Computer Vision

Exercise Session 11 – Condensation Tracker

Assignment Tasks

1. Condensation tracker with color histogram observations

2. Experiment with the condensation tracker

General Tracking Framework

1. **Prediction**, based on **system model**

$$x_t = f_{t-1}(x_{t-1}, w_{t-1})$$

f = system transition function

2. **Update**, based on **measurement model**

$$z_t = h_t(x_t, v_t)$$

h = measurement function

$Z_t = (z_1, \dots, z_t)$ is the history of observations

Condensation Tracker

- The probability distribution is represented by a sample set S

$$S = \left\{ (s^{(n)}, \pi^{(n)}) \mid n = 1 \ldots N \right\}$$

- π - weights giving the sampling probability

Condensation Tracker

1. ## Prediction

   Start with S_{t-1}, the sample set of the previous step, and apply the system model to each sample, yielding predicted samples $s_t^{'(n)}$

   $$s_t^{'(n)} = A \cdot s_{t-1}^{(n)} + B \cdot w_{t-1}^{(n)}$$

2. ## Update

   Sample from the predicted set, where samples are drawn with replacement with probability $\pi^{(n)} = p(z_t \mid s_t^{'(n)})$ (using measurement model)
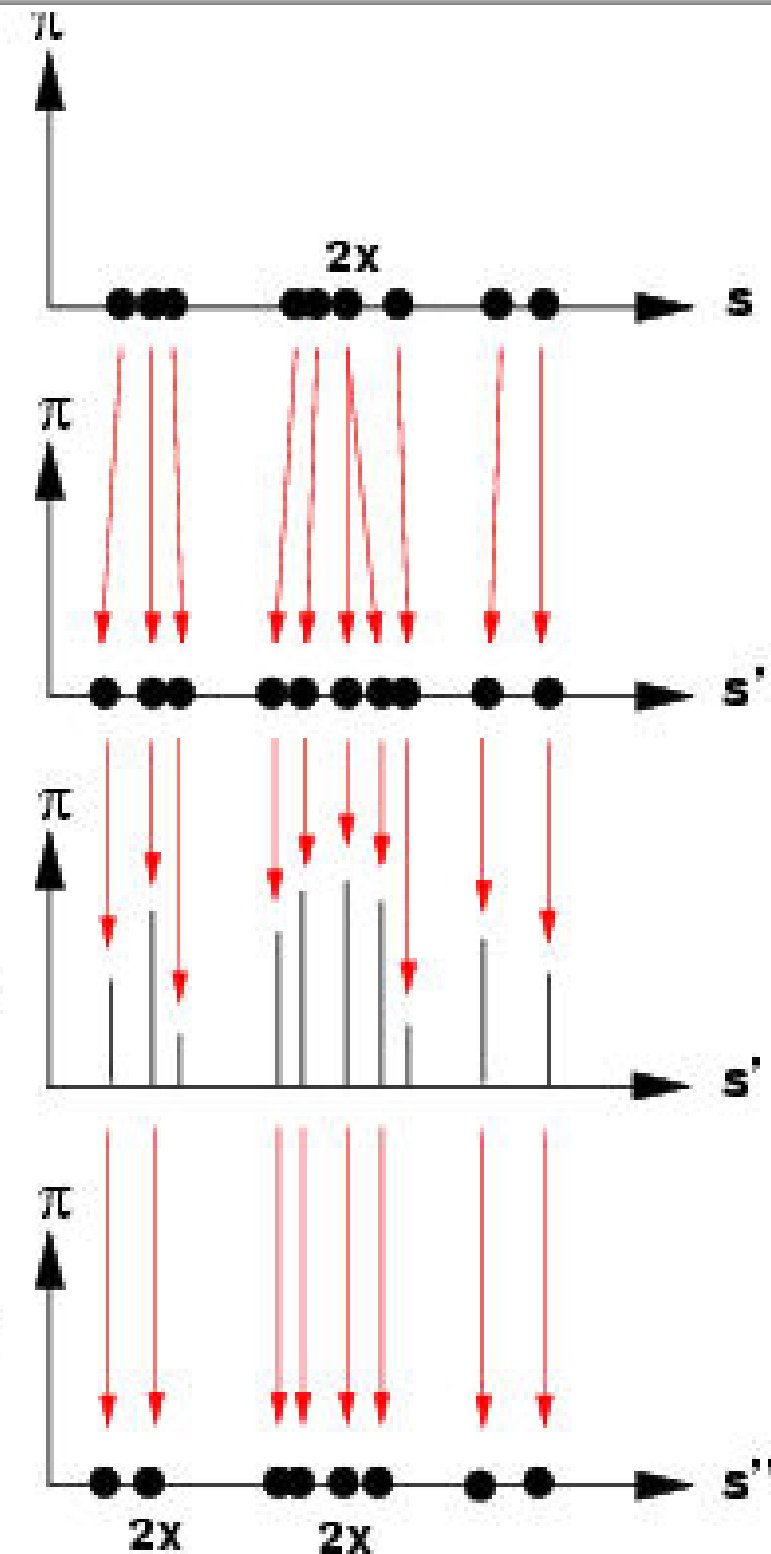
Condensation Tracker

