MULTIPLE TARGET TRACKING USING THERMAL IMAGING AND RADAR SENSORS

UNIVERSITY OF NICOSIA
ΠΑΝΕΠΙΣΤΗΜΙΟ ΛΕΥΚΩΣΙΑΣ

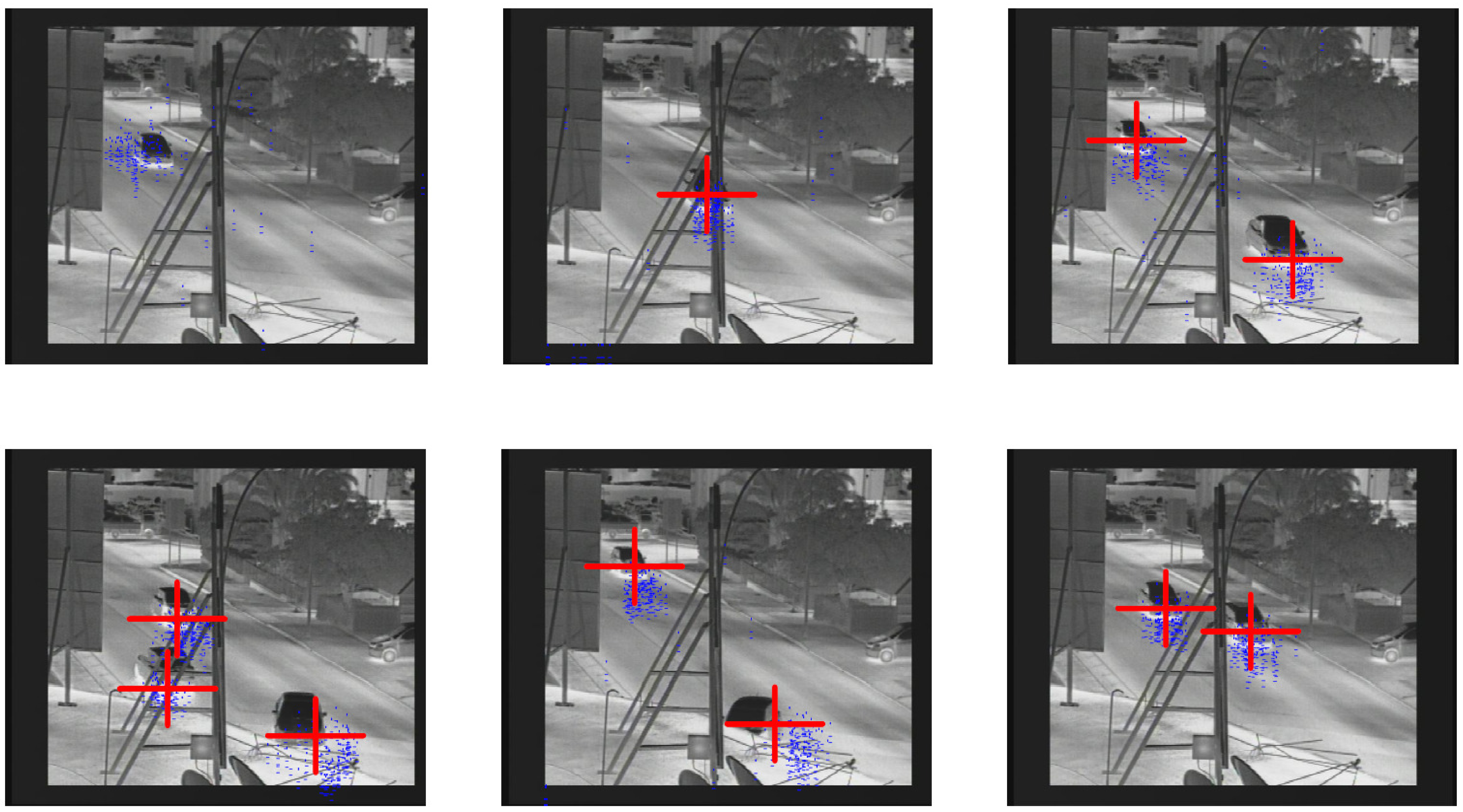
Ioannis Kyriakides

Paper contributions and benefits

- Fusion of compressive/non-compressive data from heterogeneous sensors for multiple target tracking
- Mixed sampling from prior (speed) and likelihood (accuracy) for low/high resolution sensors
- Accurately combines prior and measurement information with non-linear, non-Gaussian characteristics [1]
- Uses compressive measurements directly with no reconstruction [2,3]
- Uses adaptive information from the sequential tracking process to improve performance [4]

Simulation Scenario

- Tracking or multiple moving targets on a road segment
- Fuses Thermal Imaging and Compressed Radar measurements
- Targets enter and exit the scene



