HIS 2011
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1.0 Introduction

- The proposed system is aimed to continuously track moving object in random motion.
- Applications: robotic vision, security surveillance, traffic control and analysis of sports video.
- Some of the current tracking systems are less robust as focused in tracking object in predefined trajectory.
- An algorithm to track the random motion object is necessary.
- Multiple hypotheses property in particle filter enhanced with gradient optimization property of mean shift to estimate the target moving direction.

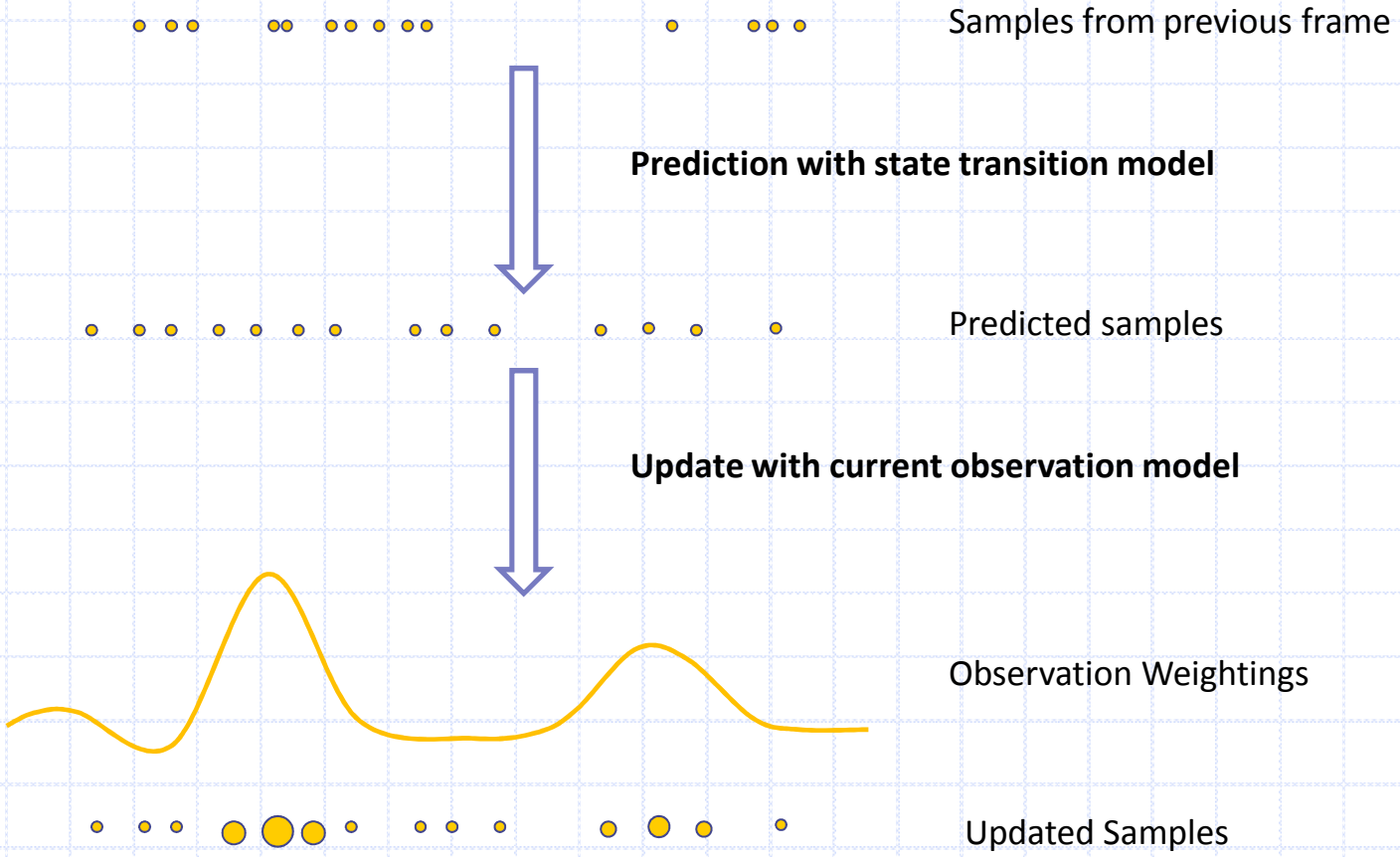
2.0 Objective

- To continuously track a random motion object under varying video conditions using the hybrid of particle filtering algorithm with mean shift approach.

- Capable to track object more efficient compared to particle filter tracker and mean shift tracker alone.

