CONDENSATION – Conditional Density Propagation for Visual Tracking [Isard, Blake]

- Alternative to Kalman filter tracking : can handle multi-modal probability distribution $P(z \mid x)$ z: observed vartiables, x : state
- Extension of factored sampling technique using : using drift-diffuse-measure for sampling from the probability distribution
- Simple as compared to Kalman filter despite generality : absence of Riccati equation (degree 2 term in differential equation) which occurs in Kalman filter in covariance propagation
- In this shape is represented by by parametric spline curve. Splines are curve normals along which white crosses (high contrast) features are sought.
- Dynamical model [$P(x_t \mid x_{t-1})$] can be shown to be temporal Markov chain
- Observational Model [$P(z_t \mid x_t)$]:
    - Assumed to be stationary in time though this is not a requirement of the condensation algorithm
    - One dimensional case:
        - Given an observation, it could come from the possible true positions or from clutter
        - Clutter : Poisson process
        - True target positions : unbiased and normally distributed
        - Not necessary to consider all true positions, only a window around the observed value is considered
    - 2-D case:
        - parameterized curve image curve z(s), hypothesized shape curve r(s) [Note the change of notation]
        - we have a mapping between positions set up by the normals traced
        - p(z|x) based upon average squared distance between corresponding points of z(s) and x(s)
- Example applications shown:
    - Tracking multimodal distribution (3 person tracking)
    - Tracking rapid motions (dancing girl)
    - Tracking articulated object
    - Tracking camoflouged object