IPLPS PARTICLE FILTER

- Receive measurements (8) for sensors $u = 1, 2$

For $u = 1$

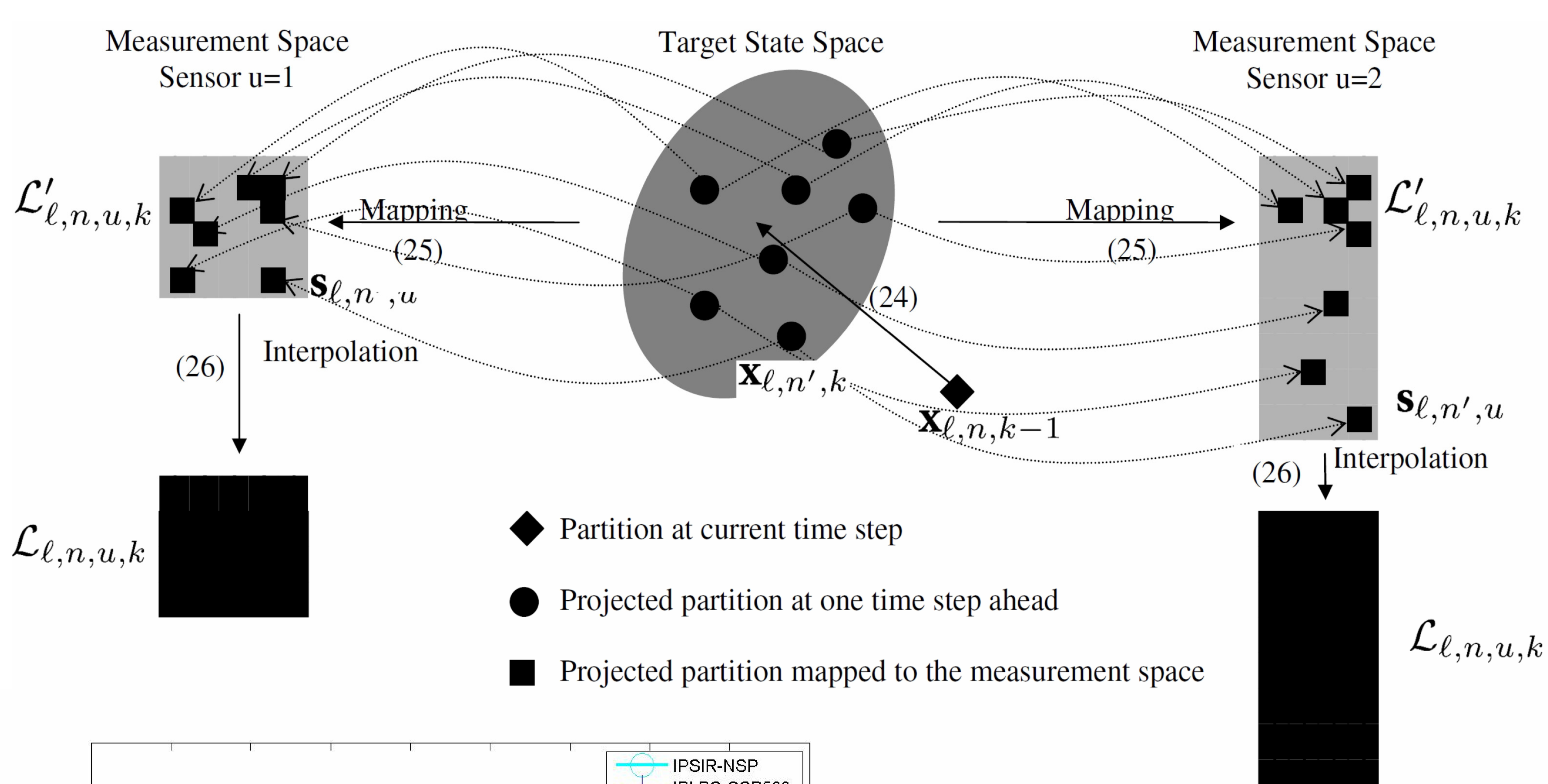
- Generate statistics $y_{u,k}(l, \bar{\jmath})$ for $l \in \mathcal{L}_u$ (9)
- For each particle $n = 1, \ldots, N$
  - For each partition $\ell = 1, \ldots, \check{\ell}$
    - Calculate likelihood ratio $\Lambda_{\ell,n,u,k}(l)$ (17) and (18)
    - Likelihood Sampling: Sample index $\tilde{l}_{\ell,n,u}$ (19)
    - Add index $\tilde{l}_{\ell,n,u}$ to the set $\widetilde{\mathcal{T}}_{n,u,k}$ (20)
- For each particle $n = 1, \ldots, N$
  - For each partition $\ell = 1, \ldots, \check{\ell}$
    - Sample $\mathbf{x}_{\ell,n',k}$, $n' = 1, \ldots, N'$ as (21)
    - Map $\mathbf{s}_{l,n',u,k} = f_{\mathbf{s},u}(\mathbf{x}_{\ell,n',k})$ (4)
    - Select $\tilde{n} : l_{\tilde{n},u} = \tilde{l}_{\ell,n,u}$ and set $\mathbf{x}_{\ell,n,k} = \mathbf{x}_{\ell,\tilde{n},k}$

