Inter-layer Correlation based Fast Intra and Inter Prediction in Spatial SHVC
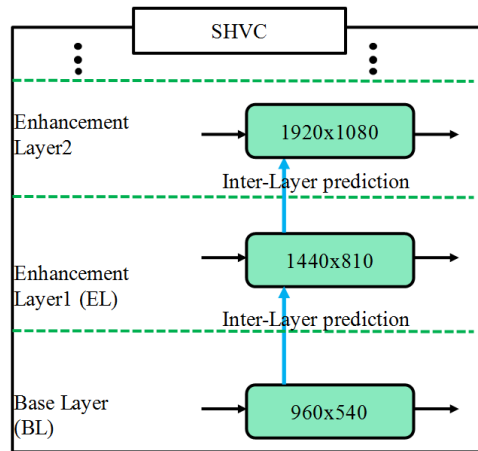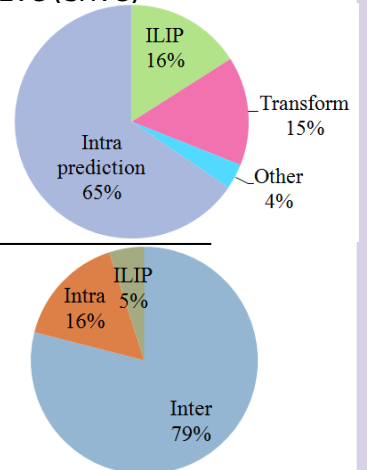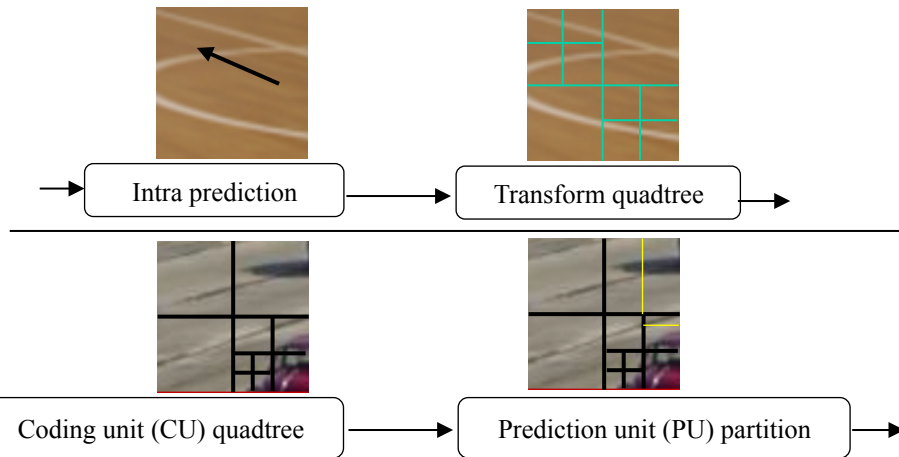
朱国靖 池永研究室　修士課程修了

◆ Research Background

SHVC

- Enhancement Layer2 — 1920x1080
  - Inter-Layer prediction
- Enhancement Layer1 (EL) — 1440x810
  - Inter-Layer prediction
- Base Layer (BL) — 960x540

➢ Complexity of intra and inter prediction in spatial scalable extension of HEVC (SHVC)

Intra prediction → Transform quadtree

- ILIP 16%
- Transform 15%
- Intra prediction 65%
- Other 4%

Coding unit (CU) quadtree → Prediction unit (PU) partition

- ILIP 5%
- Intra 16%
- Inter 79%

Target : Alleviate complexity of intra and inter prediction with negligible quality loss

◆ Proposed method

Inter-channel correlation based intra prediction

■ Seregin's work (2013)

BL luma → Intra prediction → EL luma
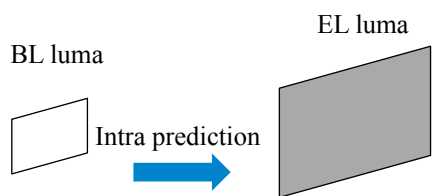
Problems
➢ Only one color channel
➢ Transform remain unchanged

■ Proposal

BL luma → Intra prediction → EL luma / EL chroma

Transform quadtree
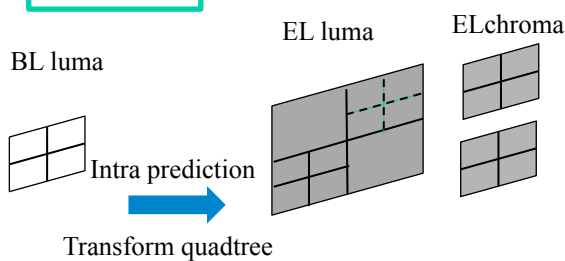
Solutions
➢ Three color channels
➢ Transform quadtree mapping

