



Subjective results (**Contrast Enhanced**) - Kimono, frame147, Intra LC QP37

HM



Prop.



*Blocking artifacts in sky regions are significantly reduced*

# Conclusion

- **Propose ND mode**
  - Modification of Planar prediction to improve coding efficiency
- **Efficient for all coding configurations**
  - Intra HE : 0.5%(Avg.), 1.1% (Max.)
  - Intra LC : 0.7%(Avg.), 1.5% (Max.)
- **Improves subjective quality as well like Planar prediction**
- **Recommend the proposed method to be studied within the CE**