

Simplification of Illumination Compensation (JCT3V-C0111)

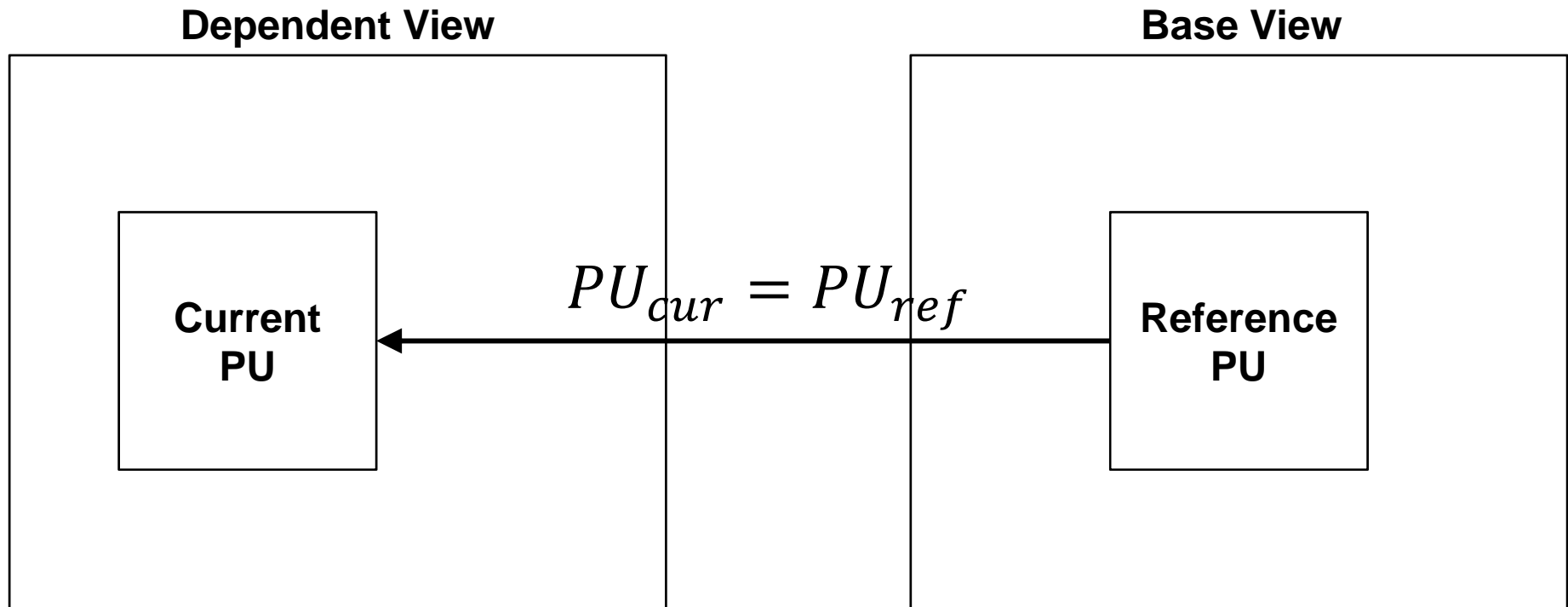
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Jan. 2013