3.0 Methodology

- Particle Filter Framework

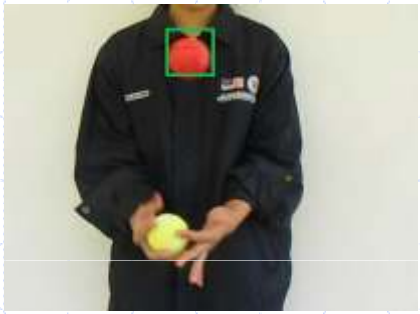


3.0 Methodology

- Mean Shift applied in Particle Filter
  - The direction of the movement for each particle is given by gradient optimization of the kernel masking.
  - The new resulting particle set represents the modes of the distribution, results in fewer particles are needed to maintain the multi-modal distribution.

4.0 Results and Discussions

TRACKING RESULT ON ABRUPT DIRECTION AND VELOCITY CHANGING TARGET



Frame 104

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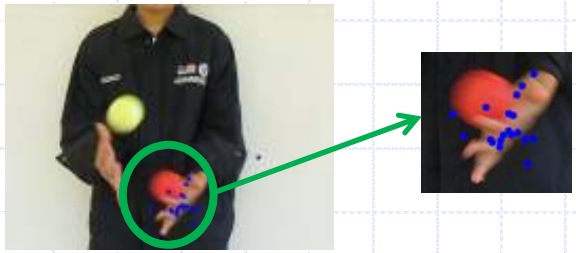
Frame 126

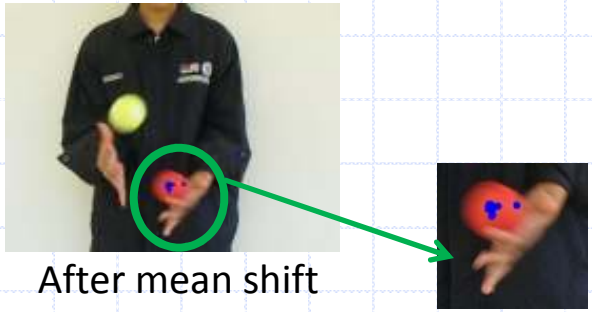
Frame 130

4.0 Results and Discussions

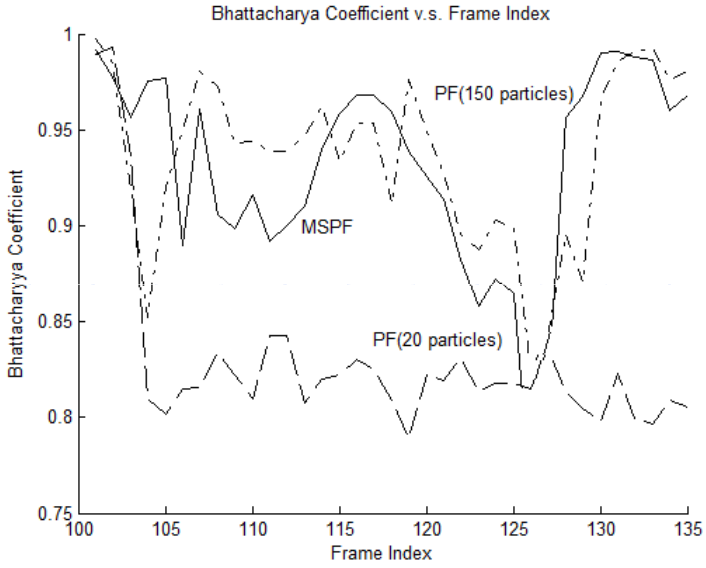
EFFECT OF MEAN SHIFT ON PARTICLE SAMPLING



Original samples



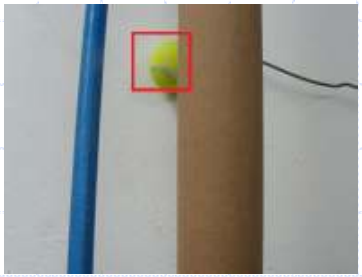
After mean shift



- After mean shift is applied to each particle, these particles move to the more likely position and concentrated in the local mode due to the gradient optimization property.
- PF tracker alone can only achieve sufficiently high coefficient when the number of particles is around 150, as compared to the MS embedded PF tracker where its sample size is only 20.

