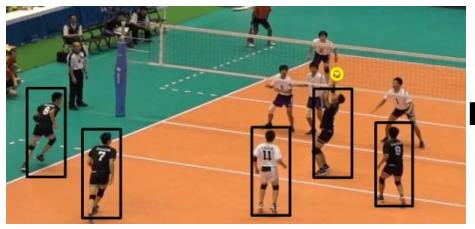
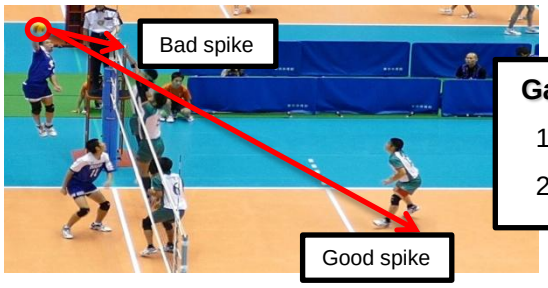
Ball Feature Based Likelihood Estimation in Particle Filter Algorithm with Automatic Recovery for 3D ball Tracking in Volleyball

修士課程卒業　程曦娜

Research background



3D Ball tracking
- •Ball's 3D position
- •3D trajectory
- •Speed
- •Direction



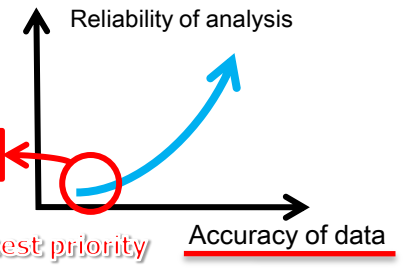
Game Analysis:
1. Improve team strength
2. Save human labor

Research target

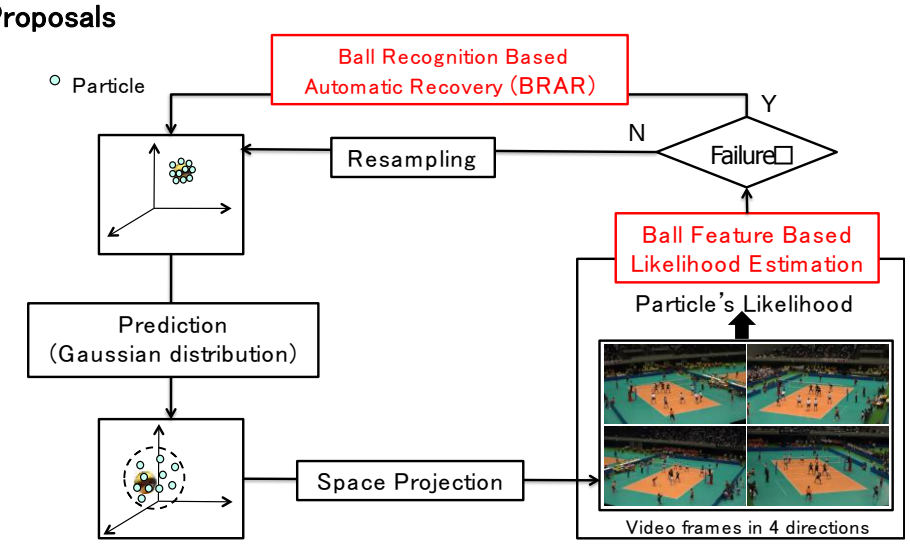
Improve the accuracy of 3D ball tracking and obtain precise ball's 3D position and trajectory.

Lack of pixel feature | Hard to predict | Occlusion Problems | Complex Background

