Distributed Sensing for Smart Grids

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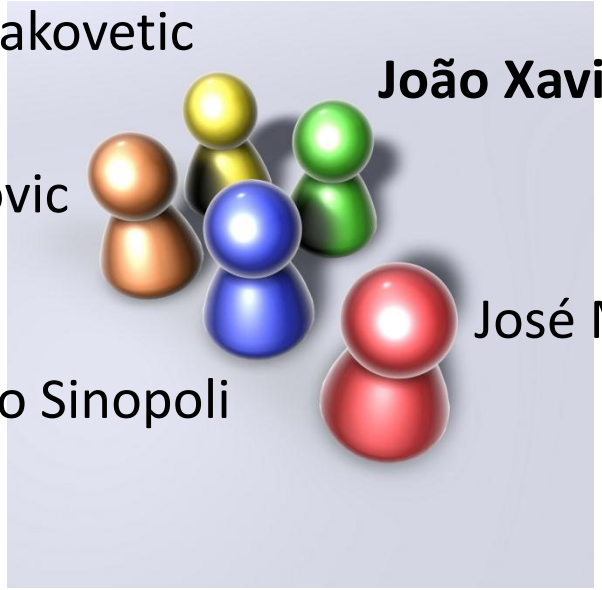
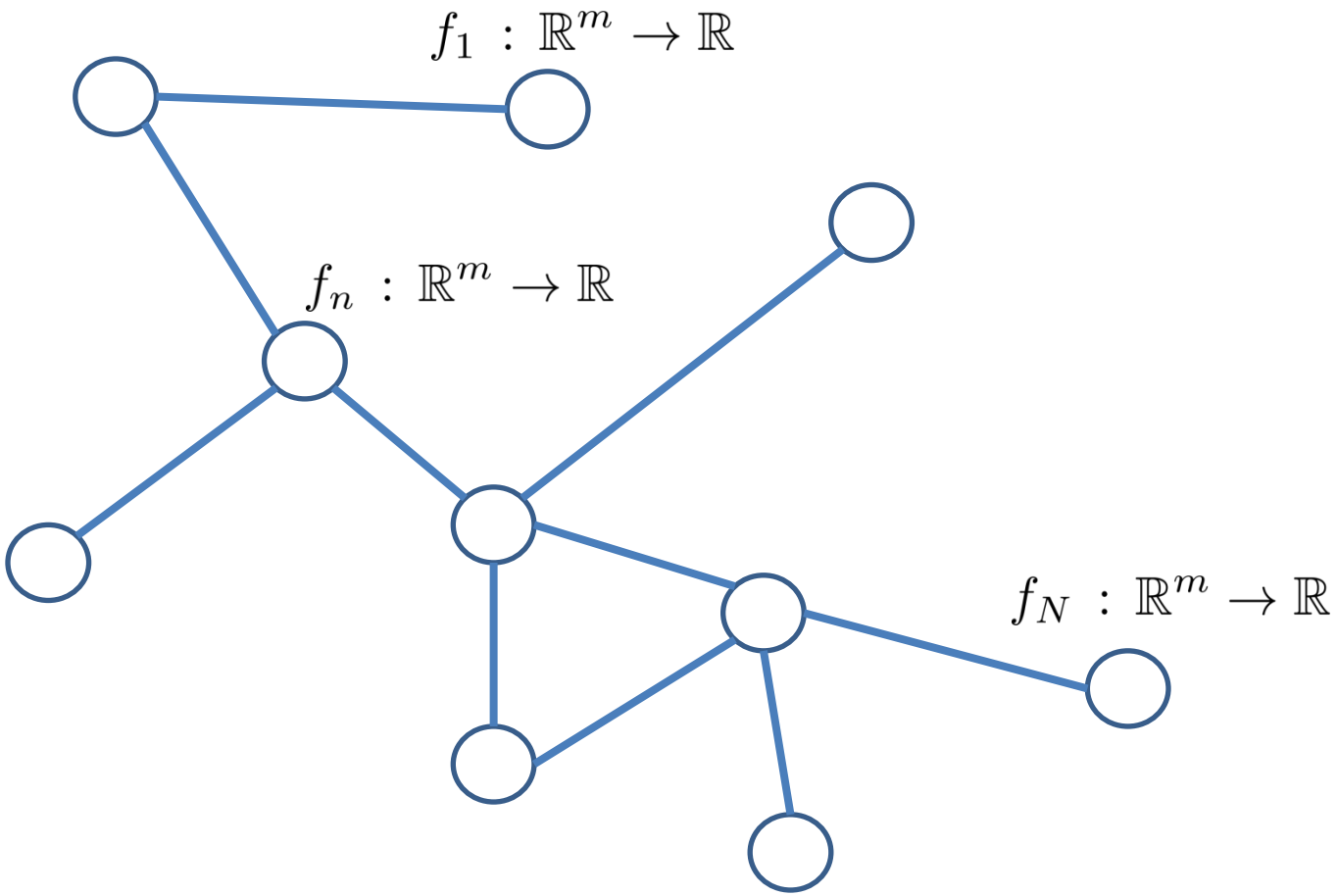
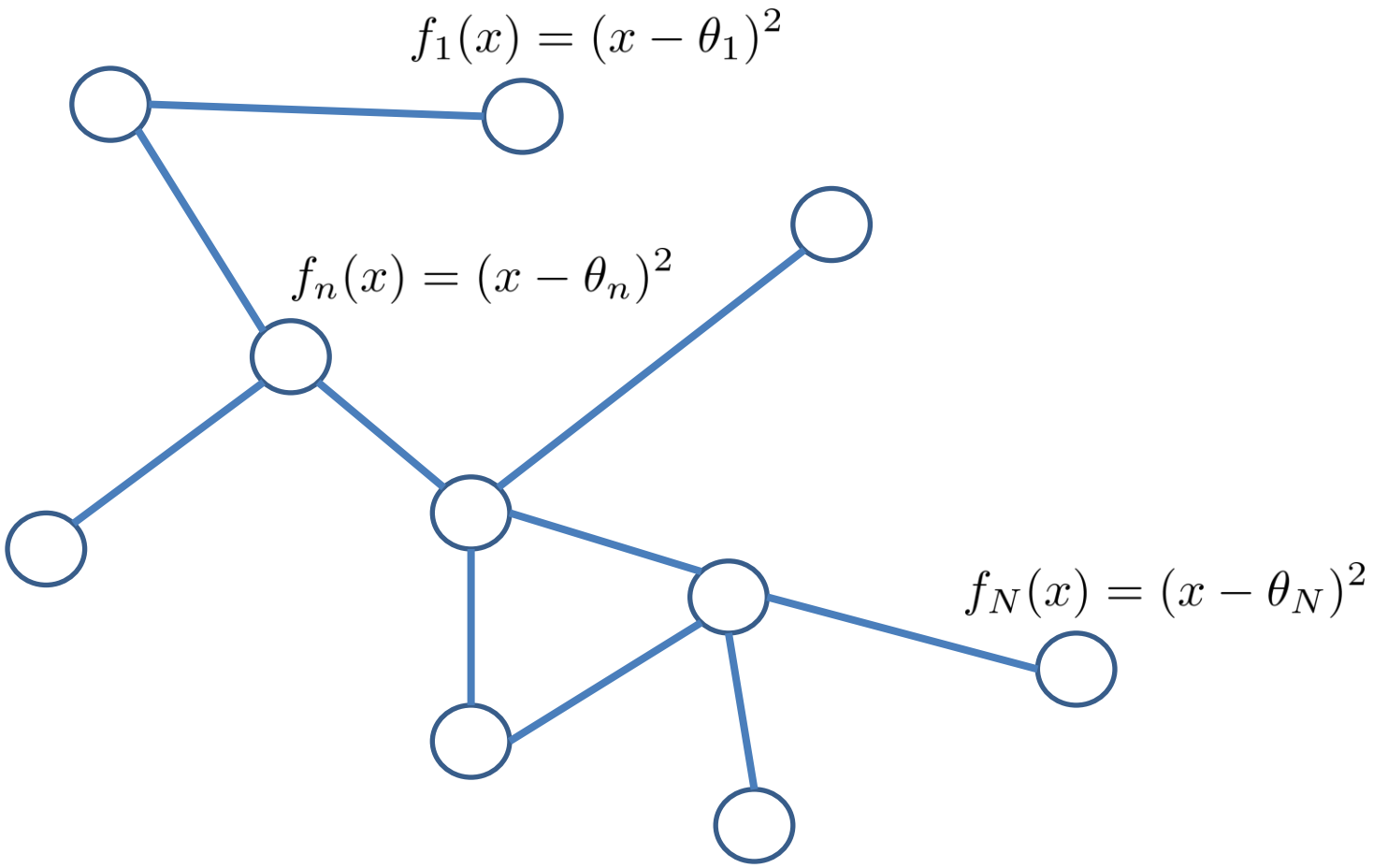


