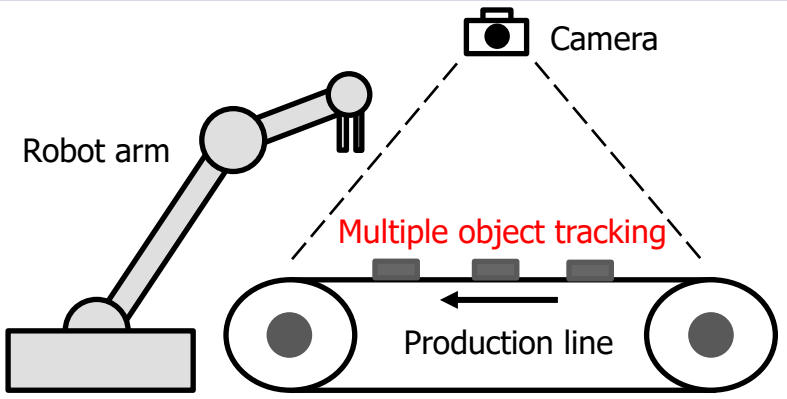
ROI-Extraction and Pipelined Observation Based Particle Filter for High Frame Rate and Ultra-low Delay Multiple Object Tracking

楊　振浩　池永研究室　修士課程修了

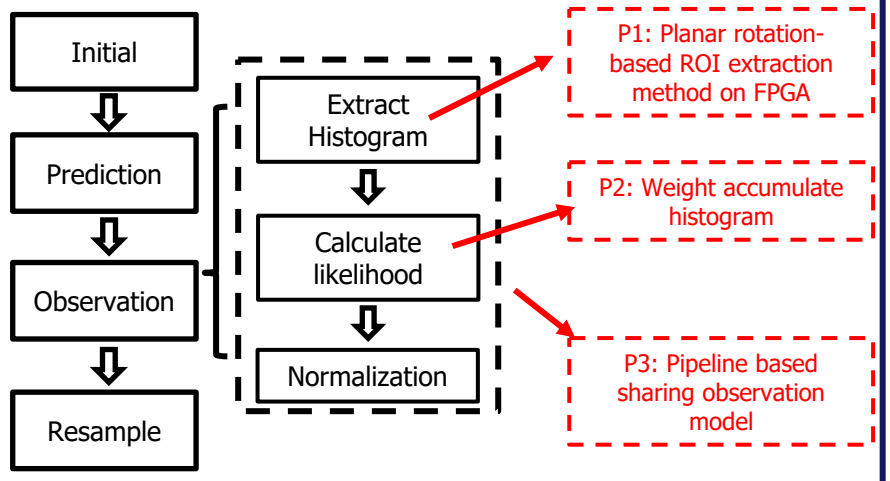
Background

- High frame rate and ultra-low delay vision tracking system in FA
  - Multiple object tracking
  - Particle Filter
  - FPGA acceleration