Samples may be drawn multiple times, but noise will yield different predictions

sample set from the previous time step

predictions of new object states

weighting according to the measurements

selection to generate new sample set
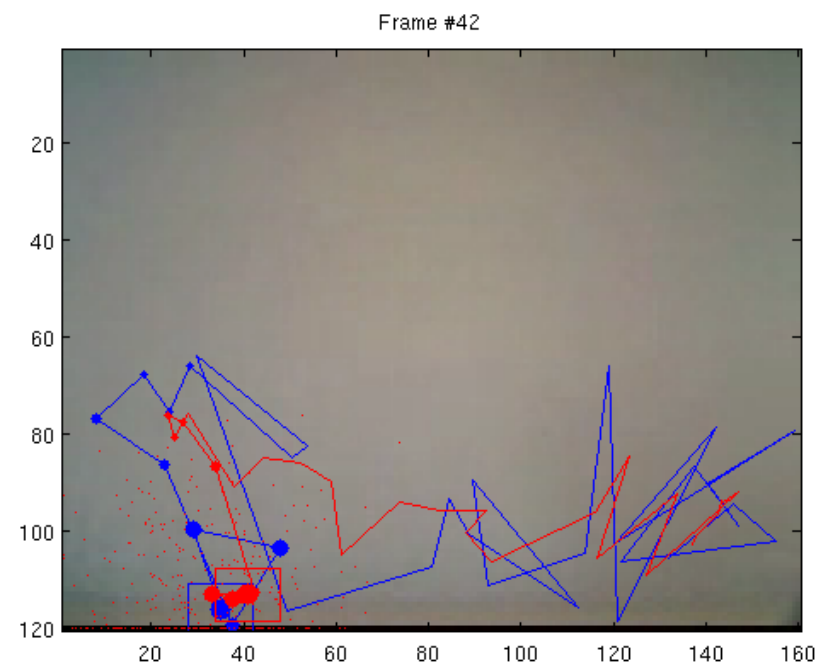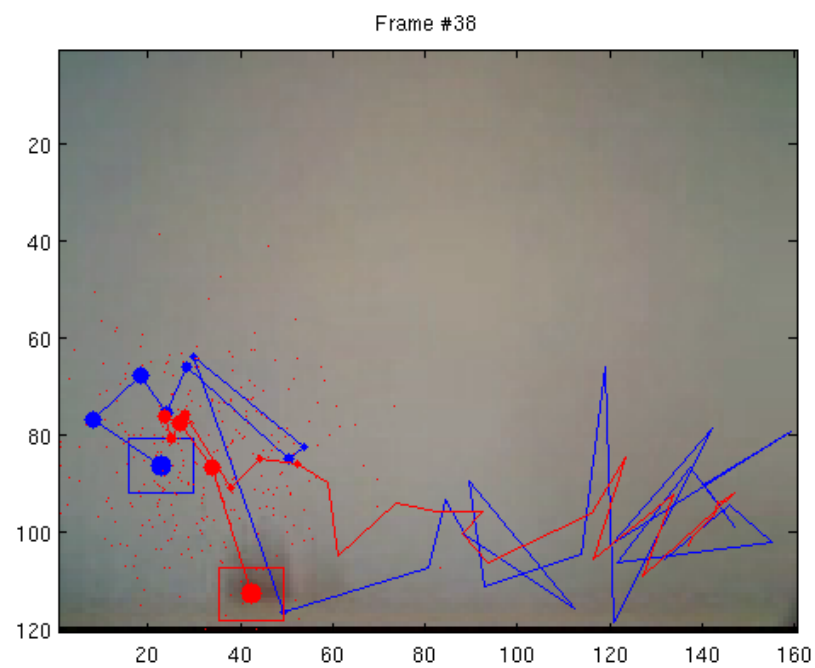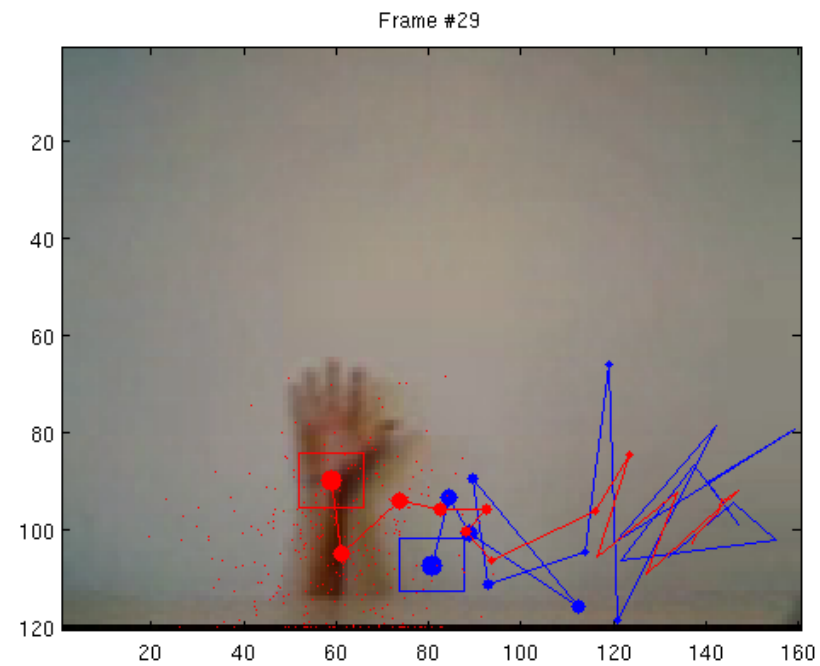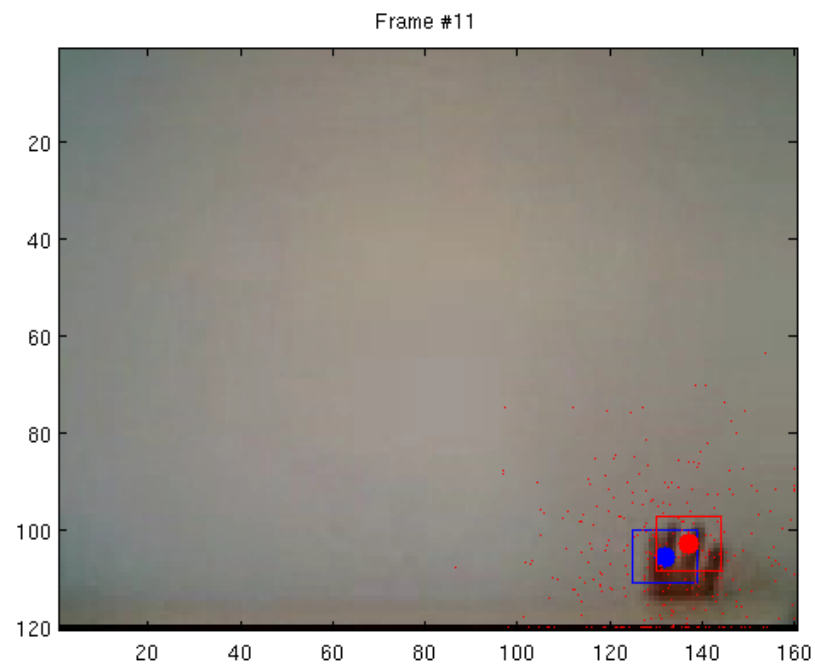
Task 2:
Experiment with the Condensation Tracker