Topic 1 : distributed optimization



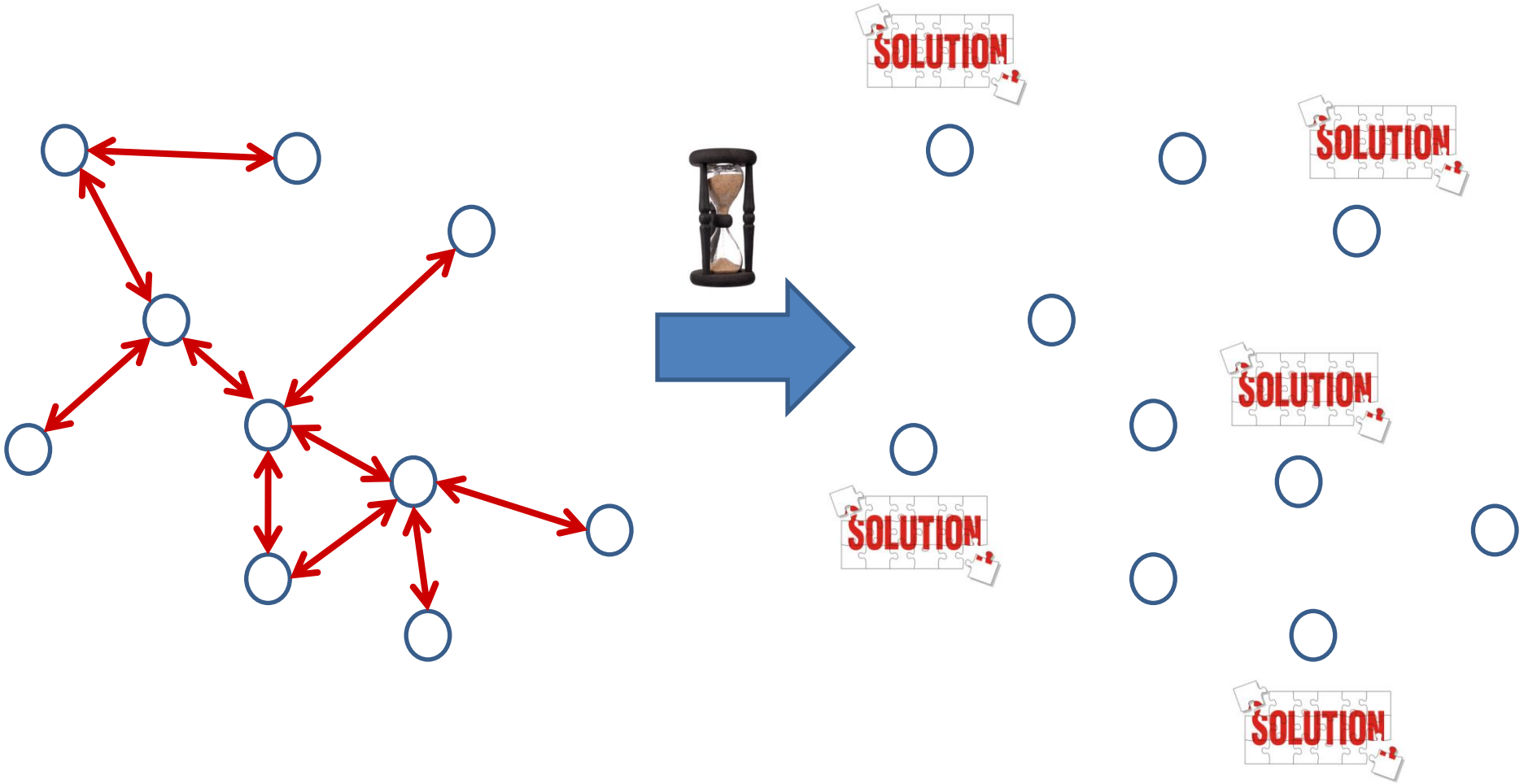
$$\begin{array}{ll} \text{minimize} & f_1(x) + \cdots + f_n(x) + \cdots + f_N(x) \\ \text{subject to} & x \in \mathbb{R}^m \end{array}$$

