Temporally Forward Nonlinear Scale Space with Pixel-Level Pre-Adjustment for High Frame Rate and Ultra-Low Delay A-KAZE Matching System

修士課程卒業　李淵

Background

- Human-computer interactive applications
  - Projection mapping
  - Automatic driving
  - AR applications

http://channel.panasonic.com/jp/contents/16913

Require

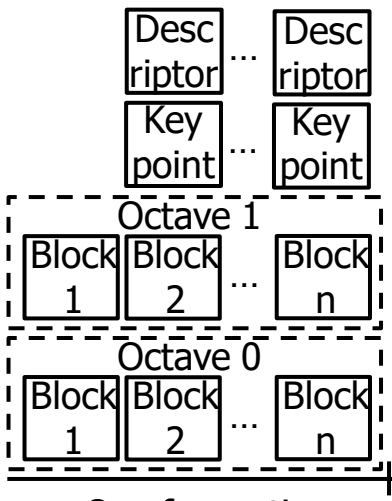
High frame rate & Ultra-low delay

High accuracy

- Previous matching system
  - ORB algorithm based system
  - Accuracy is not high especially for scale change
- Target
  - Implement nonlinear scale space of A-KAZE within one frame delay and keep high accuracy
- Challenge
  - Long delay, more than one frame

Proposals

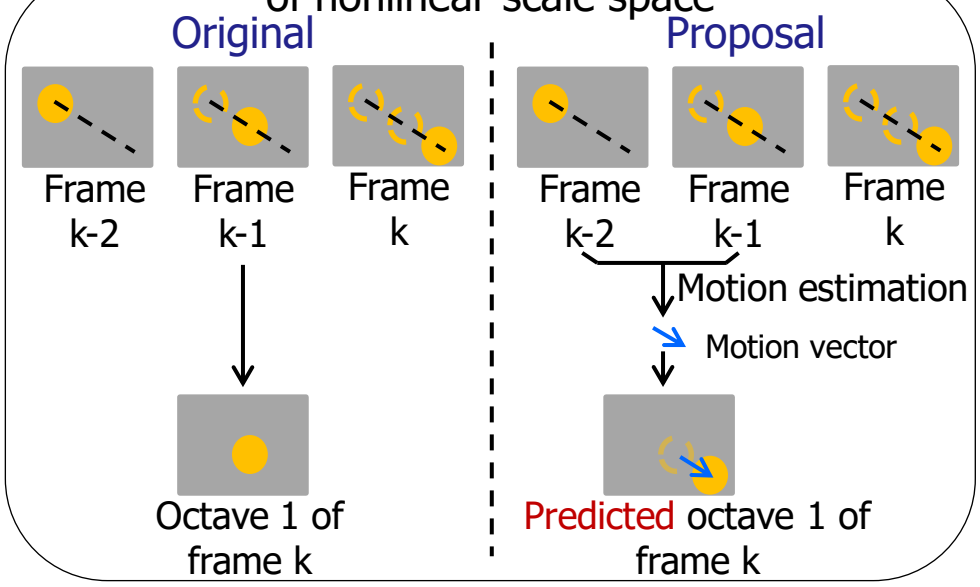
Proposal 1: Temporally forward nonlinear scale space



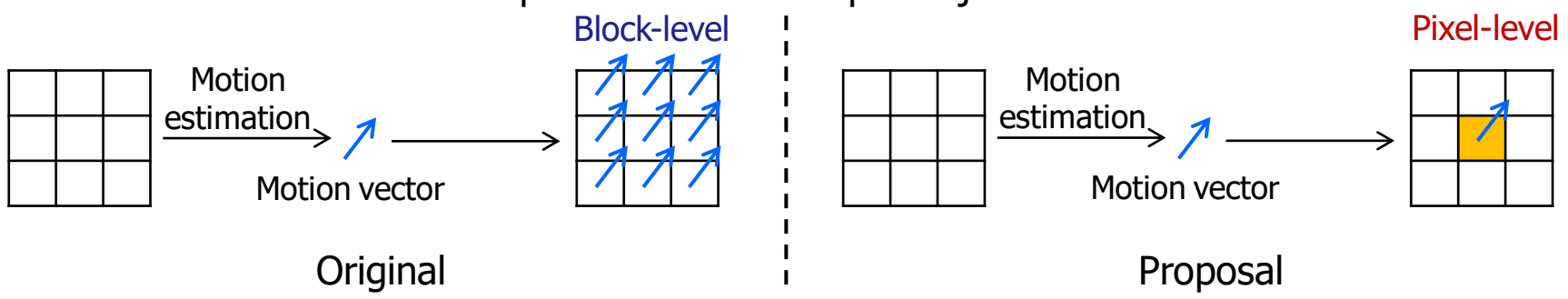
Merit: Decrease delay

Demerit: Decrease accuracy

Proposal 2: Pre-adjustment of nonlinear scale space



Proposal 3: Pixel-level pre-adjustment



Evaluation results

- Matching accuracy

	Previous	A-KAZE	Proposal
Average F-score	89.70%	97.39%	95.58%

- Hardware performance
  - Input frame rate: 784fps
  - Processing delay: 0.978ms/frame

Resource	Utilization
# LUT	196134 (96%)
# Flip Flop	157122 (39%)
# BRAM	291 (65%)
# DSP	228 (27%)

Conclusion

- Process high frame rate input videos with a delay of 0.978ms/frame, keep average matching accuracy 5.88% higher than previous matching system

Graduate School of Information, Production and Systems
Waseda University