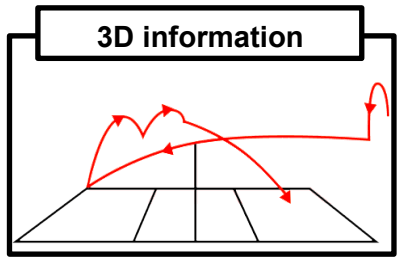
View Priority Based Threads Allocation and Binary Search Oriented Reweight for GPU Accelerated Real-time 3D Ball Tracking

修士課程卒業　侯依林

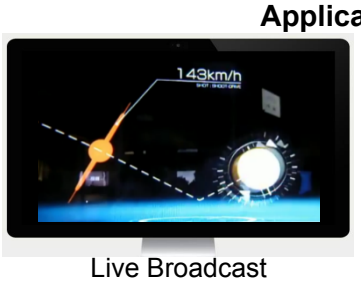
Research background

3D Ball Tracking

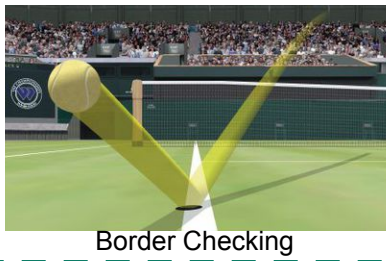


Real-time

Applications



Live Broadcast

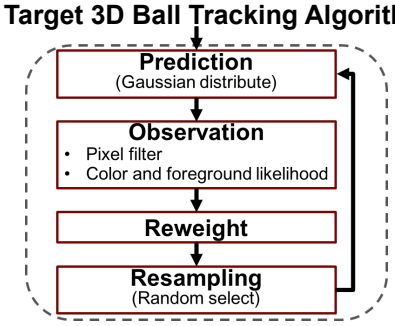


Border Checking

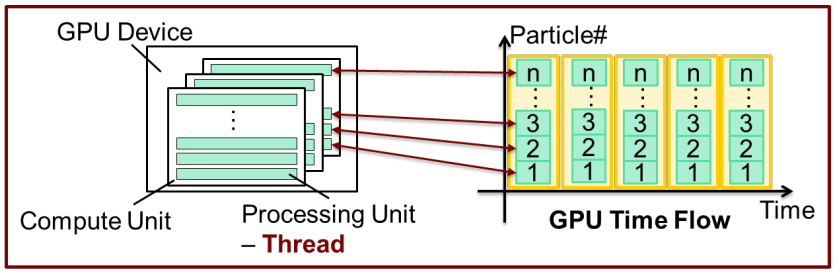
Research target

Build a Real-time 3D Ball Tracking System.

Target 3D Ball Tracking Algorithm



CPU-GPU System Design

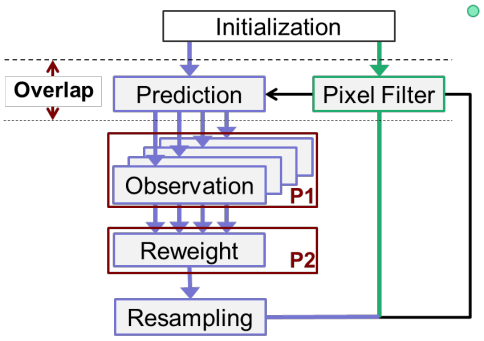


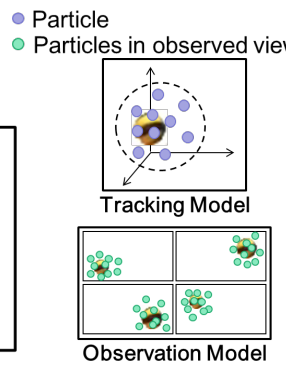
Problems

- Repeated processing for multiple views.
- Serial flowchart for each steps.
- Sequential calculation in reweight.

