

# CODING TOOLS IN VERSATILE VIDEO CODING INTRA-PICTURE PREDICTION

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# TODAY'S DISCUSSION

Video Predictive Coding Technology

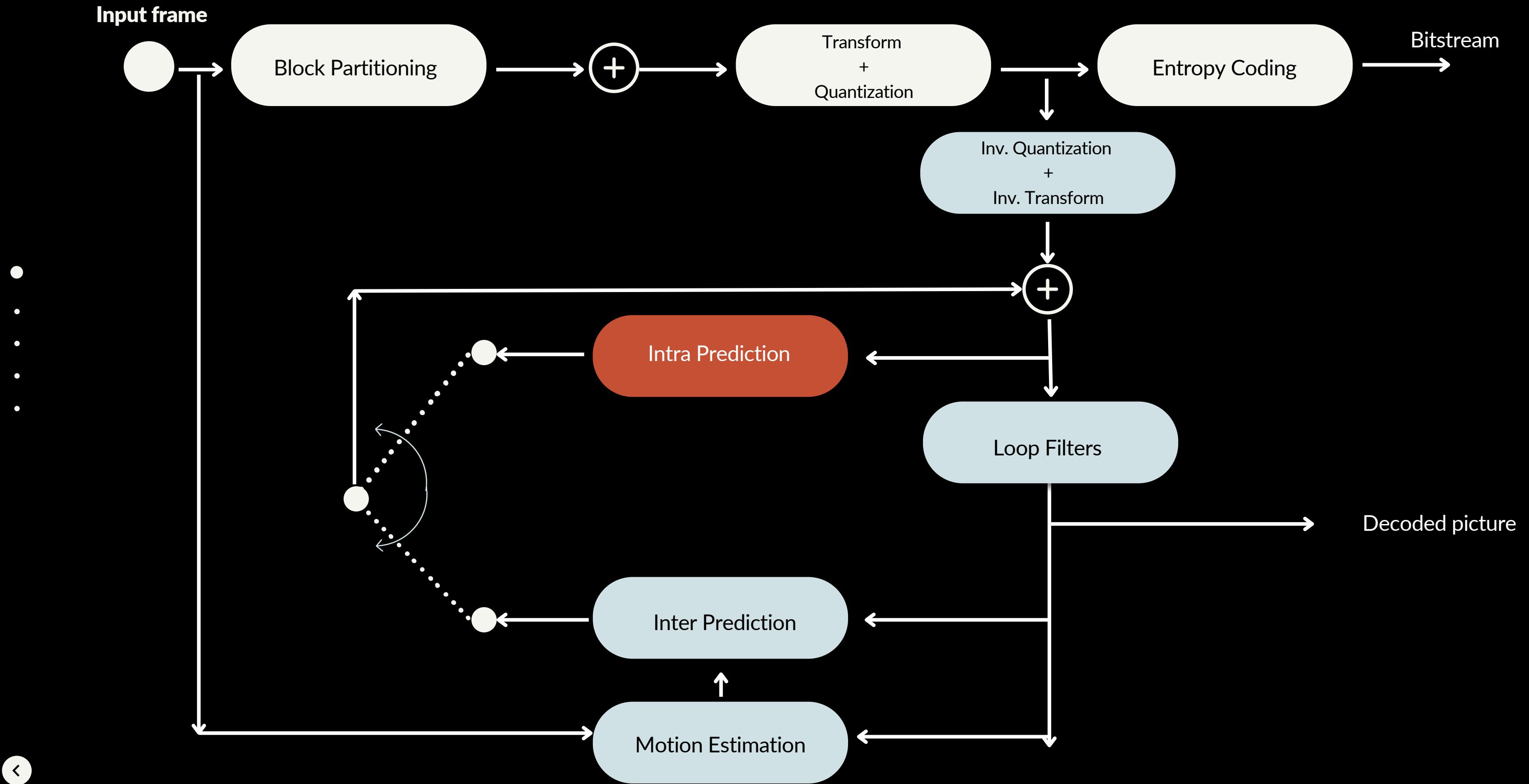
01

Intra-Picture Prediction Coding Technology

02

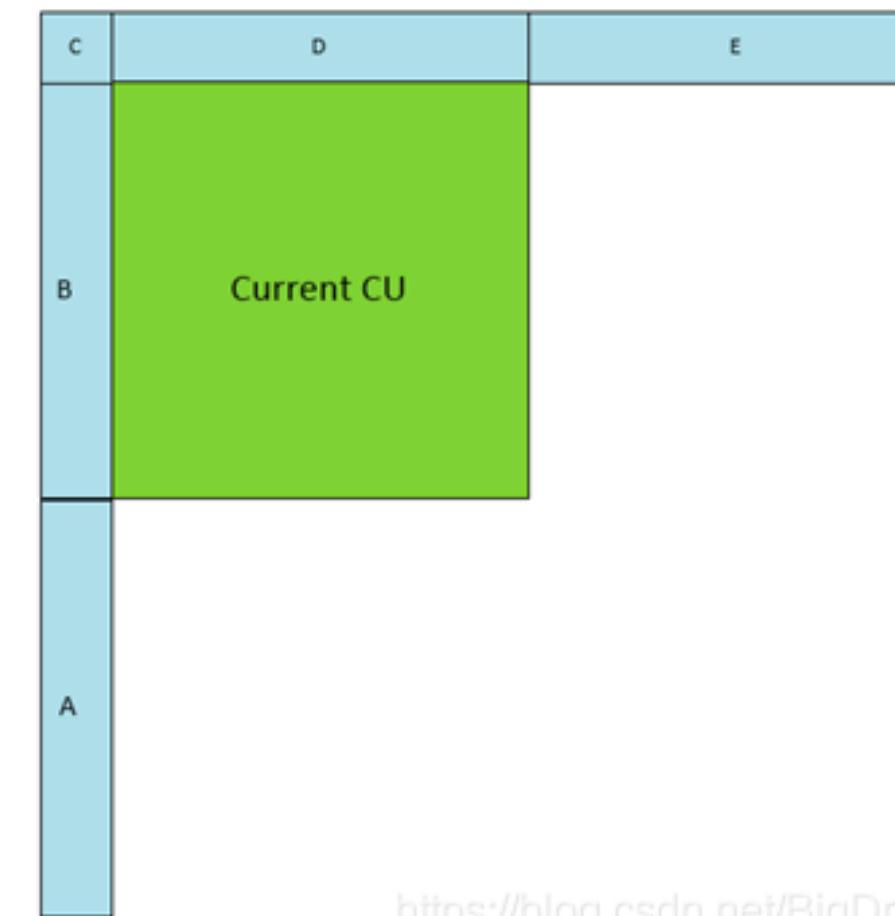


# SUMMARISE BLOCK-BASED HYBRID VIDEO CODING DESIGN



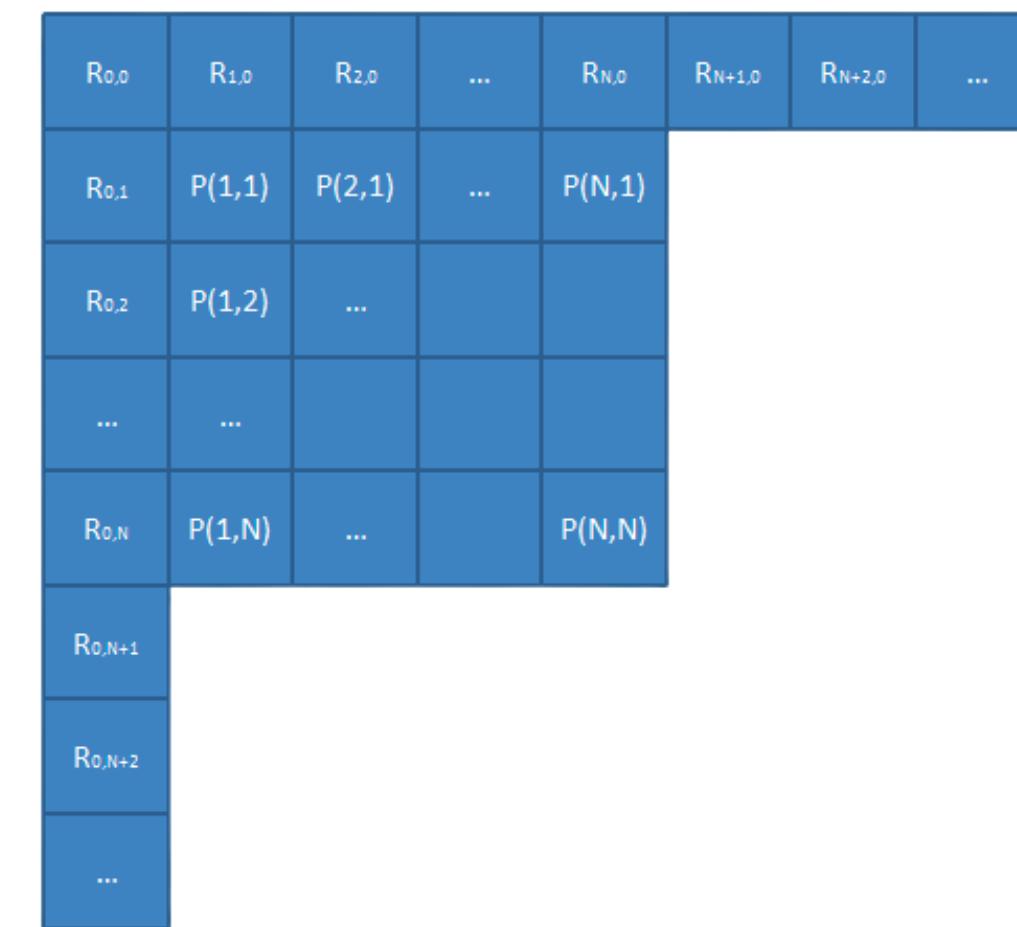
# INTRODUCTION

- Since there is a strong spatial correlation between neighbouring pixels within an image, intra-frame predictive coding uses the encoded pixel values within the image to predict the pixel values to be encoded, thus effectively removing the video spatial correlation.
- The samples of an intra-picture coded block are predicted from reference samples in neighbouring blocks to the left and above the current block, which has previously been decoded in the same picture.



