

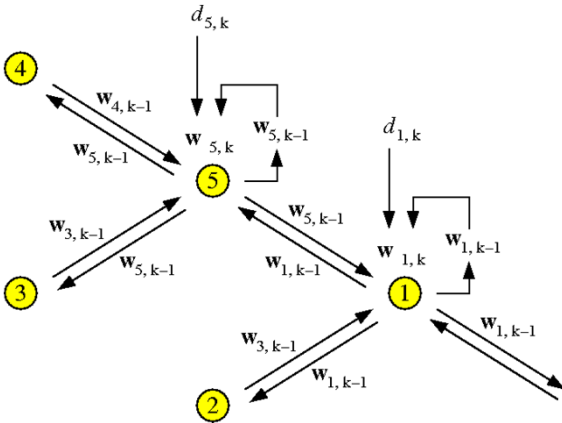
University Defence Research Centre (UDRC) In Signal Processing

Sponsored by the UK MOD

Distributed Signal Processing for Distributed Sensor Networks

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Background

- This project addresses the development of truly distributed signal processing algorithms which have provable convergence behaviour in time-varying sensor networks.
- Current approaches tend to be based on a single (vulnerable) fusion centre

Approach

- Diffusion learning makes all nodes equally dispensable and hence the network becomes more robust.
- Properly designed diffusion learning ensures that distributed networks achieve the same performance as fully connected ones.

Main algorithms

1. Diffusion learning algorithm for acoustic source location
2. Accelerated consensus algorithm to speed convergence
3. Combining 1 & 2 for acoustic source location application
4. Stochastic gradient variant of 2 for improved complexity/performance in this application

How it works:

The algorithms rely on recent results from the theory of distributed convex optimization to guarantee convergence. They are implemented efficiently using adaptive filtering techniques.

Assumptions, limitations:

The problem must be well approximated as convex optimization.

Results

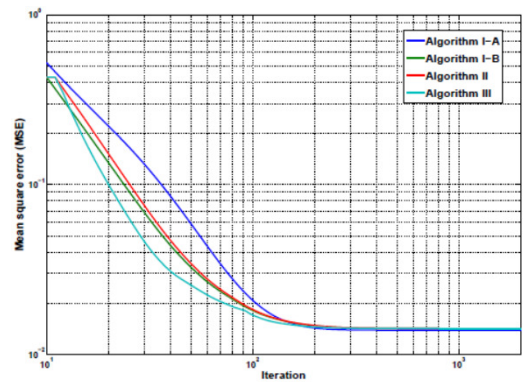


Fig: Source location mean square error with iteration number.

Diffusion learning:

Algorithm I-A: basic

Algorithm I-A: with adaptive projection radii

Algorithm II: with projection-based acceleration

Algorithm III: with gradient-based acceleration

Potential military relevance & applications of results:

- Underwater source location
- Airborne early warning systems
- Distributed radar networks



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