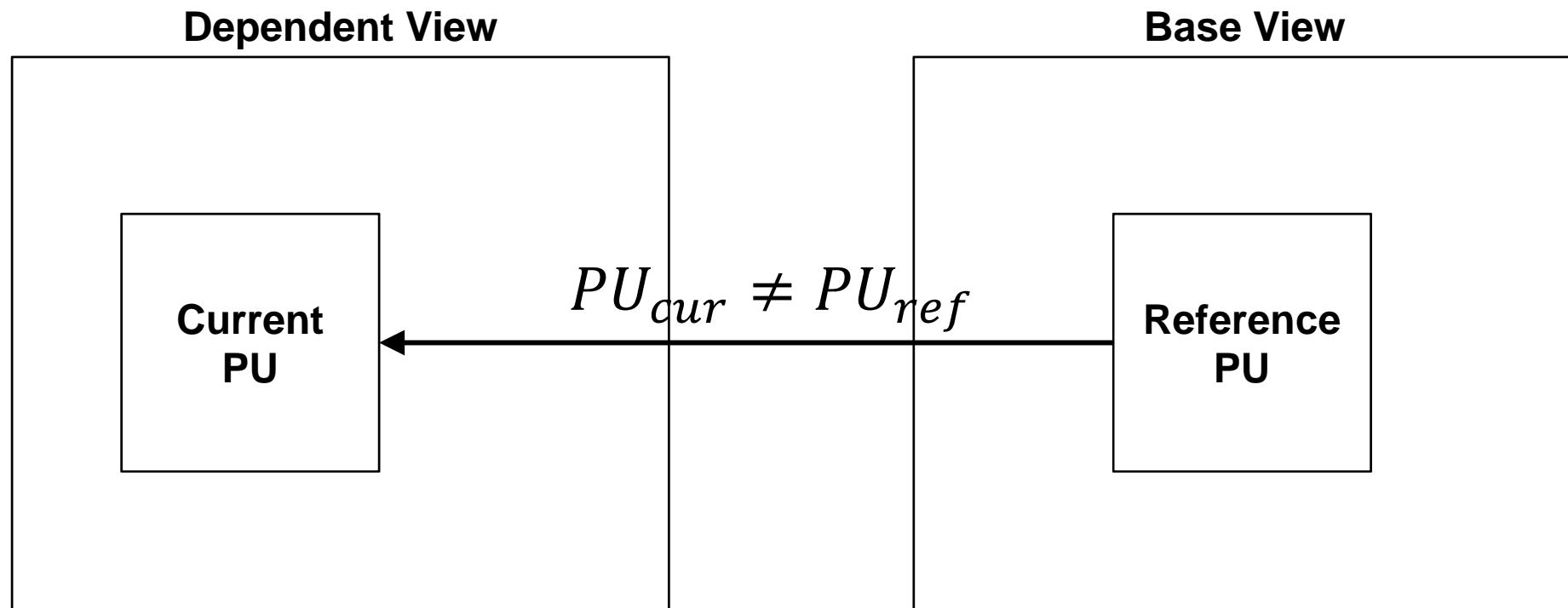
Introduction

- **Inter-view Motion Compensation**



Introduction

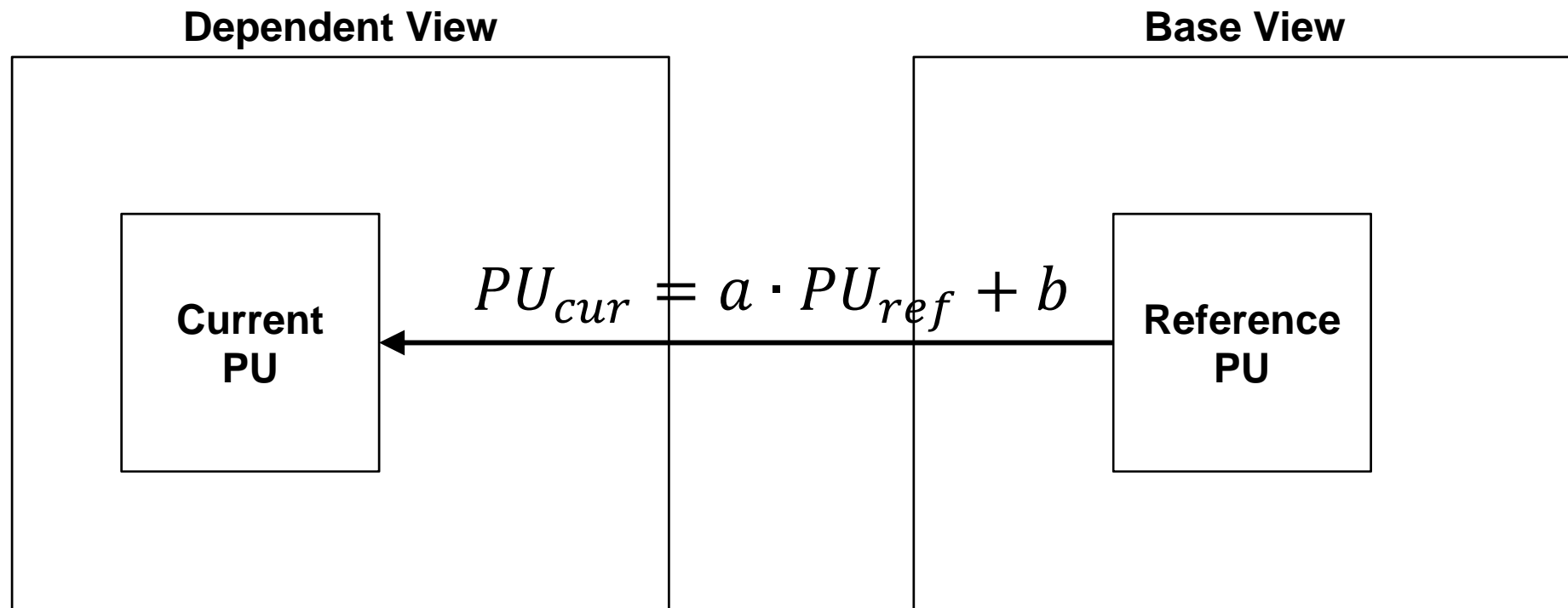
- Inter-view Motion Compensation



Cameras without calibration ➡ Mismatch

Introduction

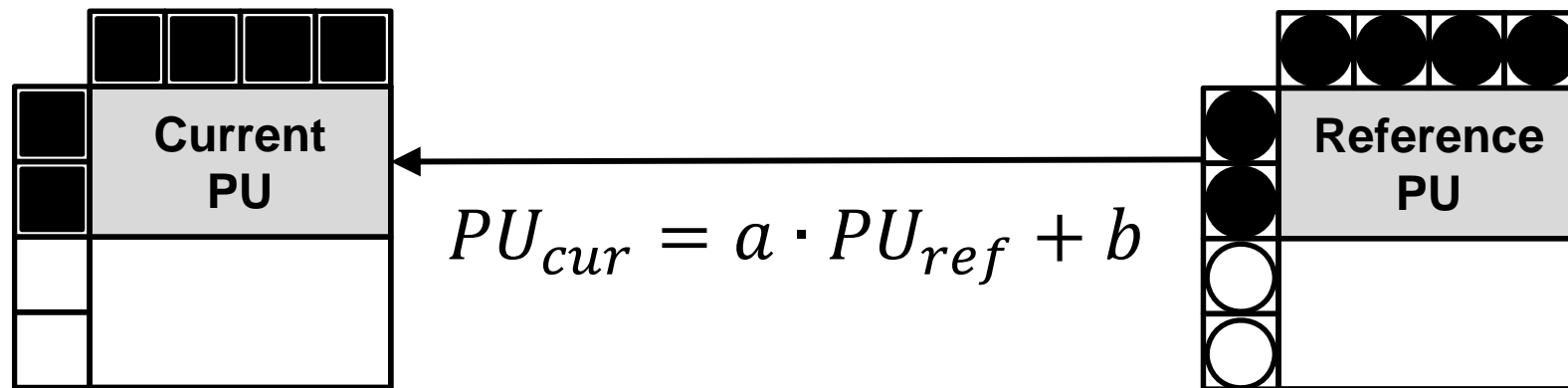
- **Inter-view Motion Compensation**



Illumination Compensation by Linear Model

Introduction

- **Illumination Compensation**
 - Using same parameter derivation in encoder & decoder (+using CU level flag).