# INTRODUCTION

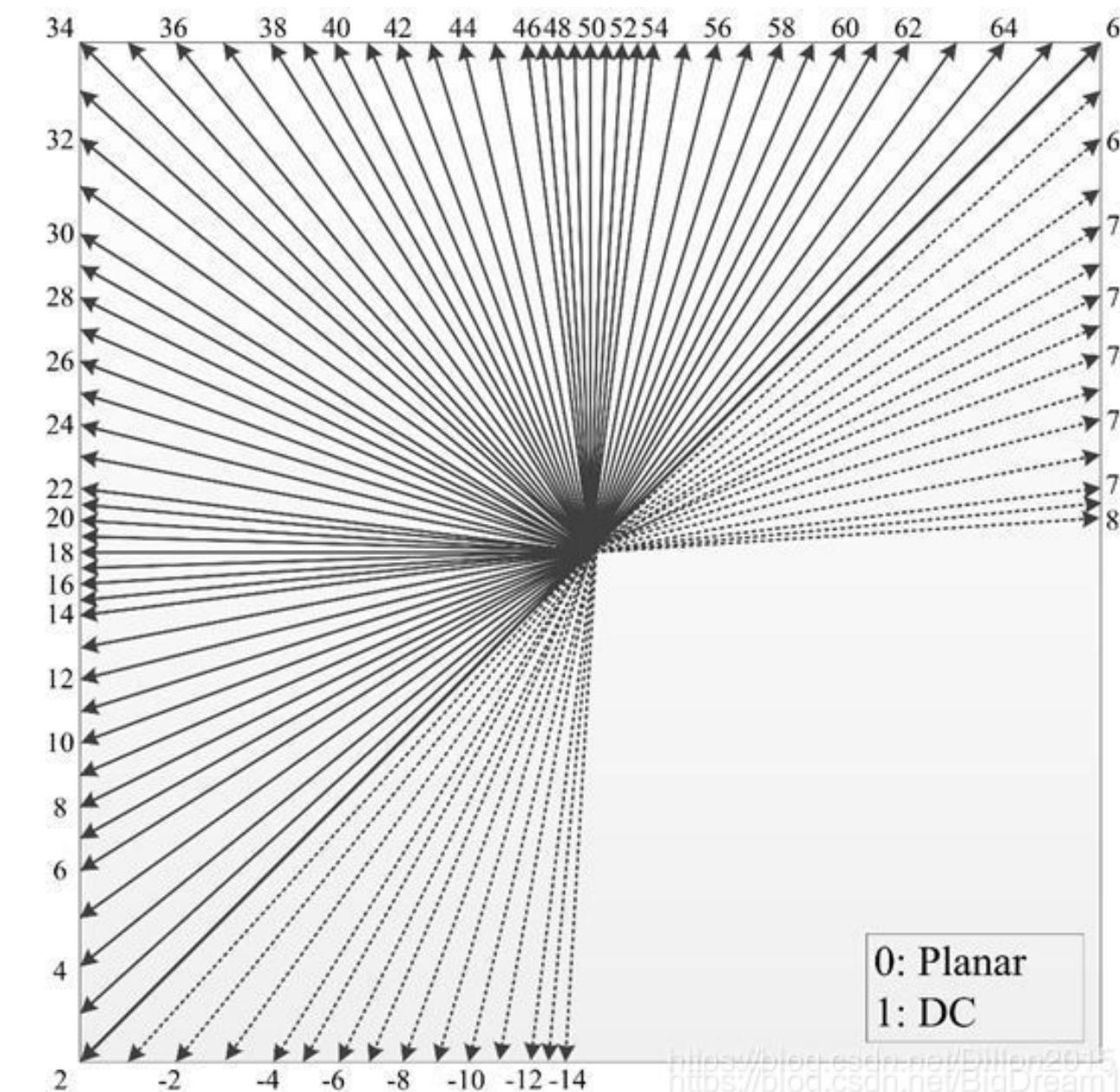
- In H.266/VVC, intra-frame predictive coding uses CU as the basic unit to reconstruct pixel information using adjacent blocks, and generates predicted pixels through 3 steps: reference pixel value acquisition, predicted value calculation and predicted value modification.



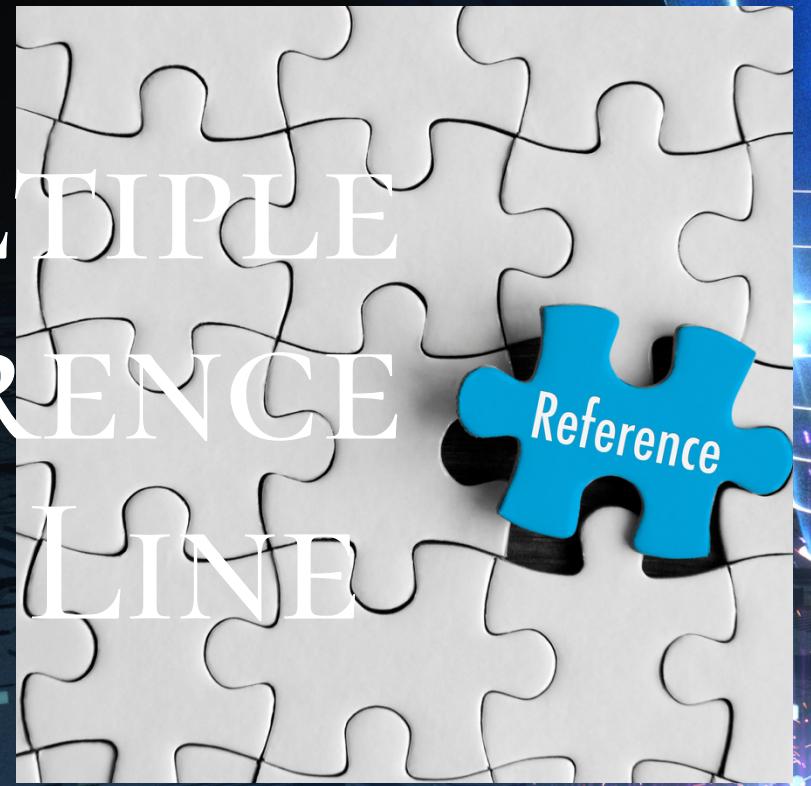
- $P(x,y)$  represents the predicted value of the pixel with coordinate position  $(x, y)$ .
- $R(x, y)$  represents the reconstructed pixel value at the coordinate position  $(x, y)$ .

# 93 INTRA-PICTURE DIRECTIONAL PREDICTION ANGLES

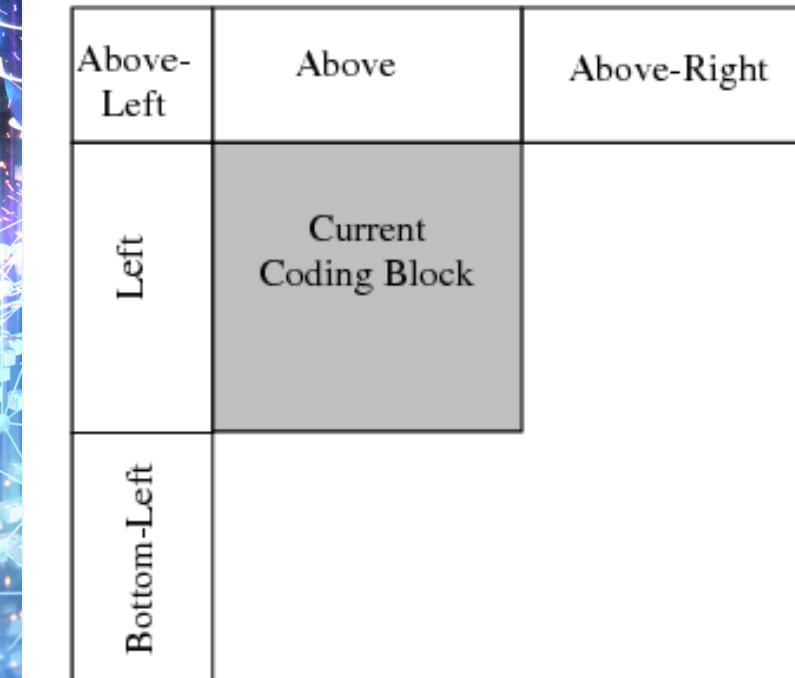
- VVC defines 65 different basic intra-frame prediction directions for the luminance prediction block.
- Considering the Wide-Angle mode which facilitates the rectangular intraframe prediction block, the VVC intraframe prediction adds -1 to -14 and 67 to 80 directions to the 65 directions.