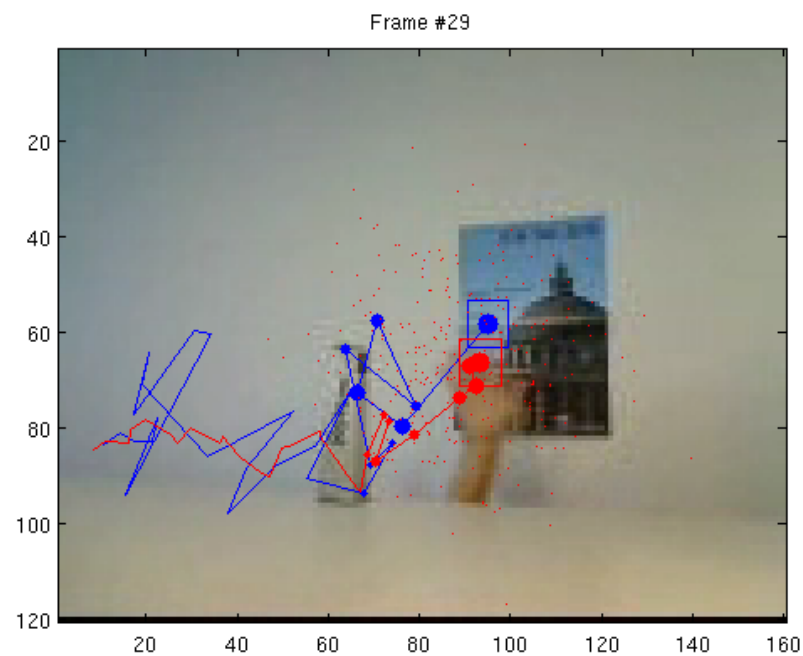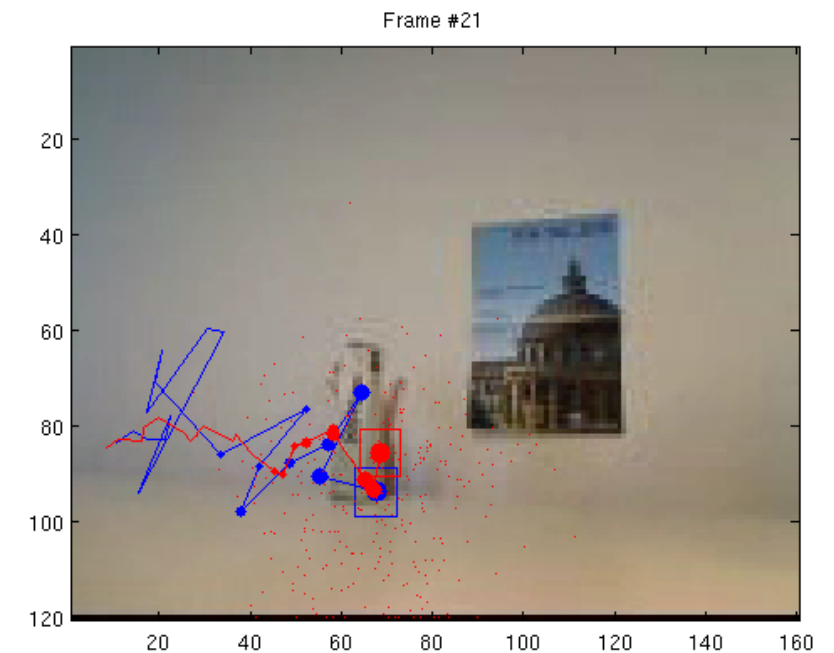