$$a = \frac{N \cdot \sum_i \blacksquare_i \bullet_i - \sum_i \blacksquare_i \sum_i \bullet_i}{N \cdot \sum_i \bullet_i \bullet_i - \sum_i \bullet_i \sum_i \bullet_i}$$

$$b = \frac{\sum_i \blacksquare_i - a \cdot \sum_i \bullet_i}{N}$$

Introduction

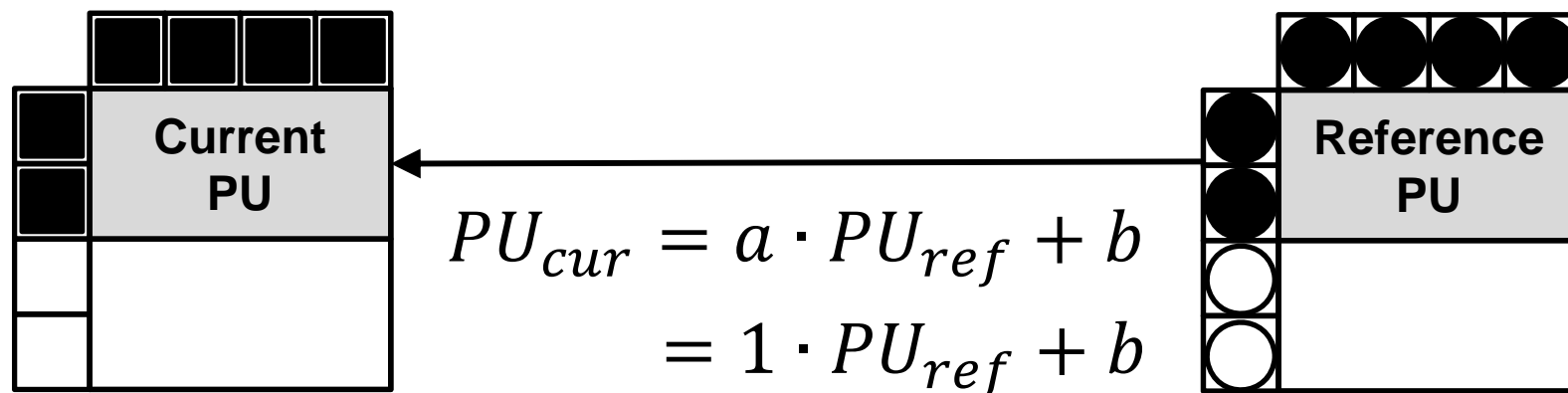
- **Illumination Compensation**
 - **Complexity of linear least square solution.**
 - **Cross-correlation of arbitrary samples.**