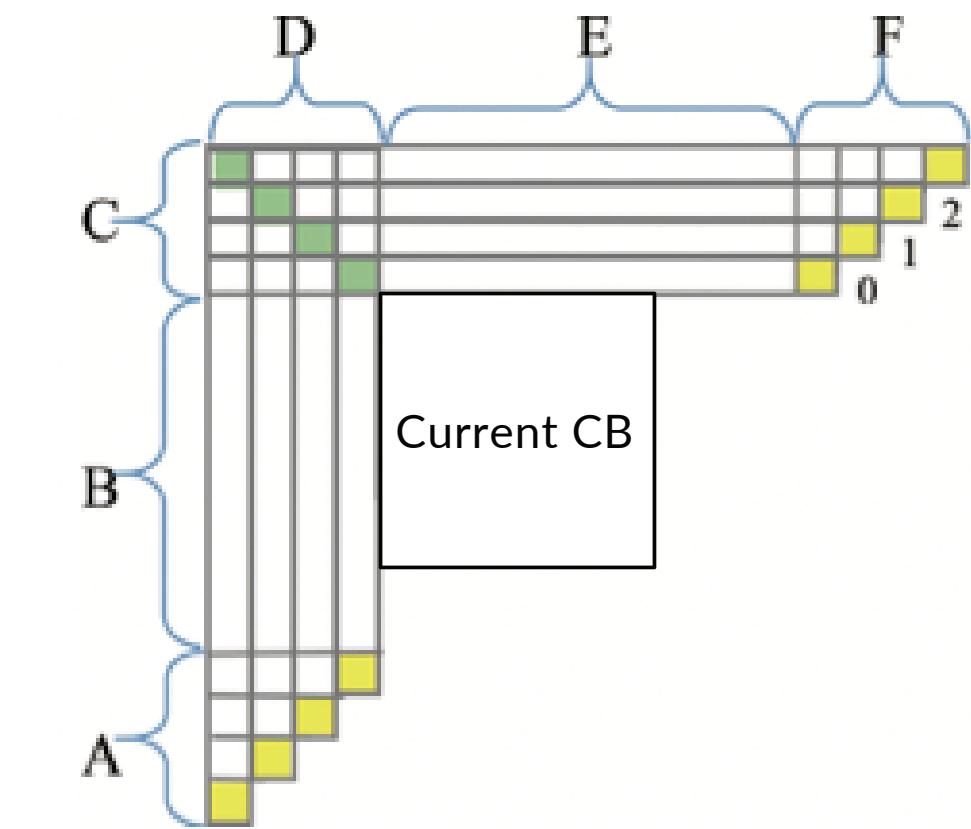
# MULTIPLE REFERENCE LINE



- Uses more reference lines besides the nearest spatial neighbouring reconstructed samples for intra-prediction.
- The MRL technique allows the use of 3 neighbouring rows of reference pixels.
- Selecting one of the rows to generate the predicted values.
- When the reference pixel does not exist or is not available, H.266/VVC uses the nearest pixel for padding.