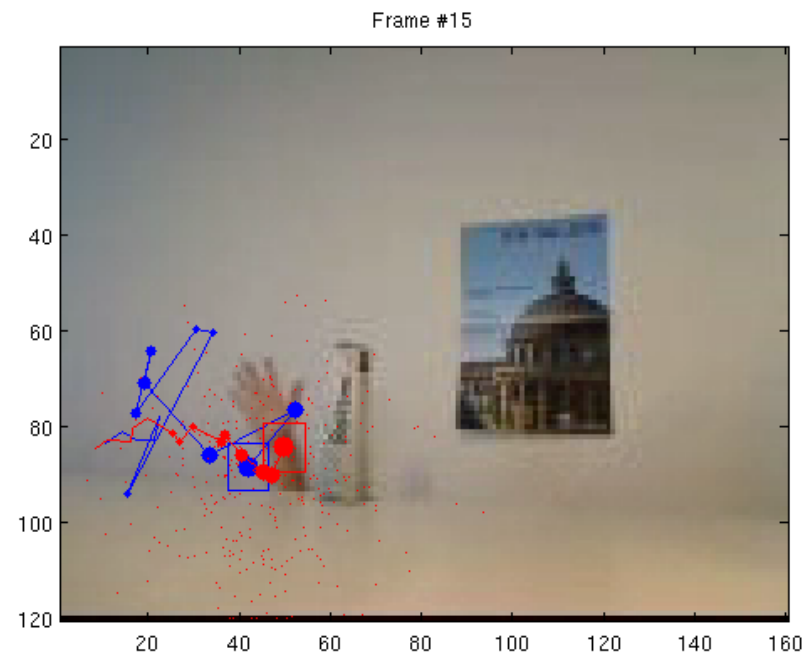- Moving hand
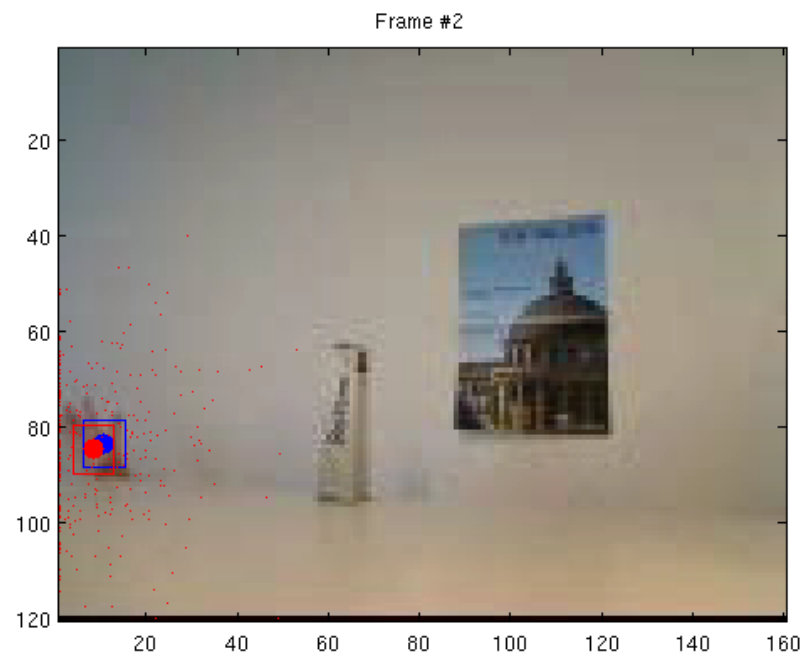- Uniform background