Example: consensus

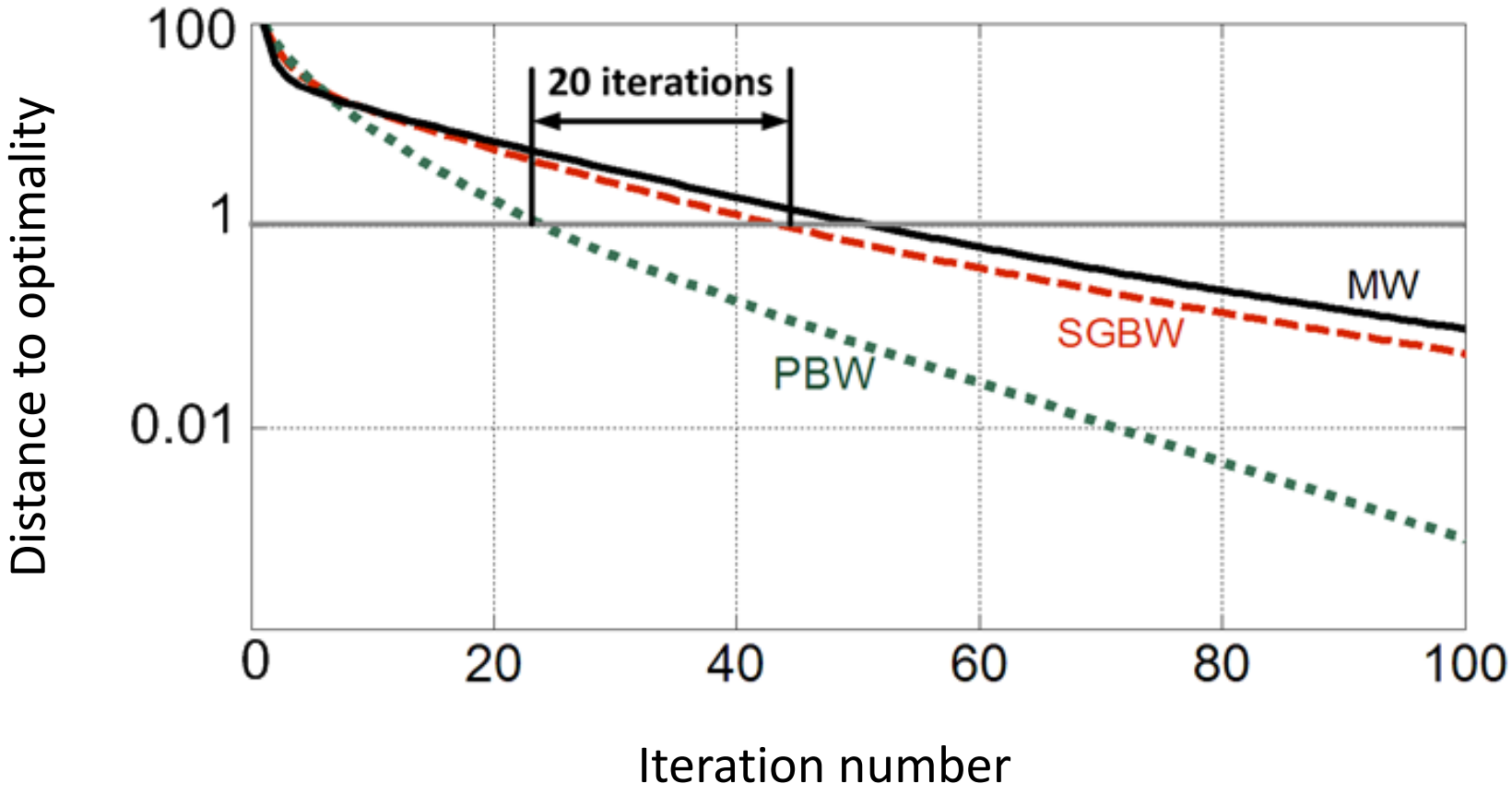


$$\begin{array}{ll} \text{minimize} & f_1(x) + \cdots + f_n(x) + \cdots + f_N(x) \\ \text{subject to} & x \in \mathbb{R}^m \end{array} \quad \Leftrightarrow \quad x^\star = \frac{1}{N} \sum_{i=1}^{N} \theta_i$$