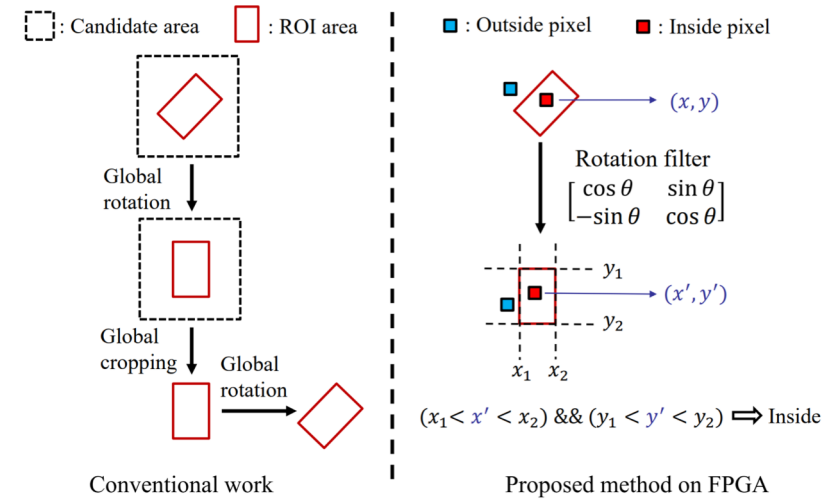


Proposed method

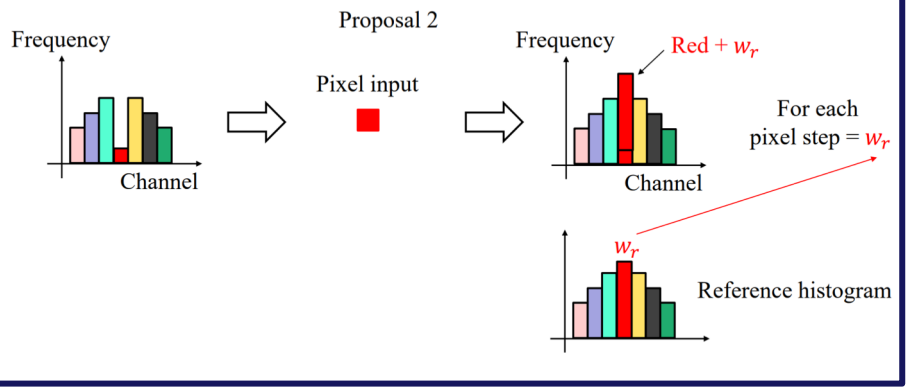
Overall framework



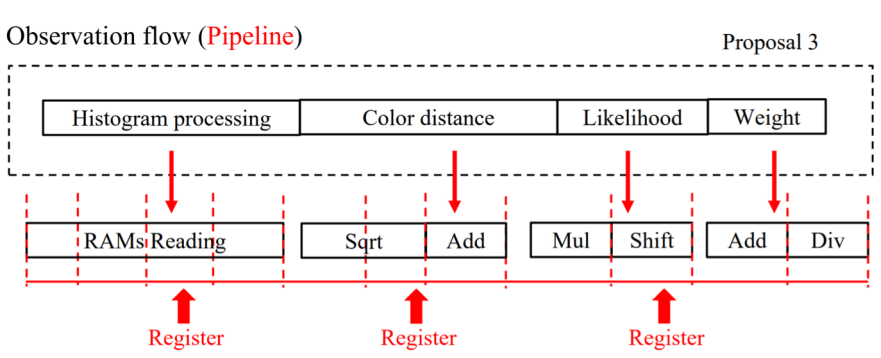
P1: Planar rotation based ROI extraction method on FPGA



P2: Weight accumulate histogram



P3: Pipeline based sharing observation model



Experiments Result

Accuracy evaluation

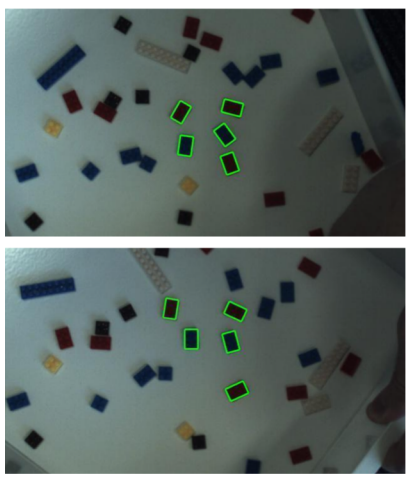
Particle number	8		27		64		125	
Sequence	CW1	P1+P2+P3	CW1	P1+P2+P3	CW1	P1+P2+P3	CW1	P1+P2+P3
Fast motion1	57.27	83.76	91.45	99.15	99.15	99.15	99.15	99.15
Fast motion2	44.12	82.35	79.41	100	94.12	100	100	100
Rotation1	93.33	88.57	99.05	100	100	100	100	100
Rotation2	49.09	54.54	85.45	100	96.36	100	100	100
Illumination change1	84.85	78.79	100	100	100	100	100	100
Illumination change2	88.33	88.33	99.17	99.17	100	100	100	100
Complex	13.51	35.14	45.95	91.89	70.27	100	91.89	100
Average	61.20	73.06	85.78	98.60	94.27	99.44	98.28	99.88

Number of object	1	2	4	6
Multi-object 1	99.15%	99.15%	99.36%	99.43%
Multi-object 2	100%	100%	100%	100%
Average	99.57%	99.57%	99.68%	99.71%

Hardware performance

Items		P1+P2+P3
Number of particle		125
Number of object		1
Logic Utilization	LUT	39375(17.09%)
	LUTRAM	1043(1.02%)
	BRAM	312(4.97%)
	FF	26776(5.81%)
	DSP	532(30.79%)
Speed	Frequency	100 MHz
	Process time	0.92934 ms/frame

Visualization result



Conclusion

- Particle filter based high frame rate and ultra-low delay multiple object tracking system is achieved

Graduate School of Information, Production and Systems
Waseda University