- Moving hand
- Clutter
- Occlusions
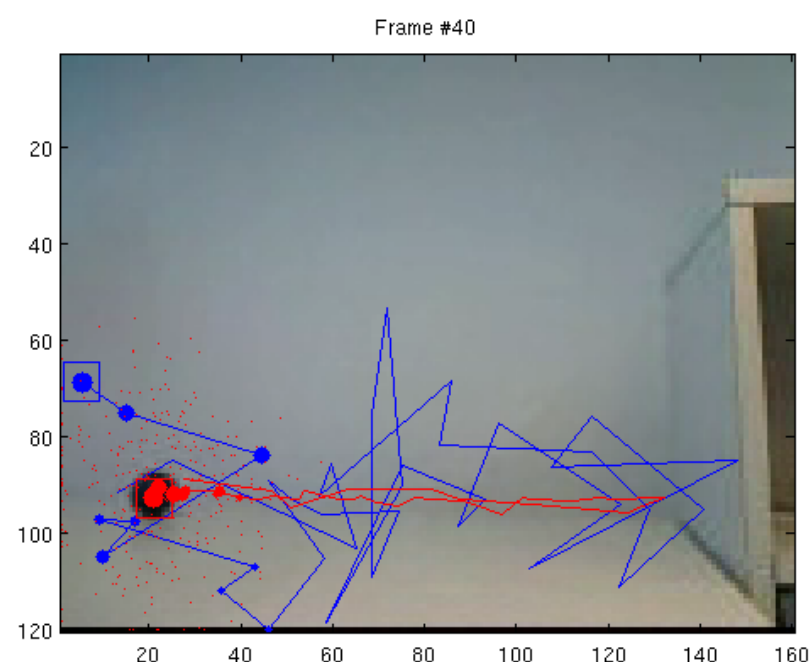

- Ball bouncing
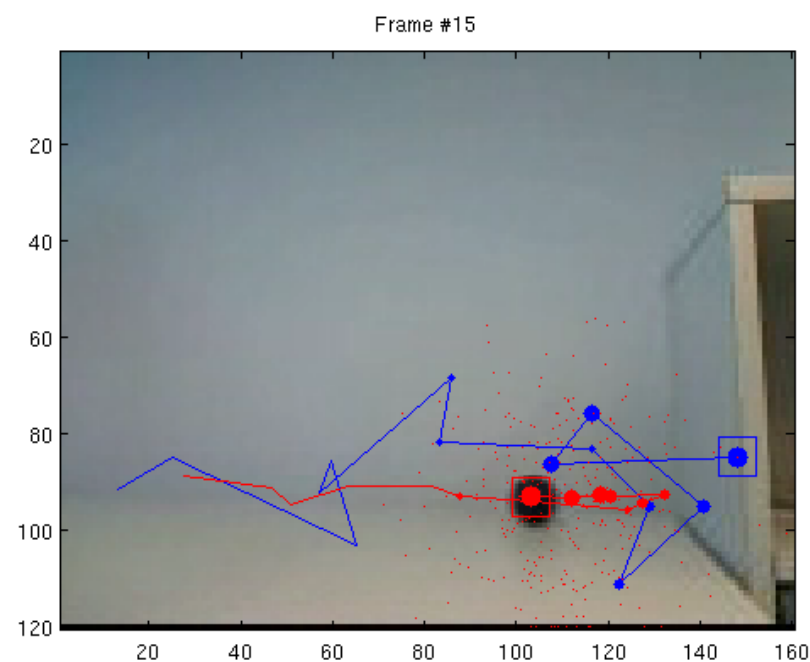