



Sensor Data Processing, Objects Detection, Tracking, Classification and Decision Making in Sensor Networks

About The Project

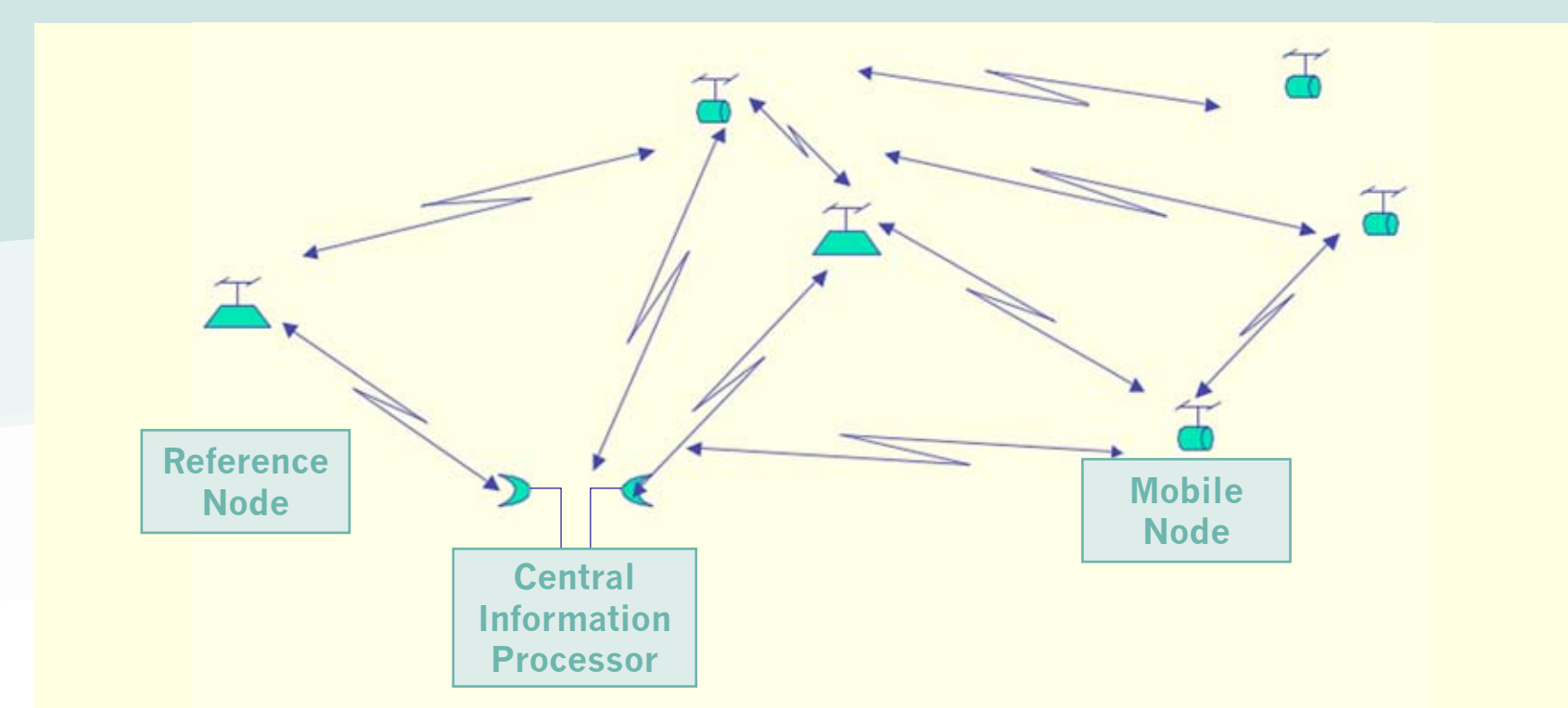
This research is concerned with the development of advanced real-time methods for efficient sensor data processing: data fusion, system monitoring and decision making. The particular interest is in nonlinear system dynamics under measurement and environment uncertainties. Typical applications are intelligent transportation systems, monitoring, and surveillance systems.