Luma   Chroma   Chroma

Prediction unit partition based mode and depth skipping

■ Tohidypour's work (2016)

BL CU → Predict
EL CU
Skip CU depth ✗
Skip all PUs
PU1 ---→ PU2

(a) Tohidypour's work

■ Proposal

PU / BL PU → Predict
EL PU / PU
Skip unnecessary PUs
CU depth
PU1 → PU2 ✗
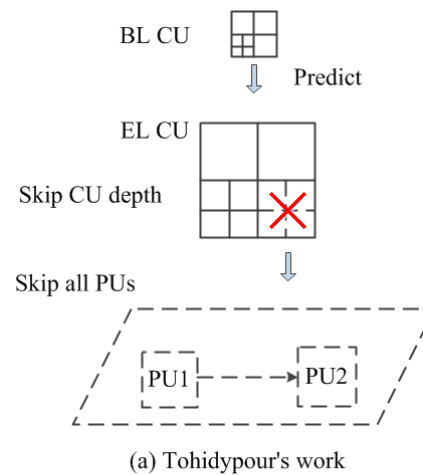
(b) My proposal

Problems
➢ CU without motion information
➢ Skip all PU modes
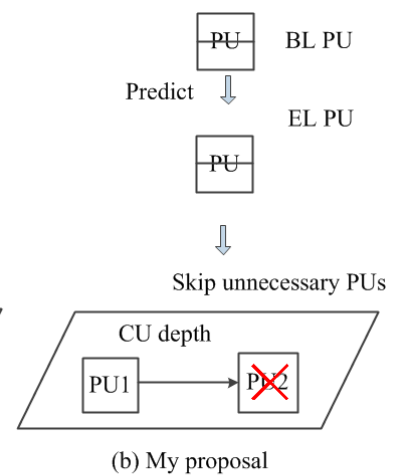
Solutions
➢ PU with motion information
➢ Skip unnecessary PUs

➢ Combination of temporal and inter-layer correlation

EL frame n-1   EL frame n   BL frame n

- Current PU
- Neighboring PU
- BL PU

◆ Experiment result

Spatial ratio	Intra prediction								Inter prediction							
	2x				1.5x				2x				1.5x			
	Seregin's		Proposal		Seregin's		Proposal		Tohidypour's		Proposal		Tohidypour's		Proposal	
	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)	BD-rate(%)	TS(%)
Traffic	0.0	18.75	-0.1	33.13					2.9	54.82	0.7	46.75				
PeopleOnStreet	0.1	18.63	0.0	32.23					1.6	44.44	0.4	27.75				
Kimono	0.0	20.25	-0.3	36.00	0.0	16.88	-1.8	32.38	1.6	46.81	0.1	31.45	0.9	35.15	-3.8	34.38
ParkScene	0.0	18.13	-0.2	34.00	0.0	12.63	-0.4	28.13	2.1	51.71	0.7	43.25	1.1	49.35	-1.0	40.38
Cactus	0.2	21.38	0.7	34.00	0.0	18.38	-0.5	30.13	2.1	51.72	0.9	41.63	1.4	42.92	-0.9	39.75
BasketballDrive	0.1	19.88	1.4	34.75	0.0	16.38	-0.3	30.50	1.7	35.18	0.5	36.88	1.7	47.26	-1.2	36.38
BQTerrace	0.3	18.38	0.9	32.75	0.0	16.38	-0.1	28.63	2.7	52.79	1.1	36.25	1.9	47.59	0.6	46.25
Average	0.1	19.4	0.3	33.80	0.0	16.2	-0.6	30.00	2.1	48.21	0.6	37.80	1.4	44.45	-1.3	39.10
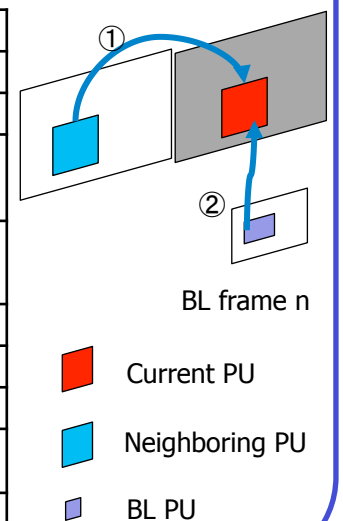
◆ Conclusion

➢ Proposed intra method can achieve 13.96% more time saving and 0.08% BD-rate reduction compared with Seregin's work
➢ Proposed inter method can achieve 2% BD-rate decrease at the cost of only 8.3% time saving reduction compared with Tohidypour's work.

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