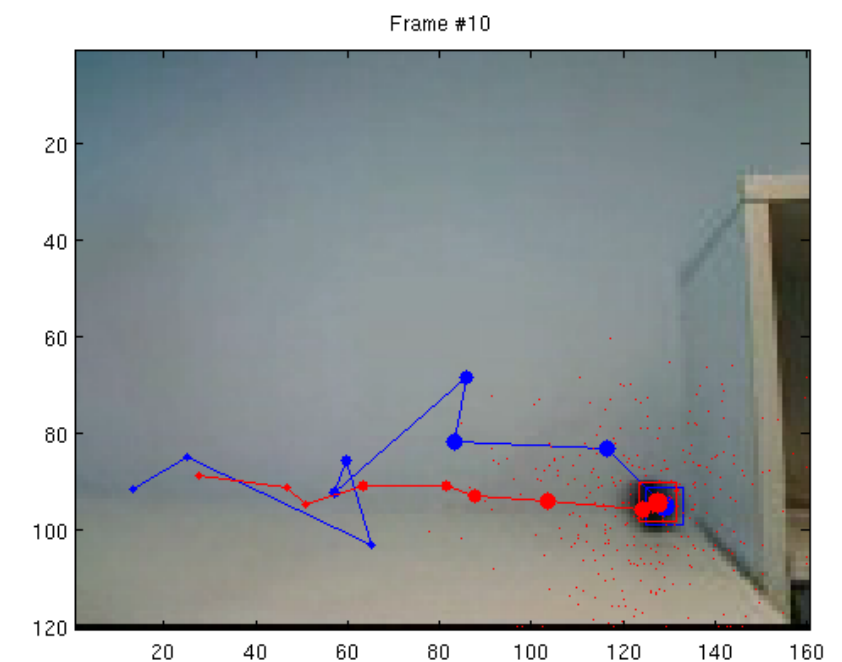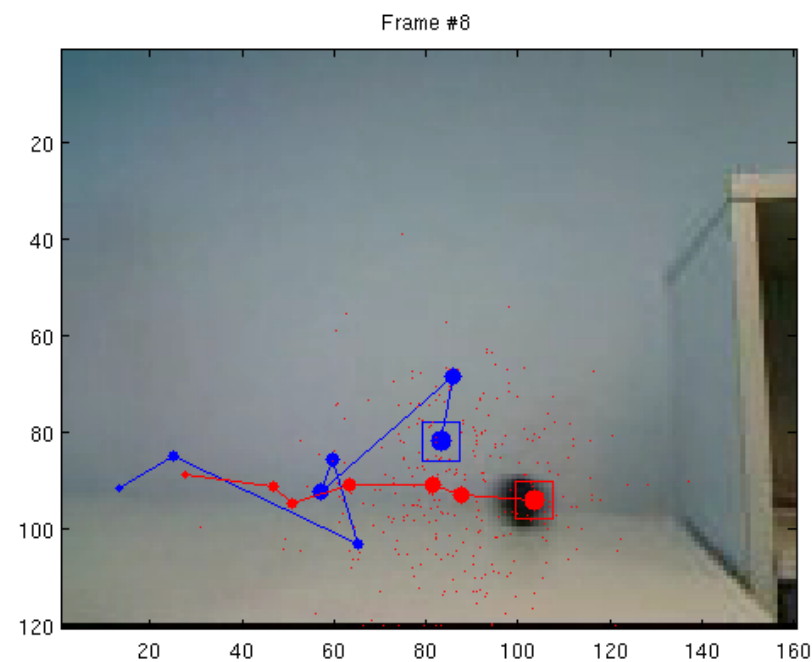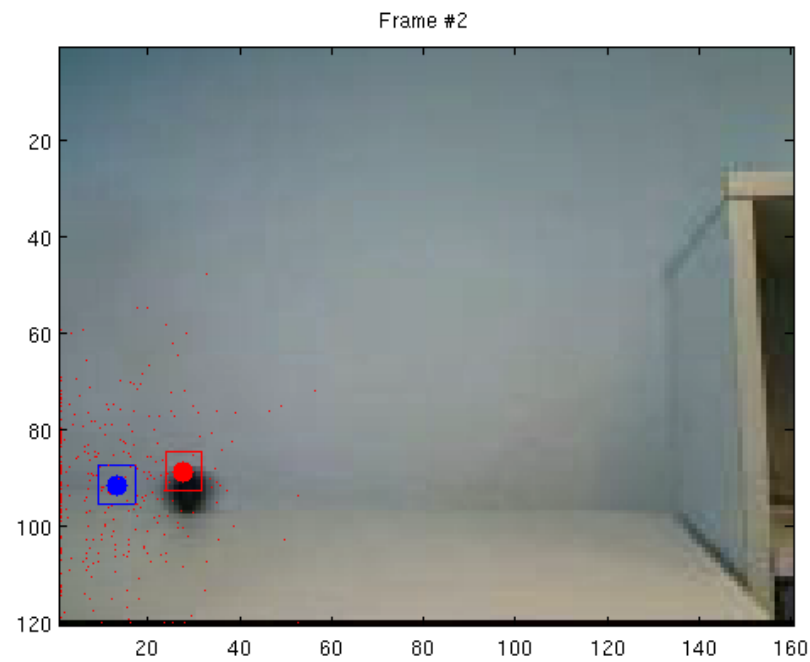- Motion model

