Summary of work done in NII

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History

September 2011 - September 2013 : Master student (Paris 6).

March 2013 - September 2013 : Internship student.

January 2014 - April 2014 : Assistant professor.

October 2014 - October 2017 : PhD student.

Summary

Distributed Constraint Optimization Problems

Popular framework to model multi-agent coordination problems.

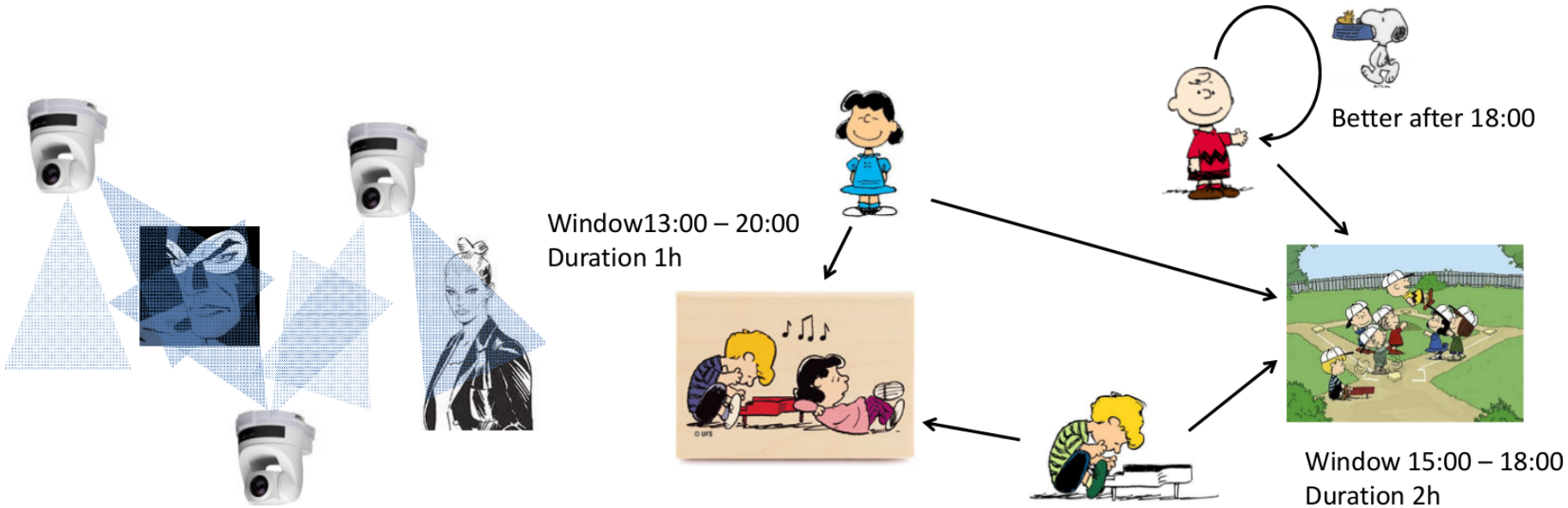
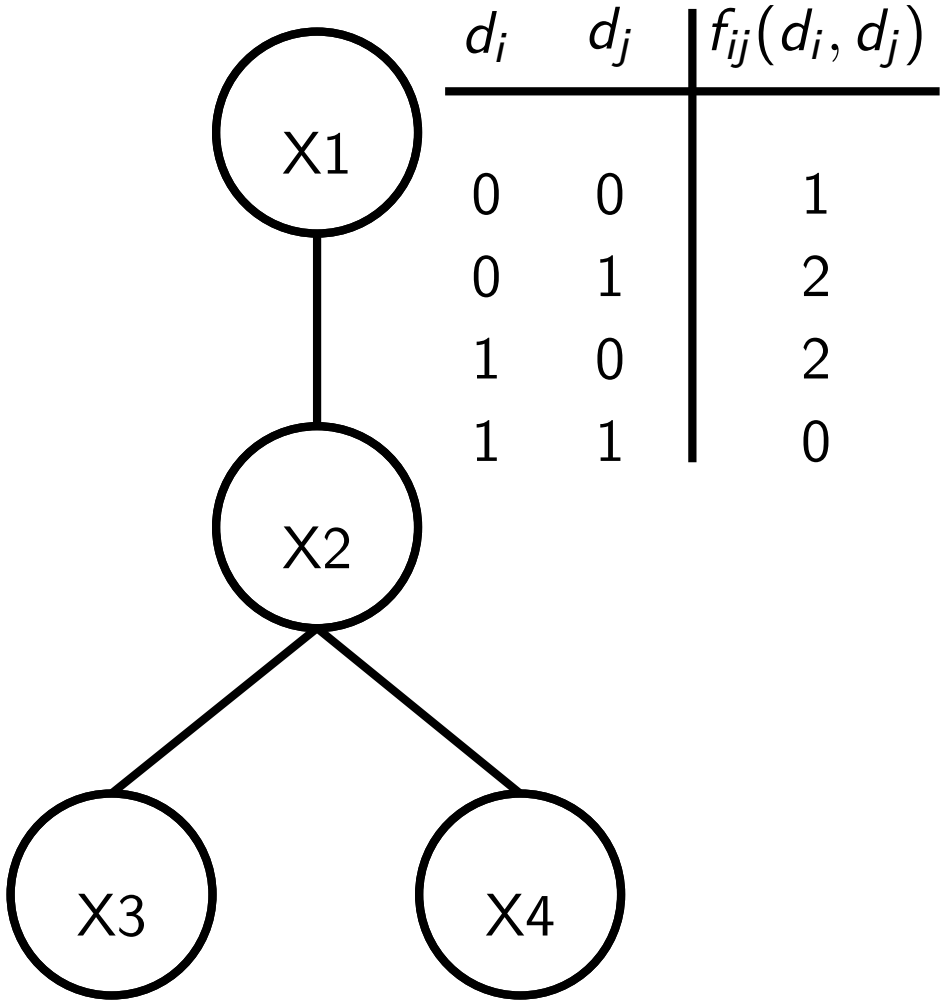


