Partial Arithmetic Consensus based Distributed Intensity Particle Flow SMC-PHD Filter for Multi-Target Tracking

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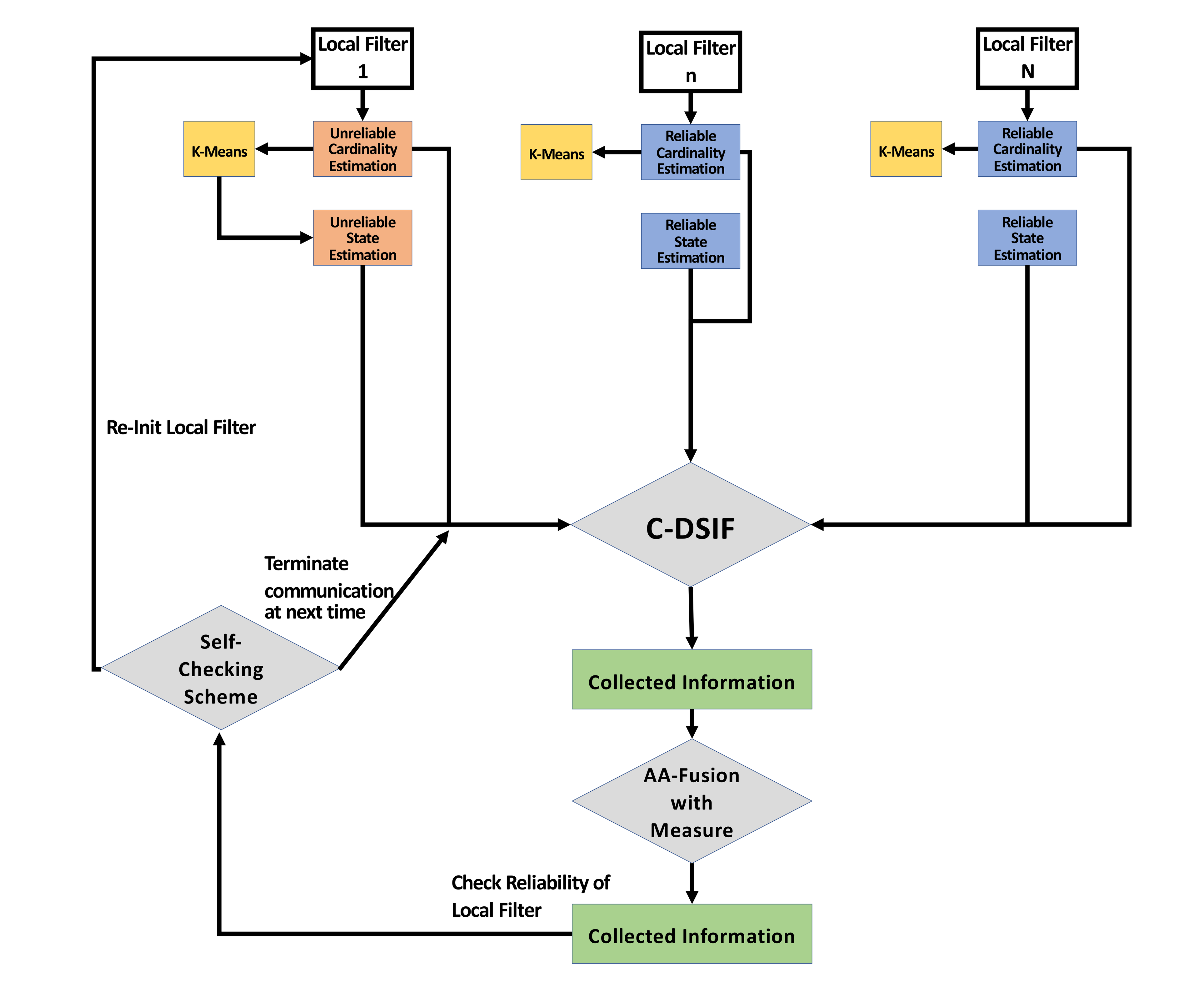
Introduction