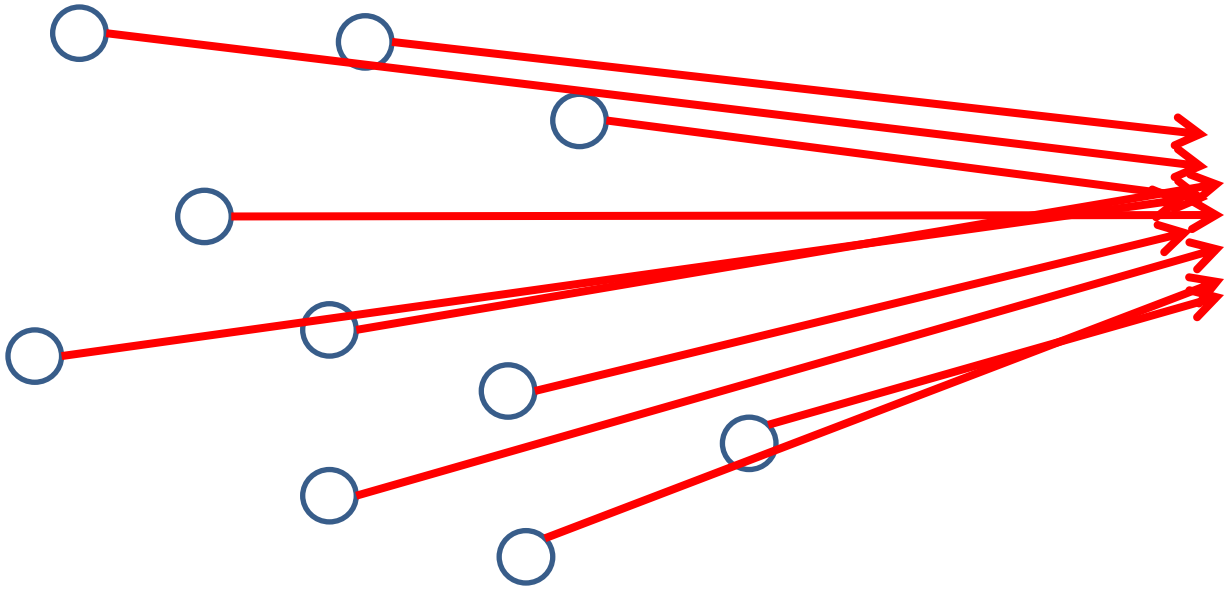
Distributed paradigm



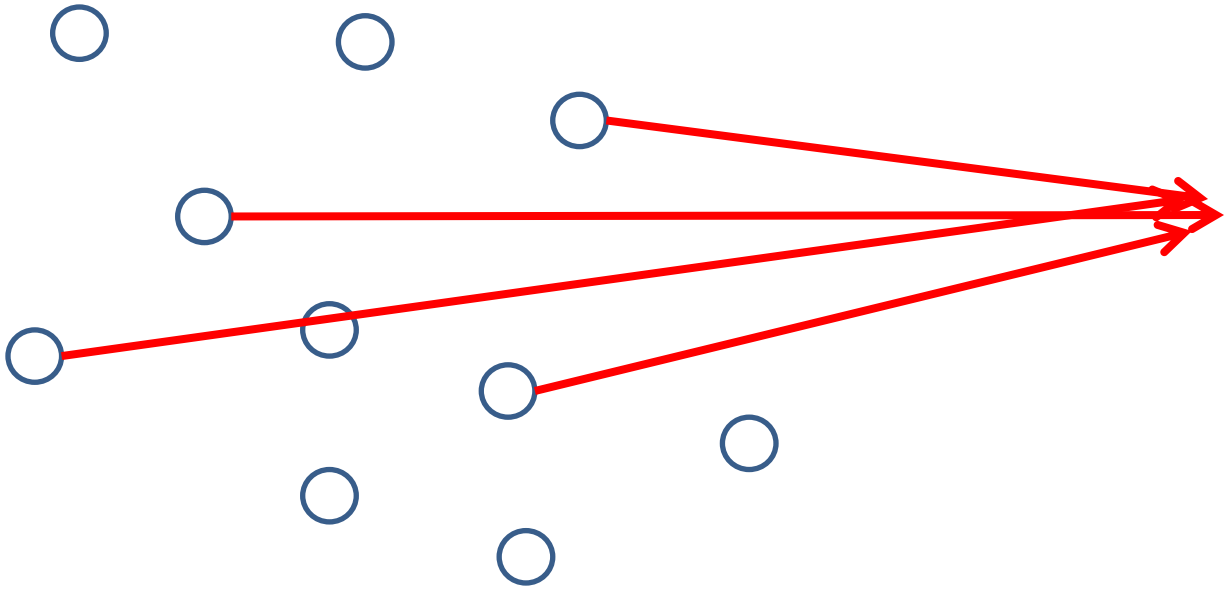
Results


100
1
0.01
0
20
40
60
80
100
20 iterations
MW
SGBW
PBW
Distance to optimality
Iteration number

Topic 2 : sensor selection



Only a few transmit….which ?



$$\begin{aligned} \text{maximize} \quad & f(i_1, i_2, \ldots, i_p) \\ \text{subject to} \quad & \{i_1, i_2, \ldots, i_p\} \subset \{1, 2, \ldots, N\} \end{aligned}$$

Results : small networks

- N = 20 sensors

p = 3	p = 5	p = 8
1.00	1.00	0.99

$$\frac{f(\text{our solution})}{f(\text{exhaustive search})}$$

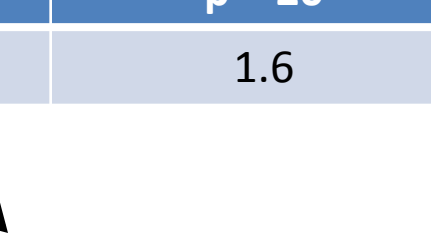
- N = 40 sensors

p = 3	p = 5	p = 8
1.00	0.91	0.87

Results : large networks

- N = 100 sensors

p = 10	p = 20	p = 40
1.4	1.6	1.3



$$\frac{f(\text{our solution})}{f(\text{random search})}$$

- Random search: 2 minutes

- Our solution: 2 seconds


THANK
YOU


TIME FOR QUESTIONS