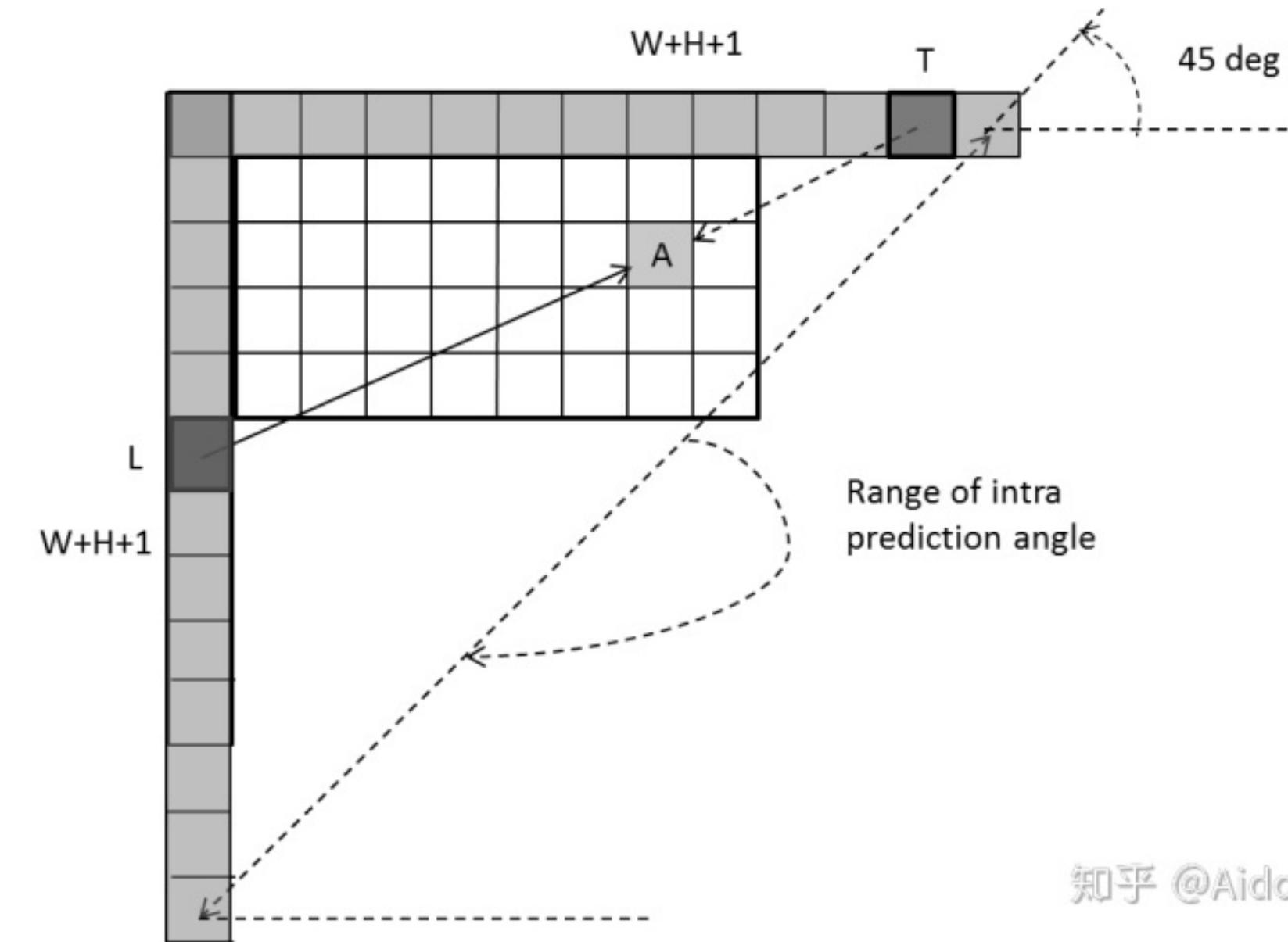
Traditional  
intra-picture prediction

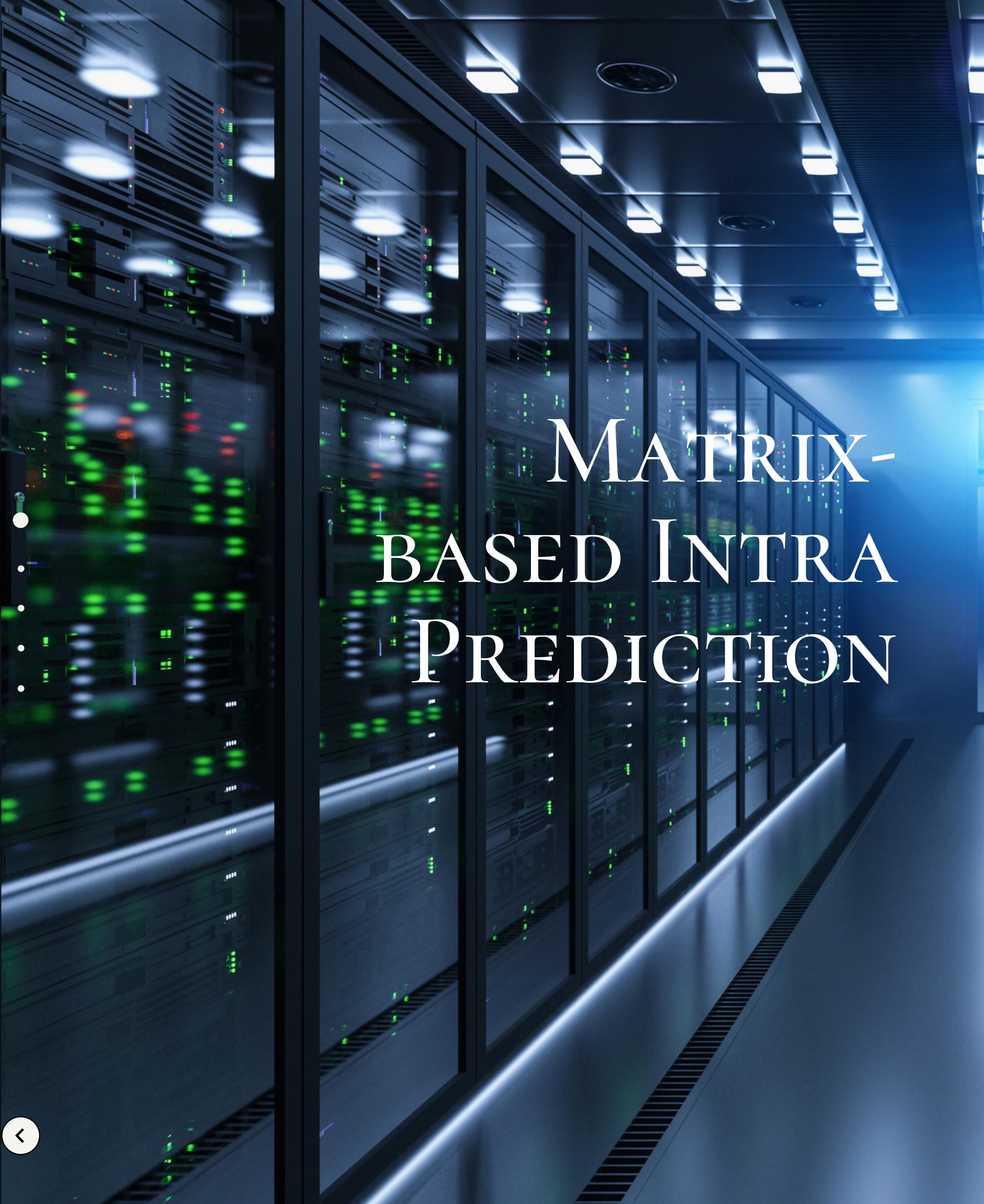


Intra-picture prediction  
with MRL

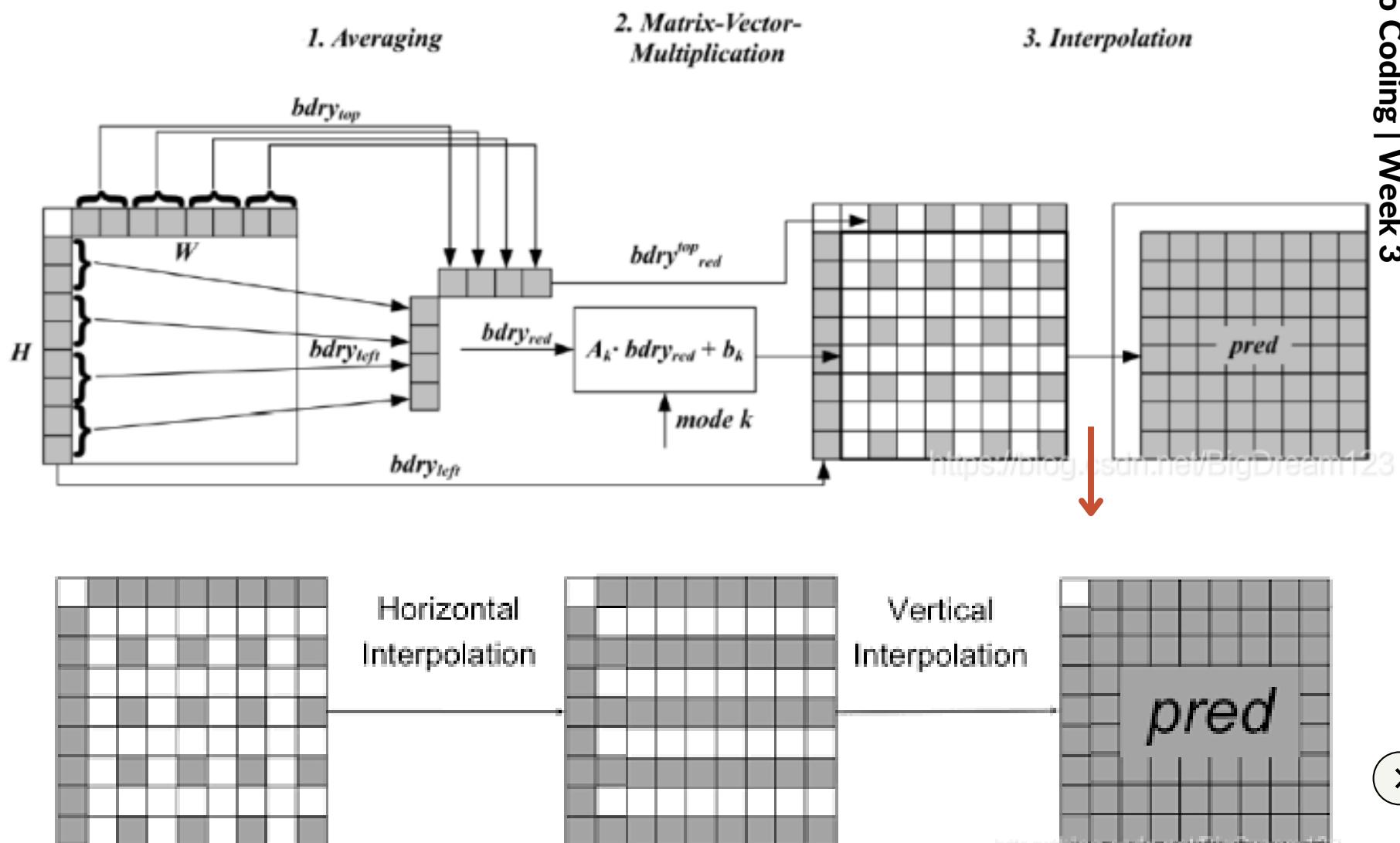
# WIDE ANGLE INTRÄ PREDICTION

- In H.266/VVC, both binary tree partitioning and ternary tree partitioning lead to non-square CUs, and the angular range of the conventional prediction model may limit the selection of reference pixels for non-square CUs.
- WAIP is introduced to extend the angle range of the intra-prediction to the angle direction from the lower-left to the upper right diagonal of the current CU.