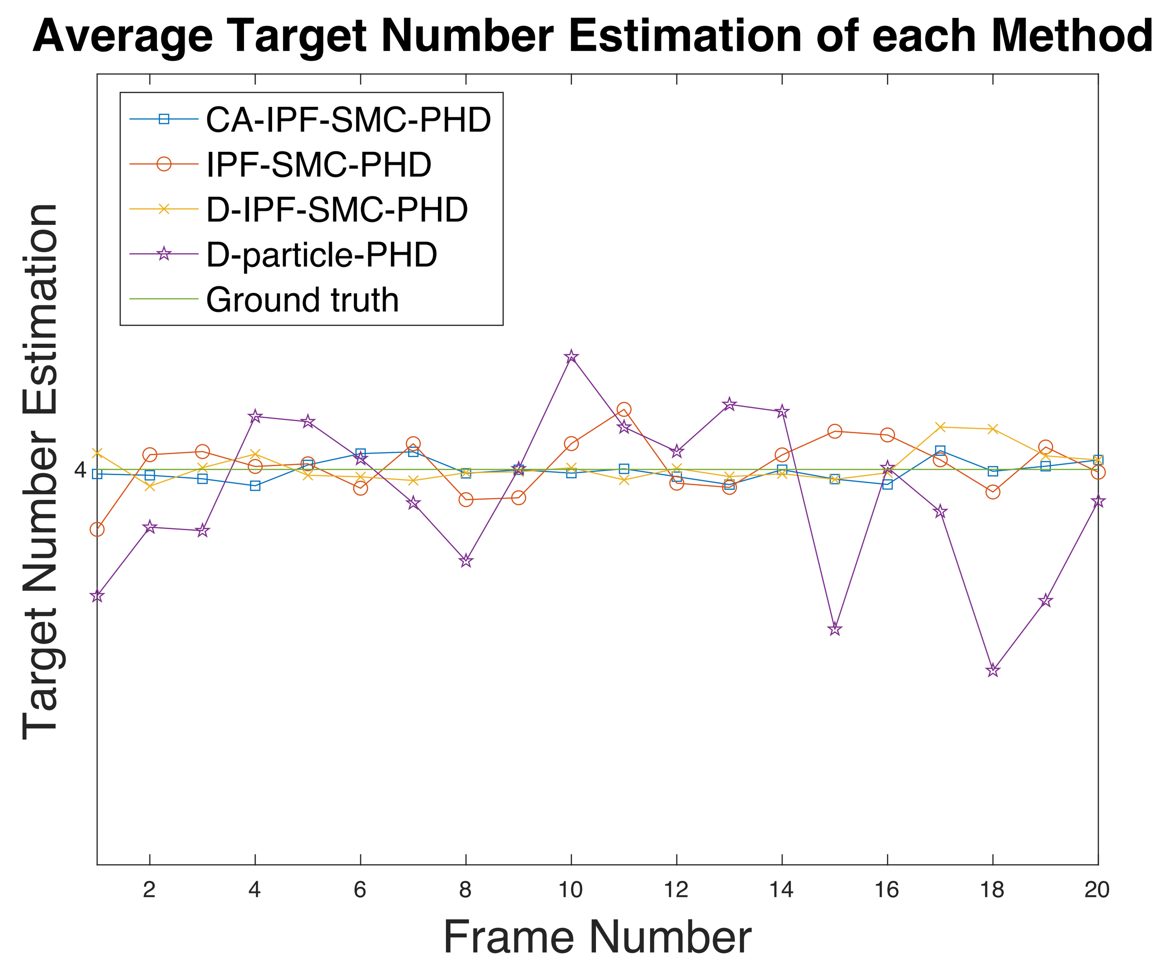
- Intensity Particle Flow (IPF) SMC-PHD achieves reliable multi-target tracking performance in a simple scenario under single sensor settings.
- Arithmetic Average (AA) fusion can be used to extend multi-target tracking into a distributed scenario, by using information from selected sensors from the network , but the performance of tracking might be degraded by unreliable estimates from the local filters.
- **This study aims to mitigate the impacts of outliers in the estimates from the local filters when performing partial consensus.**
- **This study also aims to reduce the communication cost by reducing the share of unreliable information across the local filter.**
- This study develops a reliable multi-target tracking system under distributed settings by reaching partial consensus rather than complete consensus.