Real-time Methods for Nonlinear Estimation

- Develop advanced methods for nonlinear estimation/ prediction
- Monte Carlo methods
- Computationally efficient techniques suitable in real time

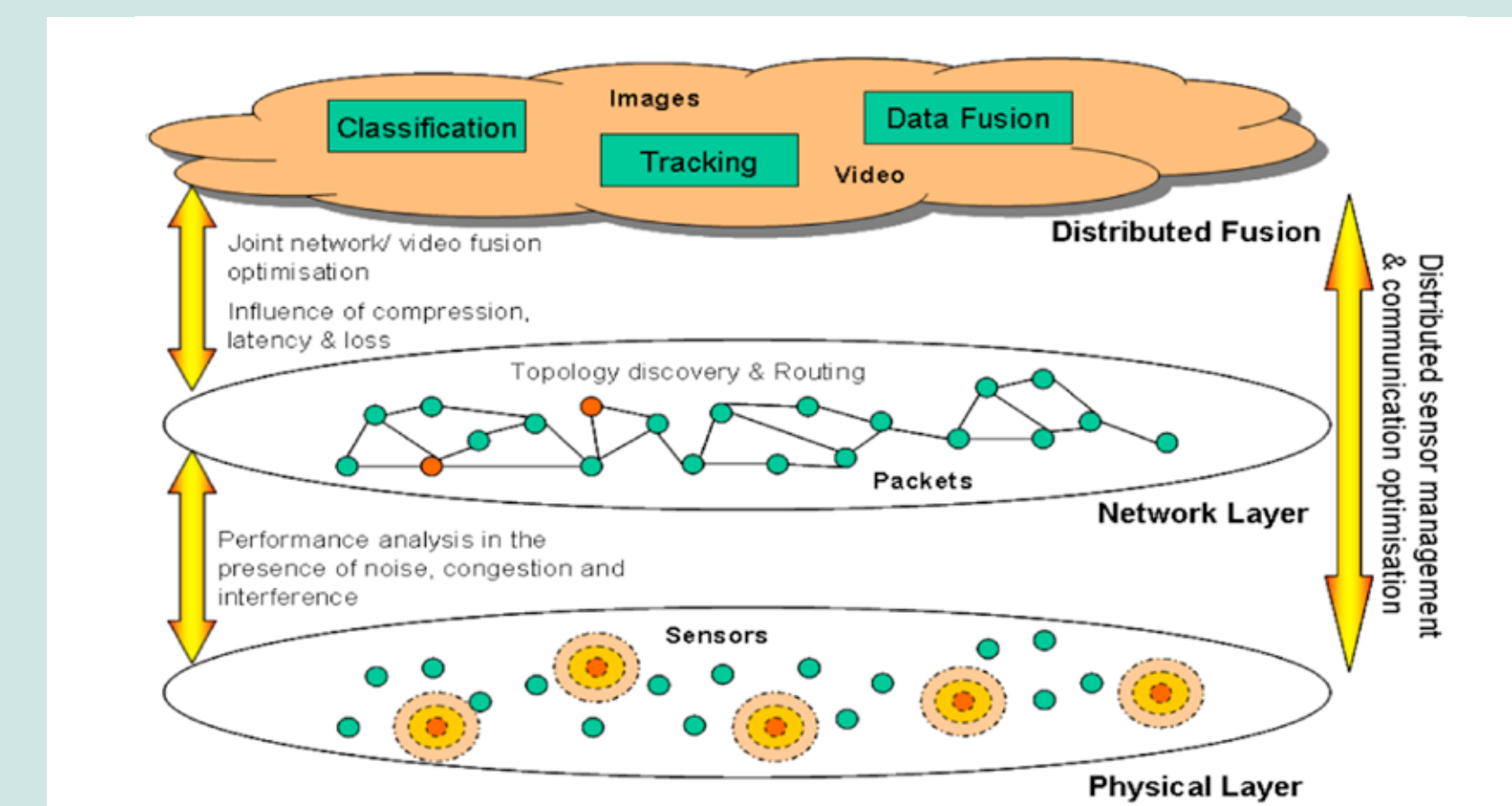
Ad Hoc Wireless Sensor Networks

- **Localisation** of moving nodes in wireless networks
- Communication issues
- Optimisation of the resources of the network
- Reconfigure the network when necessary to make it robust to sensor failures
- Distributed decision making (the cluster of nodes have only local information)