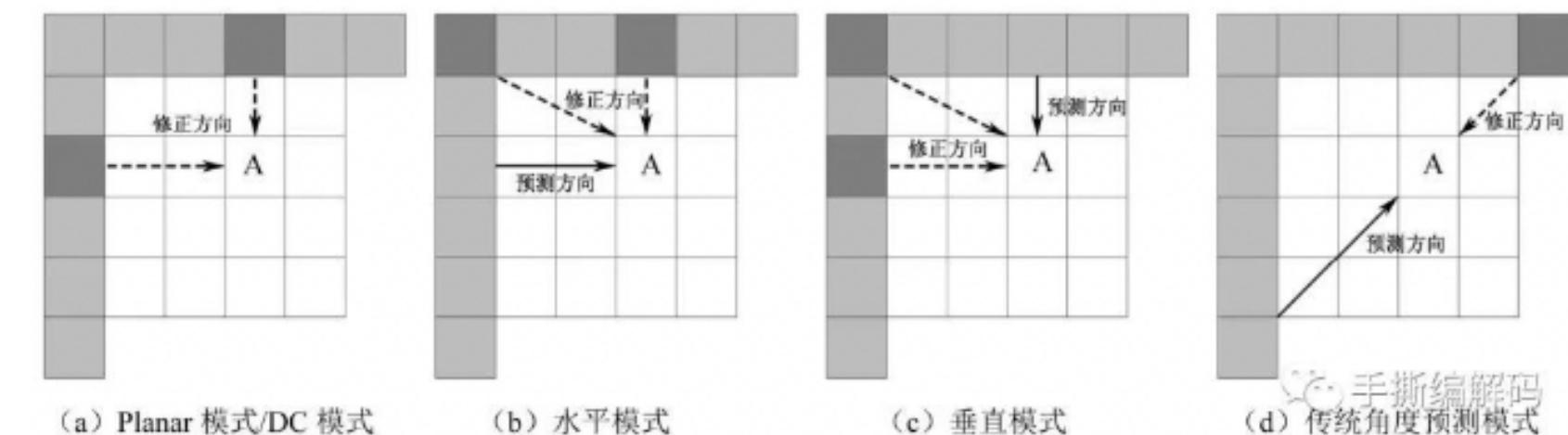


1. Averaging is applied to one left column of  $H$  reconstructed neighbouring boundary samples and one top line of  $W$  reconstructed neighbouring boundary samples to get the reduced (downsampled) boundary samples  $bdry_{red}$ .
2. A subsequent matrix–vector multiplication with a matrix  $A_i$  and an offset vector  $b_i$  generates the intermediate prediction signal  $pred_{red}$ .
3. Linear interpolation generates the prediction signal  $pred$  by upsampling  $pred_{red}$ . The matrix coefficients for each MIP mode  $i$  are pretrained with 8-bit precision.