Method

1. C-DSIF **only shares estimates from reliable sensors**, which helps reduce the communication cost incurred by the sharing of information across the sensors in the network.
2. Considering the fact that *the local estimates from unreliable sensors may adversely impact the tracking accuracy*, we propose a new scheme with confidence measure to **evaluate the local estimates' reliability**. **Only local estimates from reliable sensors** will be used for global fusion.



Result



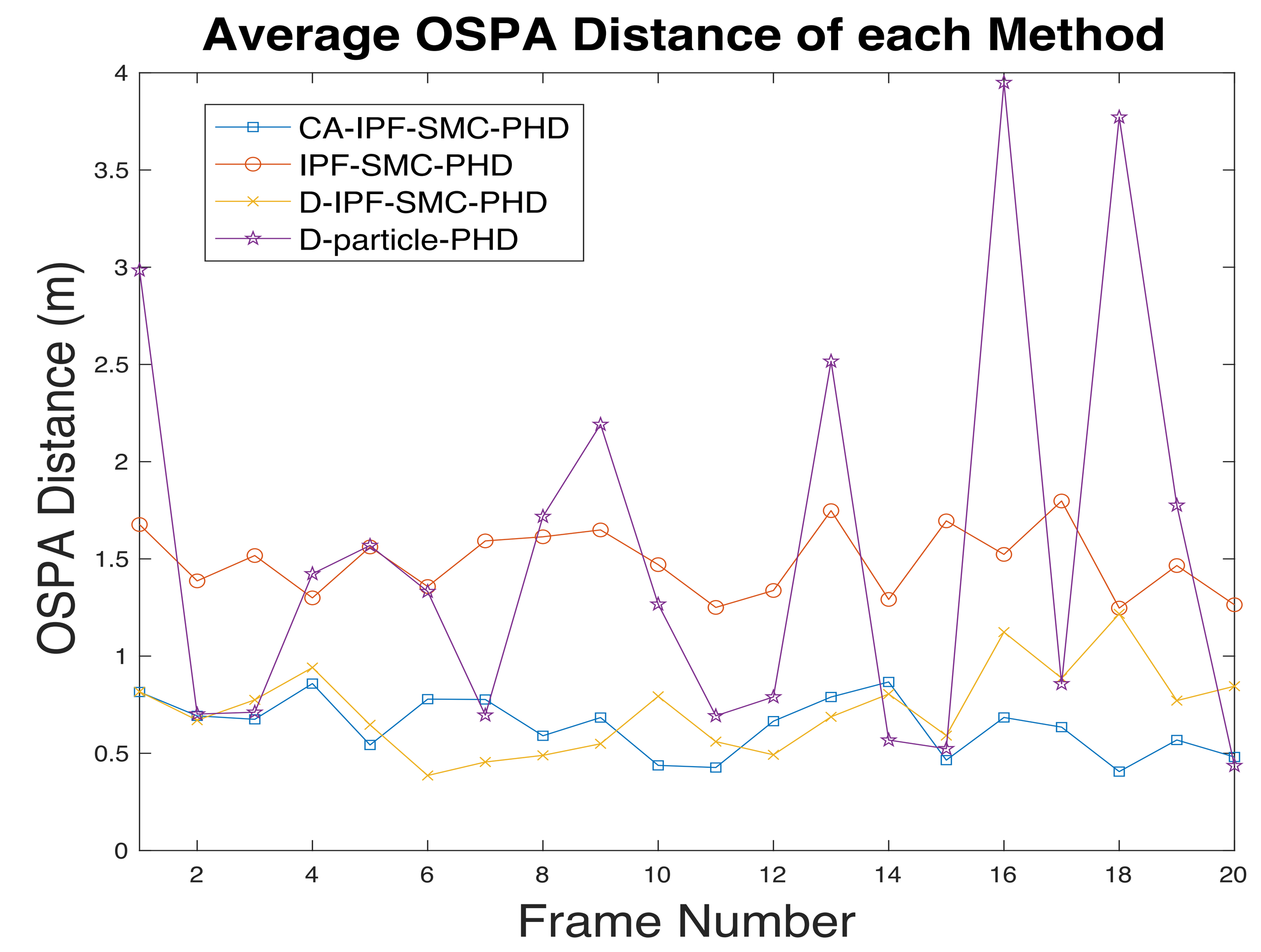


Figure 1. These two figures compare the **reliability (left)** and **accuracy (right)** of CA-IPF-SMC-PHD, IPF-SMC-PHD, D-IPF-SMC-PHD, and D-particle-PHD.

Table 1. The **time / communication** cost of D-IPF-SMC, D-Particle-PHD and CA-IPF-SMC-PHD.

Method	Ave Time Cost	Ave Communication Cost
D-IPF-SMC-PHD	41.41s	4.4