4.0 Results and Discussions

Complete Occlusion



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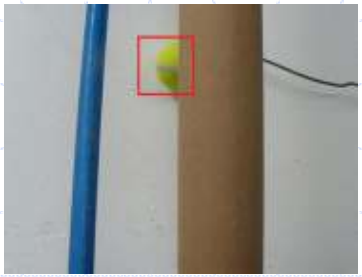
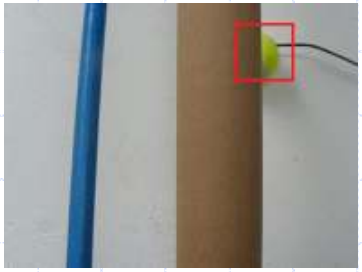
Frame 544

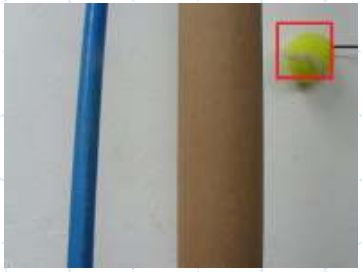


Frame 535

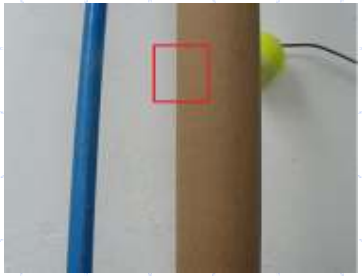
Frame 544



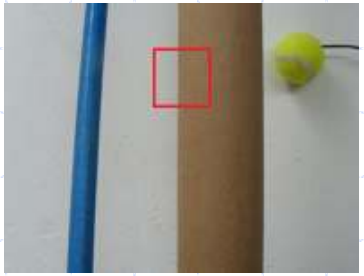
Frame 547



Frame 550



Frame 547



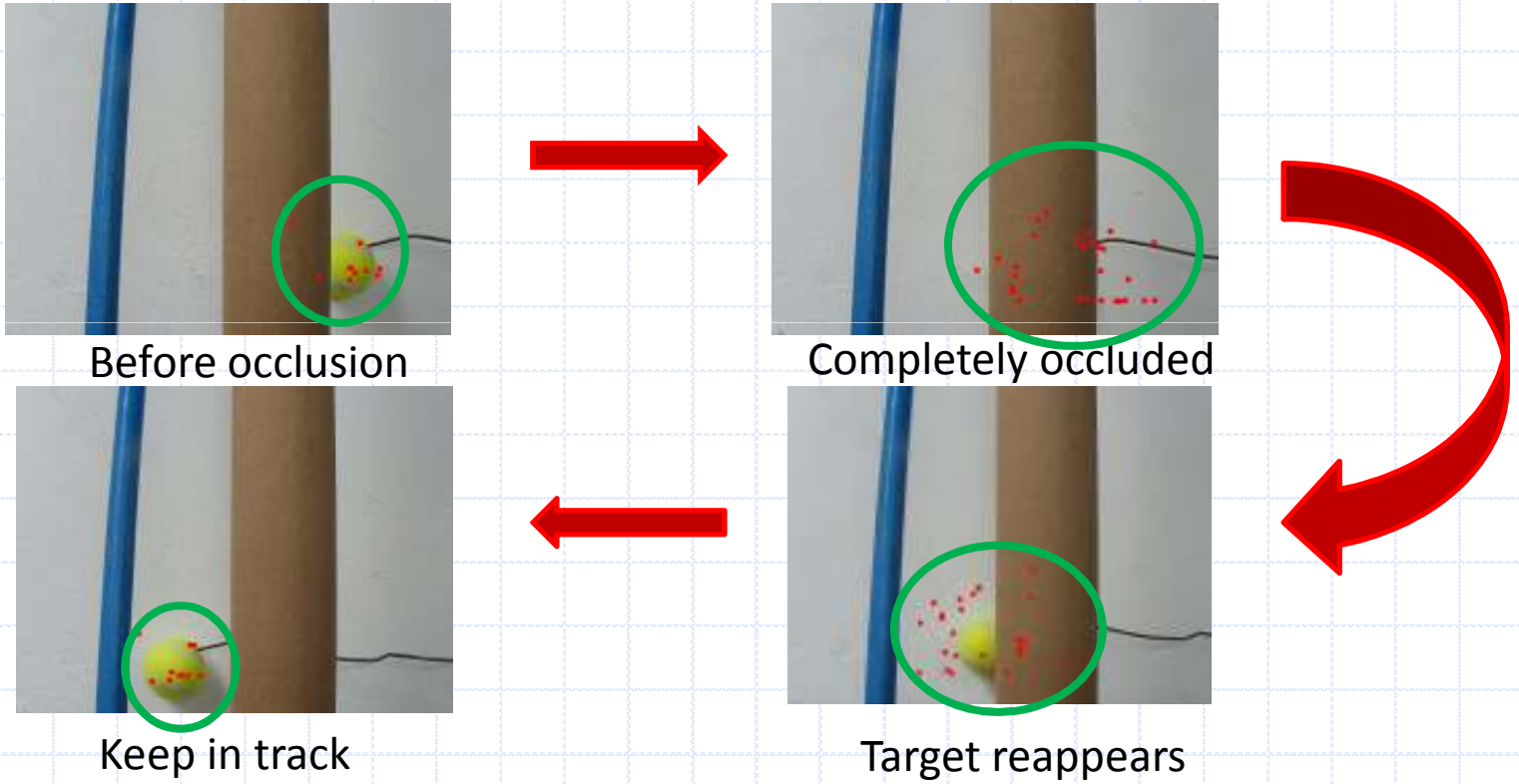
Frame 550

Mean shift embedded particle filter tracker

Mean shift tracker

4.0 Results and Discussion

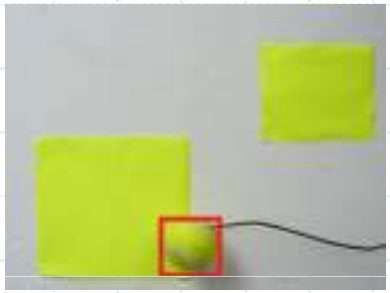
Occlusion Detection and Recovery Process



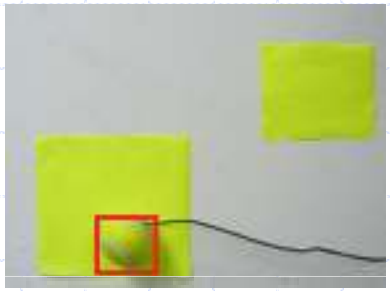
•The uniform distribution covers larger search area around to predict the location of the target when it is reappears again.

4.0 Results and Discussions

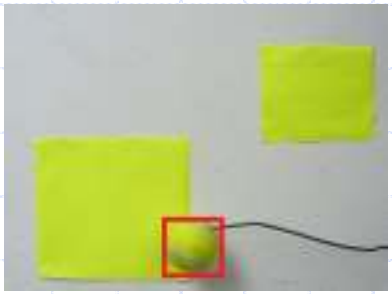