$$a = \frac{N \cdot \sum_i^N \blacksquare_i \bullet_i - \sum_i^N \blacksquare_i \sum_i^N \bullet_i}{N \cdot \sum_i^N \bullet_i \bullet_i - \sum_i^N \bullet_i \sum_i^N \bullet_i}$$

- **Not align with current motion-search method that uses mean-removed SAD based on offset model.**

Proposed Method

- **Simplified Illumination Compensation**
 - Simplify linear model to offset model.



$$\underline{a = 1}, \quad b = \frac{\sum_i^N \blacksquare_i - a \cdot \sum_i^N \bullet_i}{N}$$

Proposed Method

- **Simplified Illumination Compensation**
 - **Simplify linear model to offset model.**

Table. the number of operation for illumination compensation (16x16 block)

Prediction step	Current IC			Simplified IC		
	Mul(x)	Add(+)	Shift(>>)	Mul(x)	Add(+)	Shift(>>)
Parameter estimation	70	132	6	0	64	1
Prediction for each pixel	1	1	1	0	1	1

Multiplication-free

Simulation Results

Results of 'Simplified IC' (Anchor : HTM 5.0.1 CTC + IC off)

	video 0	video 1	video 2	Video only	synthesized only	coded & synthesized	enc time	dec time
Balloons	0.0%	-2.6%	-2.3%	-1.1%	-0.7%	-0.8%	108.5%	94.3%
Kendo	0.0%	-2.9%	-4.2%	-1.6%	-1.2%	-1.3%	109.6%	98.2%
Newspapercc	0.0%	-1.1%	-1.4%	-0.6%	-0.5%	-0.5%	105.7%	100.5%
GhostTownFly	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.8%	99.9%
PoznanHall2	0.0%	-0.5%	-3.2%	-0.9%	-0.5%	-0.6%	105.6%	106.0%
PoznanStreet	0.0%	0.1%	-0.4%	-0.1%	-0.1%	-0.1%	104.7%	106.2%
UndoDancer	0.0%	0.2%	0.2%	0.1%	0.1%	0.1%	103.9%	98.6%
1024x768	0.0%	-2.2%	-2.7%	-1.1%	-0.8%	-0.9%	107.9%	97.7%
1920x1088	0.0%	-0.1%	-0.8%	-0.2%	-0.1%	-0.2%	103.7%	102.6%
average	0.0%	-1.0%	-1.6%	-0.6%	-0.4%	-0.5%	105.5%	100.5%

Simulation Results

Results of 'Simplified IC' (Anchor : HTM 5.0.1 CTC + IC bug-fix(C0046))

	video 0	video 1	video 2	Video only	synthesized only	coded & synthesized	enc time	dec time
Balloons	0.0%	-0.8%	-0.4%	-0.2%	-0.2%	-0.2%	101.4%	102.5%
Kendo	0.0%	1.5%	1.2%	0.6%	0.5%	0.5%	100.3%	96.9%
Newspapercc	0.0%	0.0%	0.1%	0.0%	0.1%	0.1%	100.3%	94.8%
GhostTownFly	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	95.6%
PoznanHall2	0.0%	-0.3%	-1.7%	-0.5%	-0.3%	-0.4%	100.3%	98.3%
PoznanStreet	0.0%	-0.3%	-0.1%	-0.1%	0.0%	-0.1%	100.0%	102.9%
UndoDancer	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	99.9%	95.1%
1024x768	0.0%	0.2%	0.3%	0.1%	0.1%	0.1%	100.7%	98.0%
1920x1088	0.0%	-0.1%	-0.4%	-0.1%	-0.1%	-0.1%	100.0%	97.9%
average	0.0%	0.1%	-0.1%	0.0%	0.0%	0.0%	100.3%	98.0%

Summary

- **Simplified illumination compensation**
 - **Simplify linear model to offset model.**
 - **Multiplication free**
 - **No BD-rate change on coded & synthesized.**
- **Recommend to adopt simplified illumination compensation into 3D-HEVC**