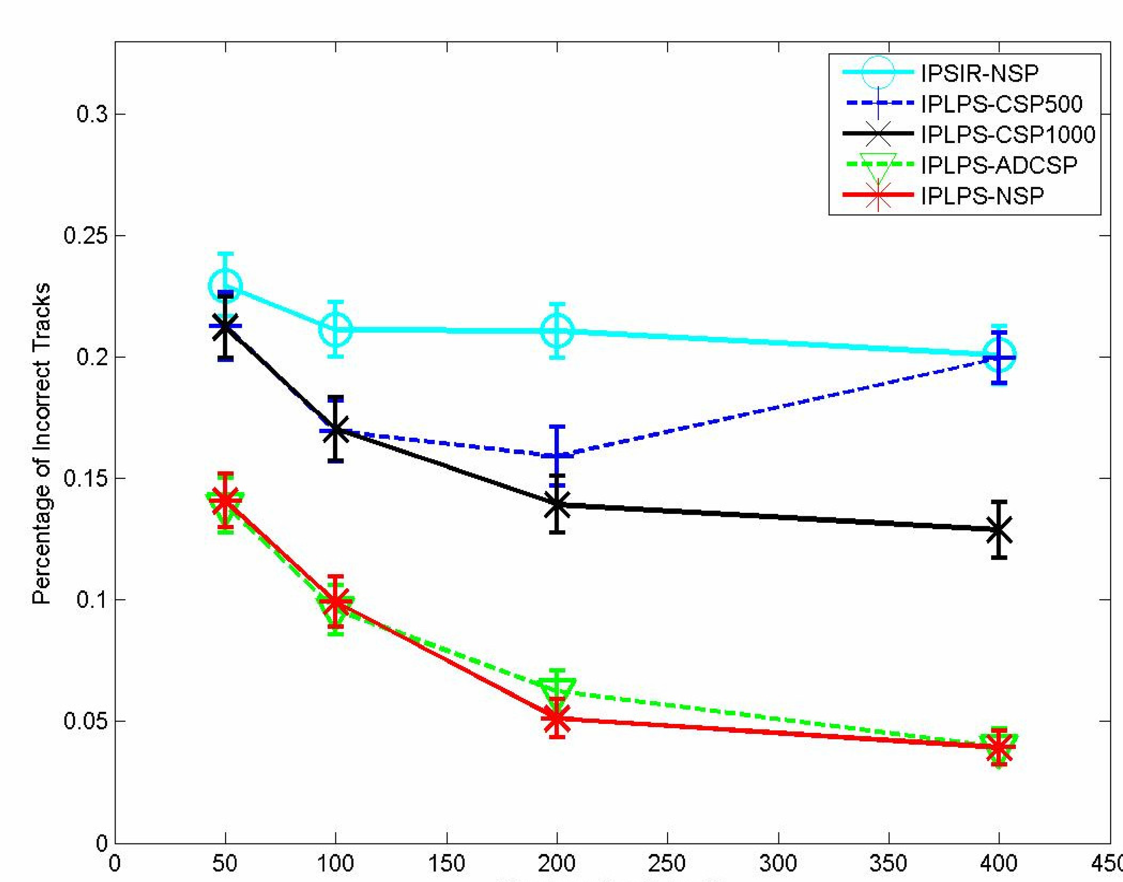
For $u = 2$

- For each particle $n = 1, \ldots, N$
  - For each partition $\ell = 1, \ldots, \check{\ell}$
    - Map state to measurement as $\mathbf{s}_{l,n,u,k} = f_{\mathbf{s},u}(\mathbf{x}_{\ell,n,k})$ (4)
    - Calculate likelihood ratio $\Lambda_{\ell,n,u,k}$ (23), (24), and (25)
    - Sample $\tilde{n} = 1, \ldots, N$ from $\{\Lambda_{\ell,n,u,k}\}_{n=1}^{N}$
- Concatenate partitions into particles

$$\mathbf{X}_{n,k} = [\mathbf{x}_{1,n,k}, \mathbf{x}_{2,n,k}, \ldots, \mathbf{x}_{\check{\ell},n,k}]$$

- Obtain weights $w_{n,k}$ using (32)
- Calculate $p(\mathbf{X}_k|\mathbf{Y}_k)$ and $\hat{\mathbf{X}}_k$ using (35) and (36)
- Repeat the process for the next time step k





Author information:
Ioannis Kyriakides
Department of Engineering,
University of Nicosia
kyriakides.i@unic.ac.cy

References

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