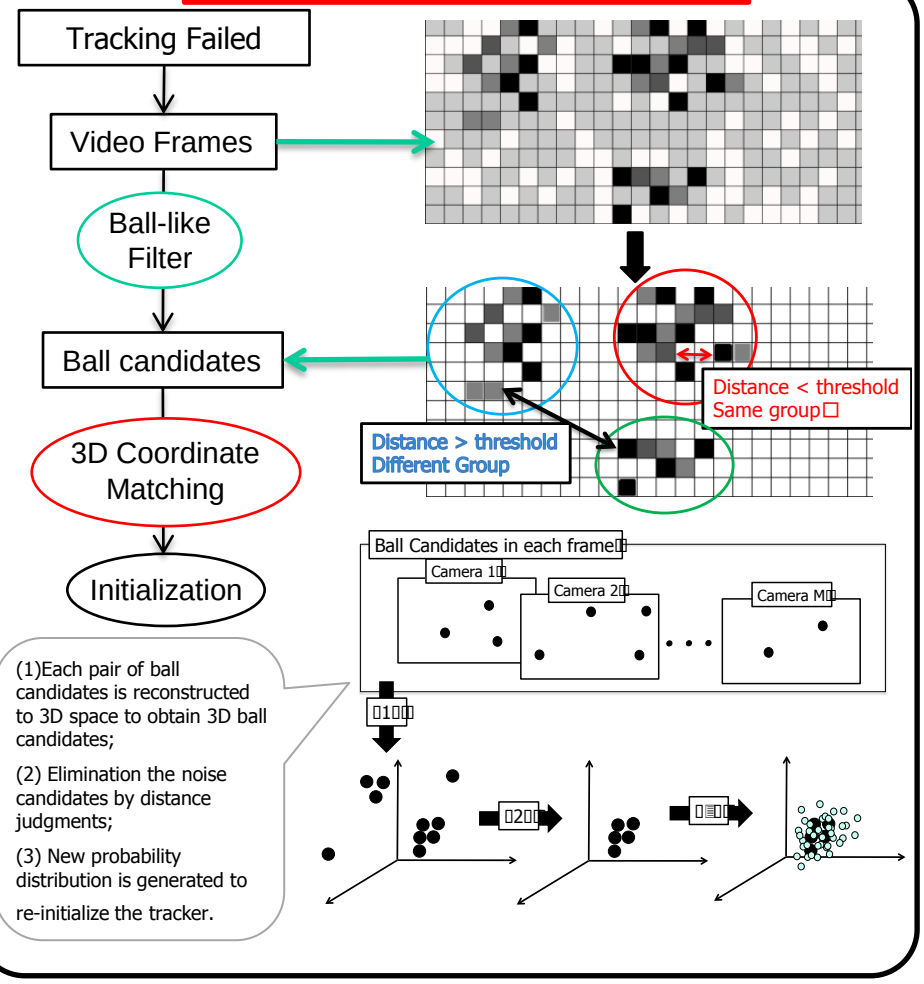
Low accuracy of ball tracking



Proposals



Ball Recognition Based Automatic Recovery



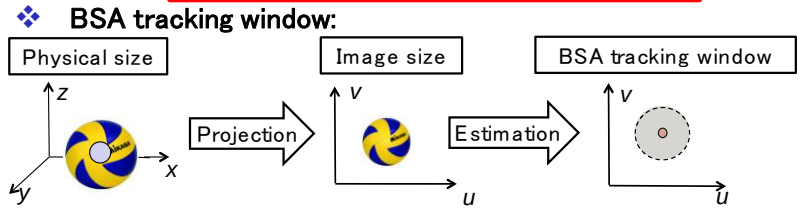
(1)Each pair of ball candidates is reconstructed to 3D space to obtain 3D ball candidates;

(2) Elimination the noise candidates by distance judgments;

(3) New probability distribution is generated to re-initialize the tracker.

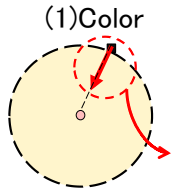
Ball Feature Based Likelihood Estimation

❖ **BSA tracking window:**



❖ **Ball feature likelihood model:**

(1)Color　(2) Circle　(3) Moving



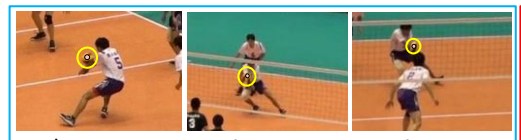
$$Circularity = \sum CircleGradient$$

⇩

Circle Likelihood

❖ **Anti-occlusion likelihood measurement:**

4 direction's frames at same time:



Higher 3 directions ⇩

Likelihood Measurement

Particle's Likelihood ⇩

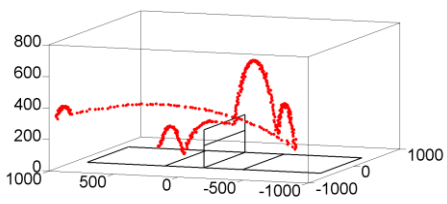
Delete lowest Image likelihood

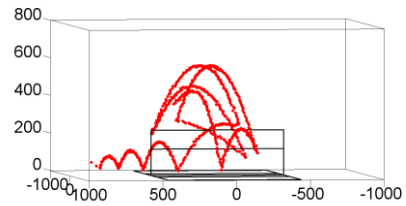
Particle's projected position

BSA tracking window

Experiment result:

	Set 1	Set 2	Set 3	Total
HIT	226	237	231	694
Successful HIT	221	236	231	688
Success rate	97.79%	99.58%	100%	99.14%





Conclusion:

Our proposals achieves 99.14% tracking accuracy in average and can obtain the ball's 3D trajectory.

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