D-Particle-PHD	41.99s	5.1
CA-IPF-SMC-PHD	42.21s	6.3

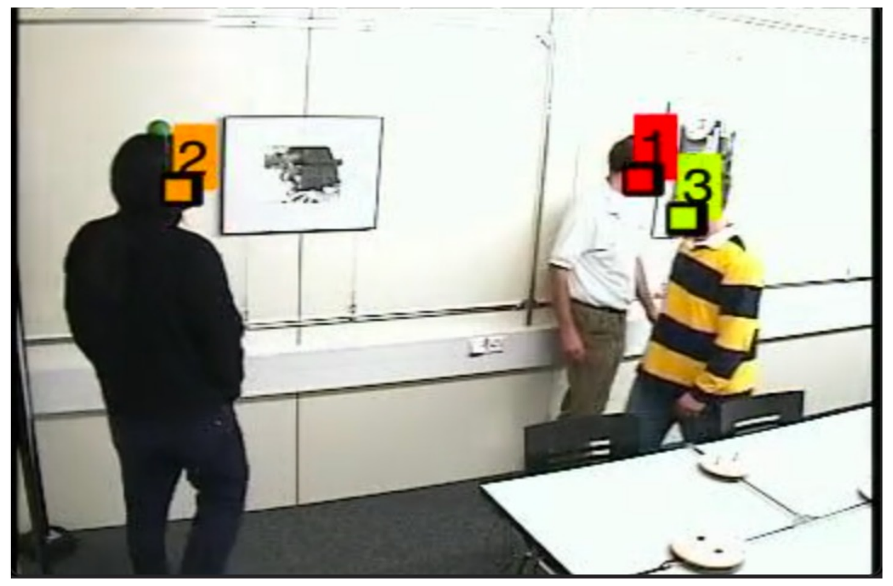


Figure 2. The global state estimation given by D-IPF-SMC-PHD on the AV16.3 dataset.

Conclusion & Further Studies

We have presented a novel AA fusion method to extend IPF-SMC-PHD into a distributed version under partial consensus condition, with improved tracking accuracy and reduced computational/communication cost. Simulation results show that the proposed method outperforms several recent baseline methods. In the future, we will study the performance of D-IPF-SMC-PHD for target tracking when sensor nodes are limited in sensing range.

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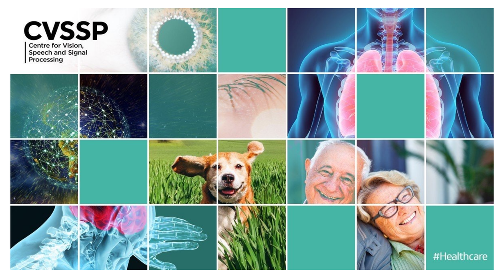

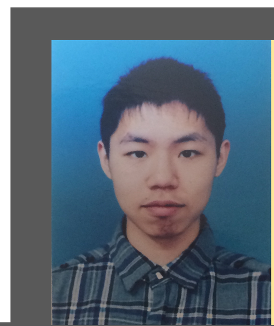

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