Video 1: Hand, uniform background

a priori mean state

a posteriori mean state

Video 2: Hand, clutter, occlusions
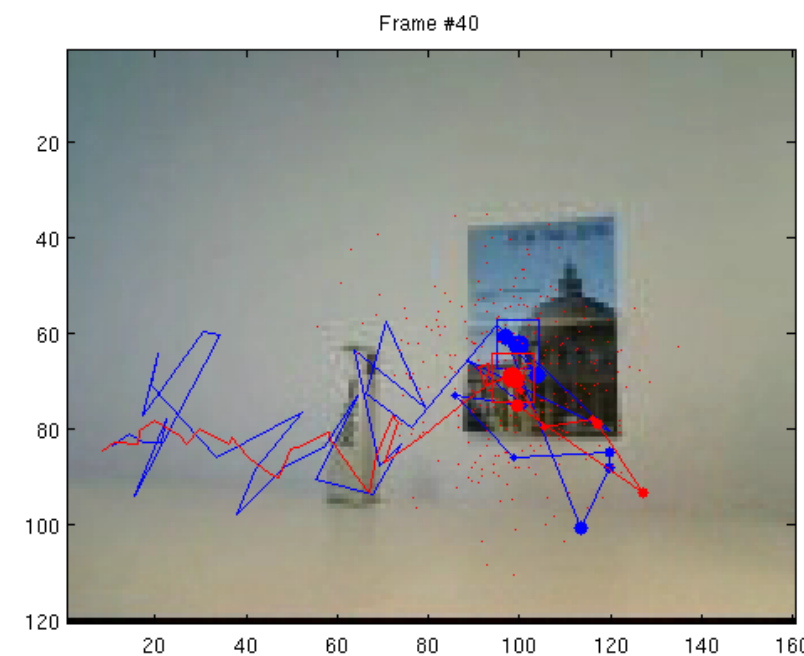
a priori mean state

a posteriori mean state

Video 3: Ball bouncing

a priori mean state

a posteriori mean state

Report

- MATLAB code
  - We provide the overall structure
  - Write the code to perform each step of the CONDENSATION tracker

- Plot the trajectories of the mean state

- Experiment different settings
    - number of particles
    - number of bins for quantization
    - updating appearance model
    - motion model

- Try your own video (bonus)

Hand-in

Hand in by **23:30** on **28**th **December 2018**

to Moodle