# POSITION DEPENDENT INTRAPREDICTION COMBINATION

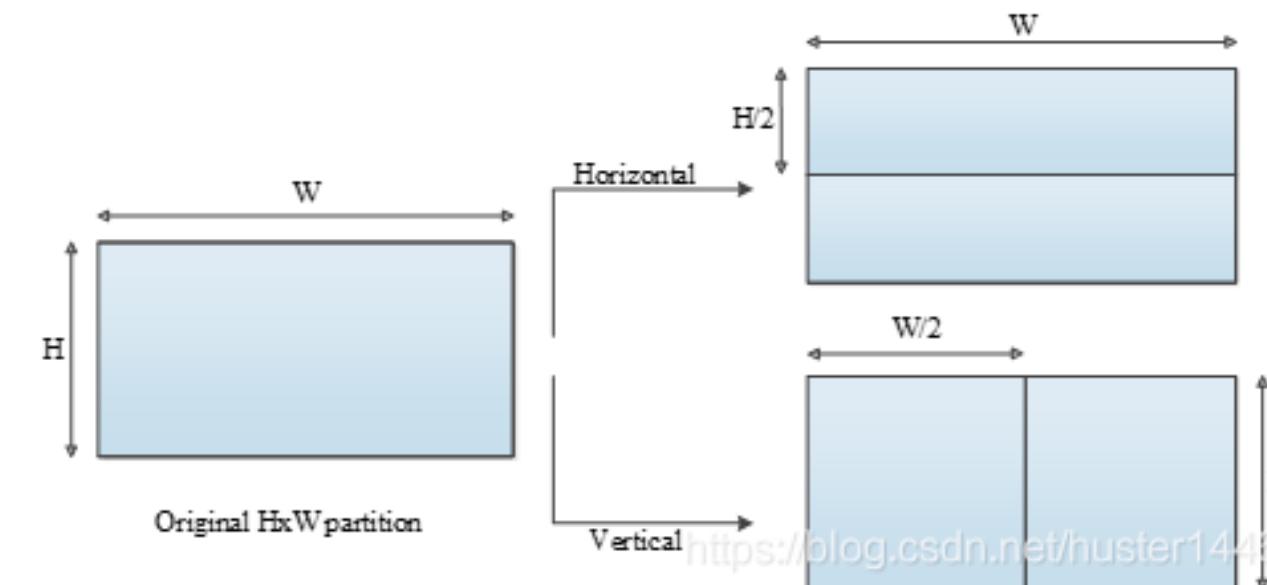
- PDPC invokes a combination of prediction with unfiltered boundary reference samples and prediction with filtered boundary reference samples.
- The final prediction sample is a linear combination of the initial prediction sample and the reference samples with the combination weights dependent on prediction modes and sample location.



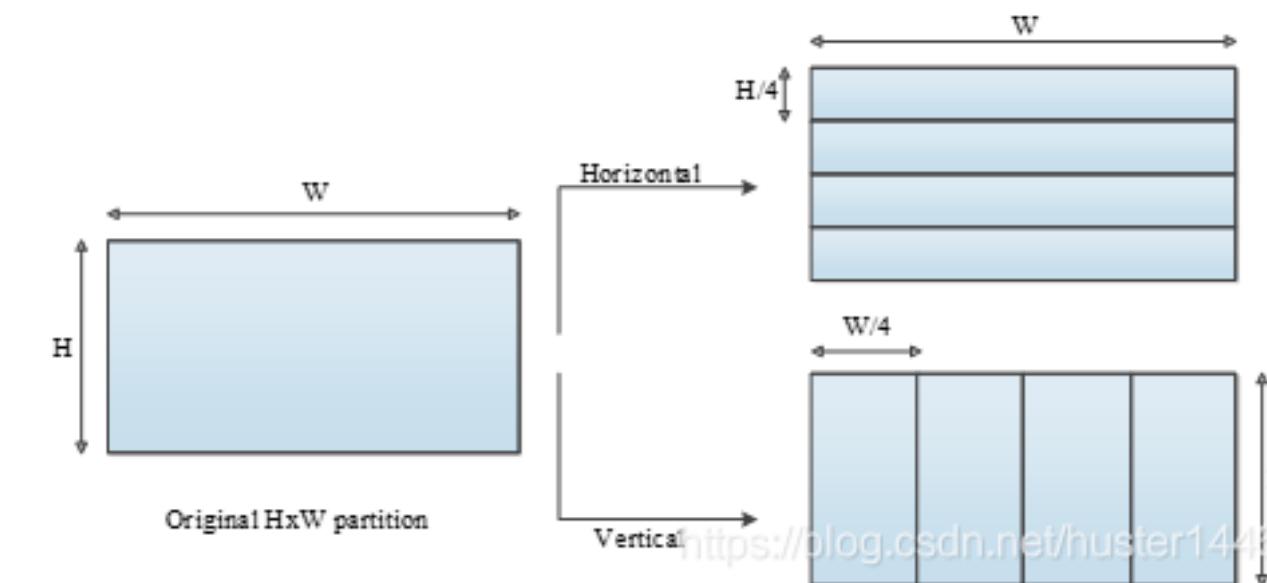
# INTRA SUB-PARTITION

- Divides a luma CU vertically or horizontally into two or four sub-partitions depending on the block size.
- Minimum Block Size:  $4 \times 8$  or  $8 \times 4$
- Maximum Block Size:  $64 \times 64$

$4 \times 8$  and  $8 \times 4$  sub-block division within the frame:

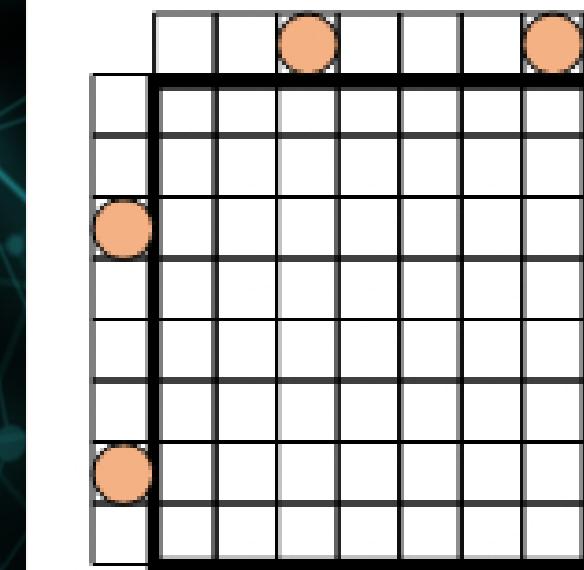


Other sub-block division within the frame:

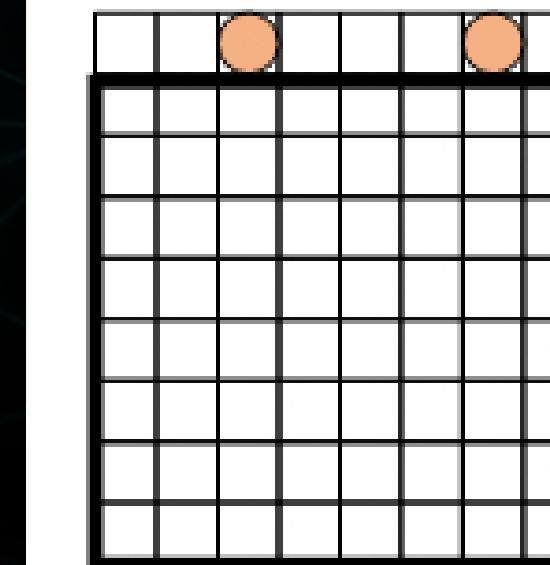


# CROSS-COMPONENT LINEAR MODEL PREDICTION

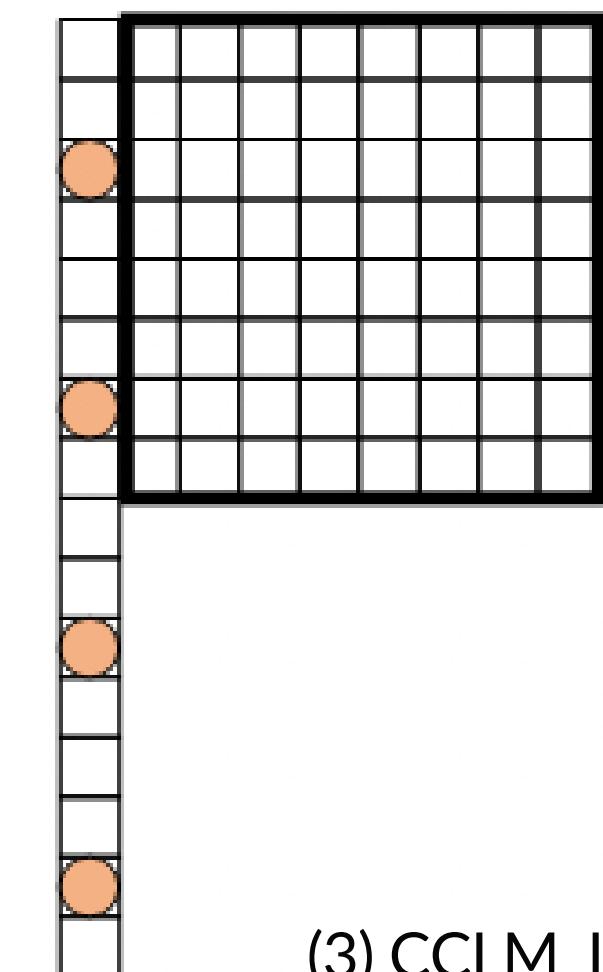
1. Downsampling of the luma block and its neighbouring reconstructed samples to match the size of corresponding chroma block
2. Model parameter derivation based on reconstructed neighbouring samples
3. Application of the model equation to generate the chroma intra prediction samples.



(1) CCLM\_LT



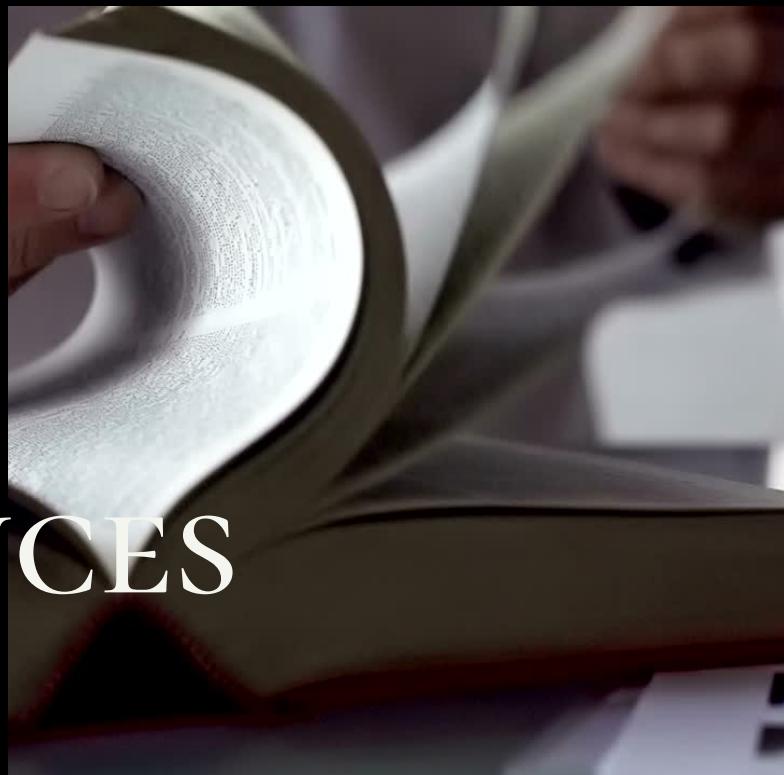
(2) CCLM\_T



(3) CCLM\_L



# REFERENCES



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