Real-Time Estimation Over Sensor Networks

- Comparison of centralised with decentralised techniques
- Probabilistic graphical methods: Markov random fields
- Work with synchronous and asynchronous data



Other Research Issues

- Developments of methods for **sensor data fusion**
- Investigations with different scenarios (indoor, outdoor) fusing data from different sensors, single and multiple objects
- 3D scenarios, littoral tracking, articulated objects tracking.

Modelling & Data Processing for Safe Road Networks

- Vehicular traffic modelling and prediction
- **Distributed estimation** in road networks
- Robustness to missing data



Group and Extended Object Tracking

- Model and predict the movement of **group of objects** (vehicles), find typical patterns
- Estimation methods for **extended objects** (they are not considered as one single point)

Video Object Tracking and Classification

- **Automatic detection, tracking multiple objects** in video
- Cope with full and partial occlusions
- Surveillance applications



- Reach complexity suitable for real-time applications with single and multiple cameras

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Localisation in Wireless Sensor Networks

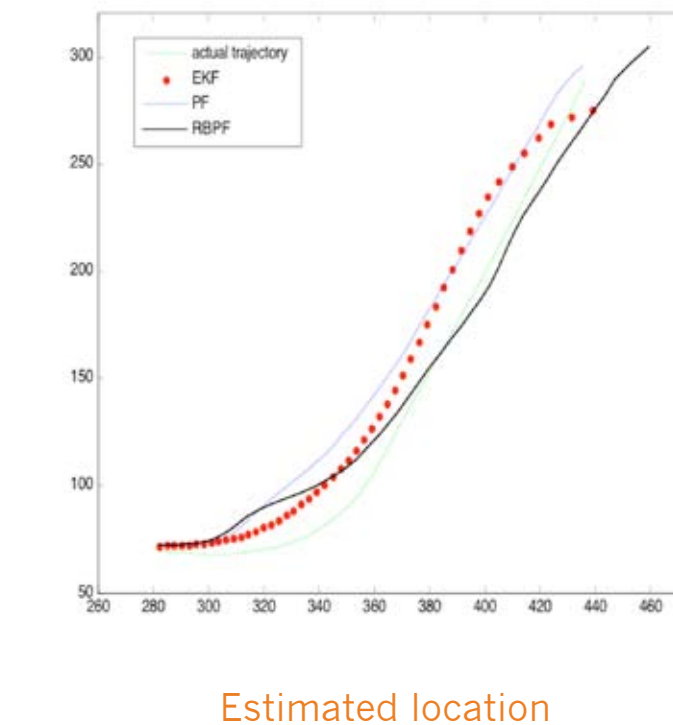
Achievements:
Estimate the position and speed of a mobile (a vehicle or person) based on received signal strengths with Bayesian methods



Experiments with real data



Positions of the base stations



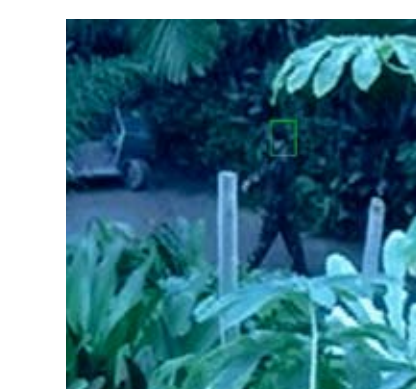
Estimated location

Articulated Objects Tracking

Project with the UK Data Information Fusion Centre

Partners:
Bristol University, Cambridge University, Imperial College London, Lancaster University, QinetiQ

Achievements:
Development of a framework for fusing complementary cues (colour, texture, edges, motion) and adaptation of their parameters within particle filtering for real-time tracking



In optical videos



In infrared videos



Track multiple people



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