Proposals

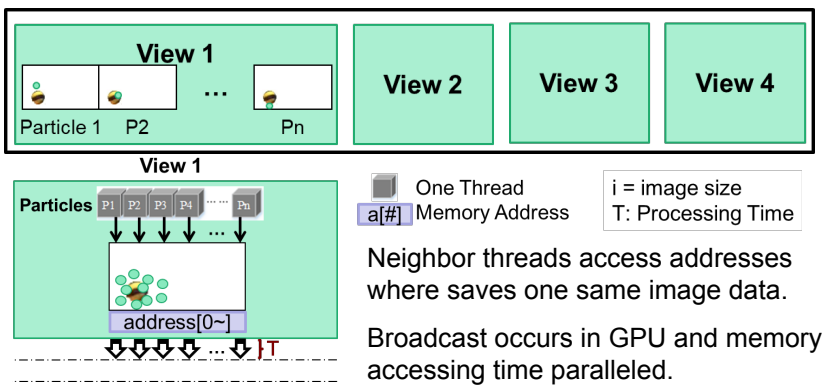
Framework





P1: View Priority Based Threads Allocation
P2: Binary Search Oriented Reweight

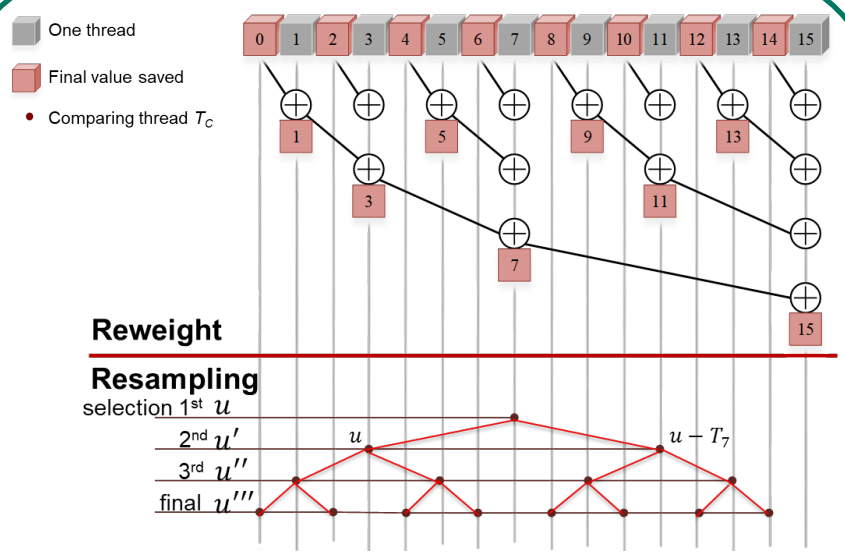
Proposal 1: View Priority Based Threads Allocation



Neighbor threads access addresses where saves one same image data.

Broadcast occurs in GPU and memory accessing time paralleled.

Proposal 2: Binary Search Oriented Reweight



Process:

If $u<T_c$, to left tree, $u'=u$; If $u>T_c$, to right tree, $u'=u-T_c$.

- **Lowest complexity.**
- **Every thread's complexity is same.**

Experiment Result

Particle#	1024			
Method	CPU		CPU-GPU	
Sequence	Successful HIT	Success rate	Successful HIT	Success rate
Set1	221	97.79%	223	98.67%
Set2	226	99.58%	225	99.12%
Set3	231	100%	231	100%
Total	688	99.14%	689	99.23%
Time	75.1ms		3.4ms	

Time(ms)	1024		
	Proposal1	Proposal 1+2	Proposal 1+2+ Multiple Queues
Prediction	0.4	0.4	0.4
Pixel Filter	1.2	1.2	1.2
Observation	1.5~1.8	1.5~1.8	1.5~1.8
Reweight	0.5	0.05	0.05
Resampling	1.6	0.1	0.1
1+2+3	3.1~3.4	3.1~3.4	2.8~3.1
Sum	5.2~5.5	3.4~3.7	3.1~3.4

Time(ms) / Kernel	512	1024	2048	4096
Sum	3.1~3.4	3.1~3.4	3.1~3.5	3.1~3.5

Conclusion:

With view priority based threads allocation and binary search oriented reweight, the system can have a tracking success rate of 99.23% and takes 3.4ms for one frame which satisfied the real-time target with 60fps videos.

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