Like-Colored Background



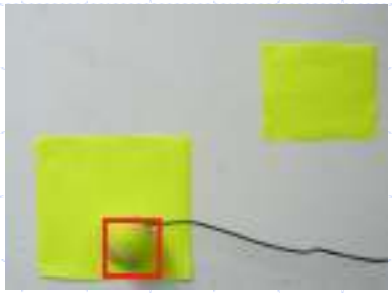
Frame 303



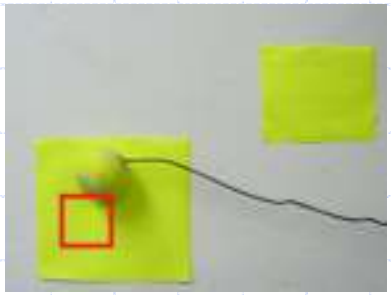
Frame 305



Frame 303



Frame 305



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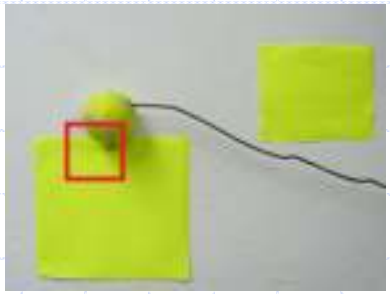
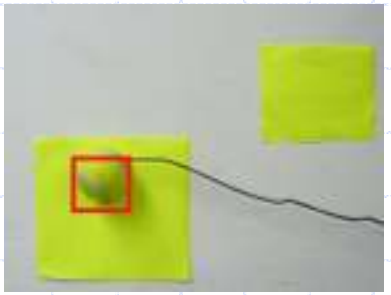
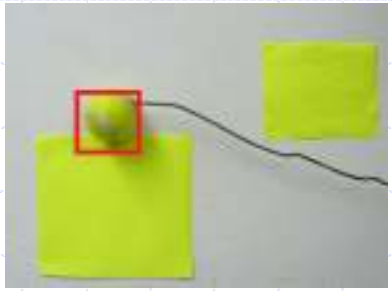


Frame 310

The tracking result of MS embedded PF tracker without edge feature



Frame 308



Frame 310

The tracking result of MS embedded PF tracker with edge feature

5.0 Conclusion

- Enhancement of particle filter sampling by mean shift algorithm.
- The developed tracker is capable to track abrupt direction and velocity changing object.
- The ability of maintaining multiple hypotheses on PF combined with the gradient optimization property of MS enable the tracker to deal with occlusion and clutter situations.