FIGURE : distributed coordination problems

Distributed Constraint Optimization Problems

Example of DCOP

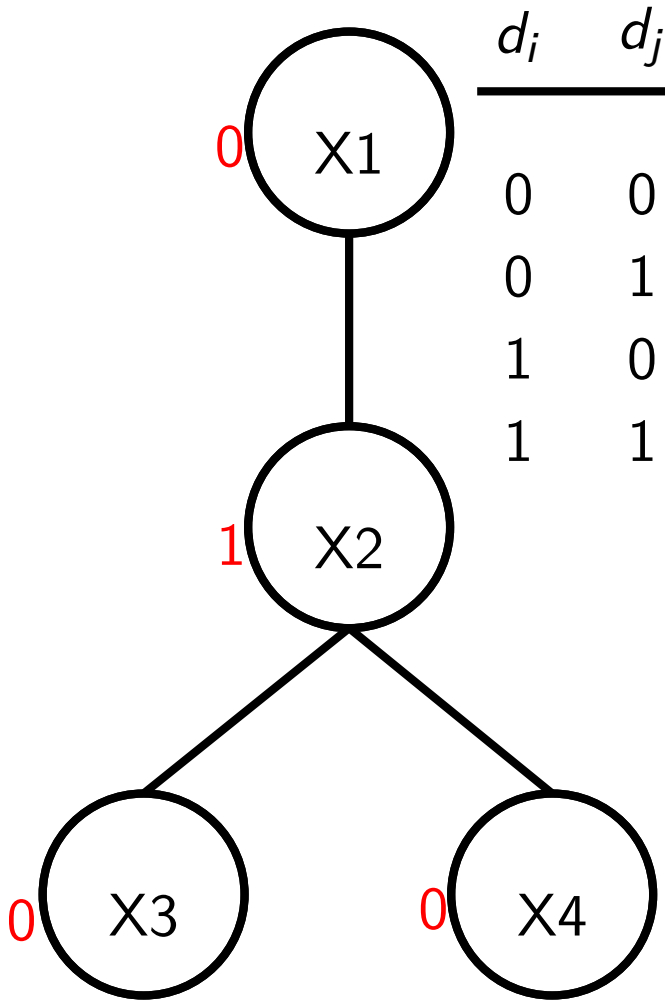


d_i	d_j	$f_{ij}(d_i, d_j)$
0	0	1
0	1	2
1	0	2
1	1	0

FIGURE : A mono-objective problem

Distributed Constraint Optimization Problems

Example of DCOP



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Distributed Constraint Optimization Problems

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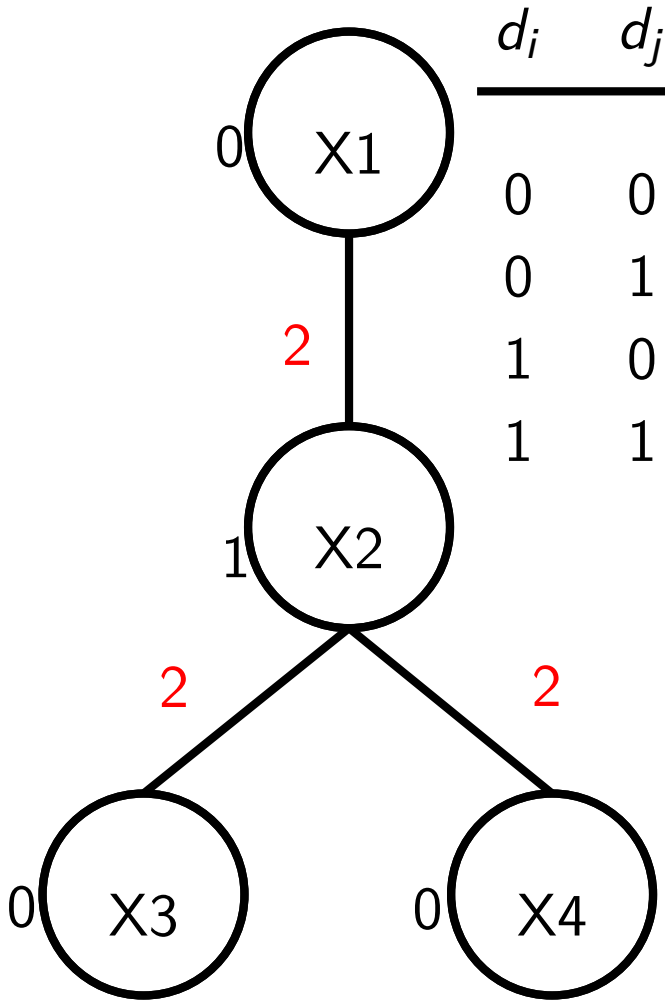

d_i	d_j	$f_{ij}(d_i, d_j)$
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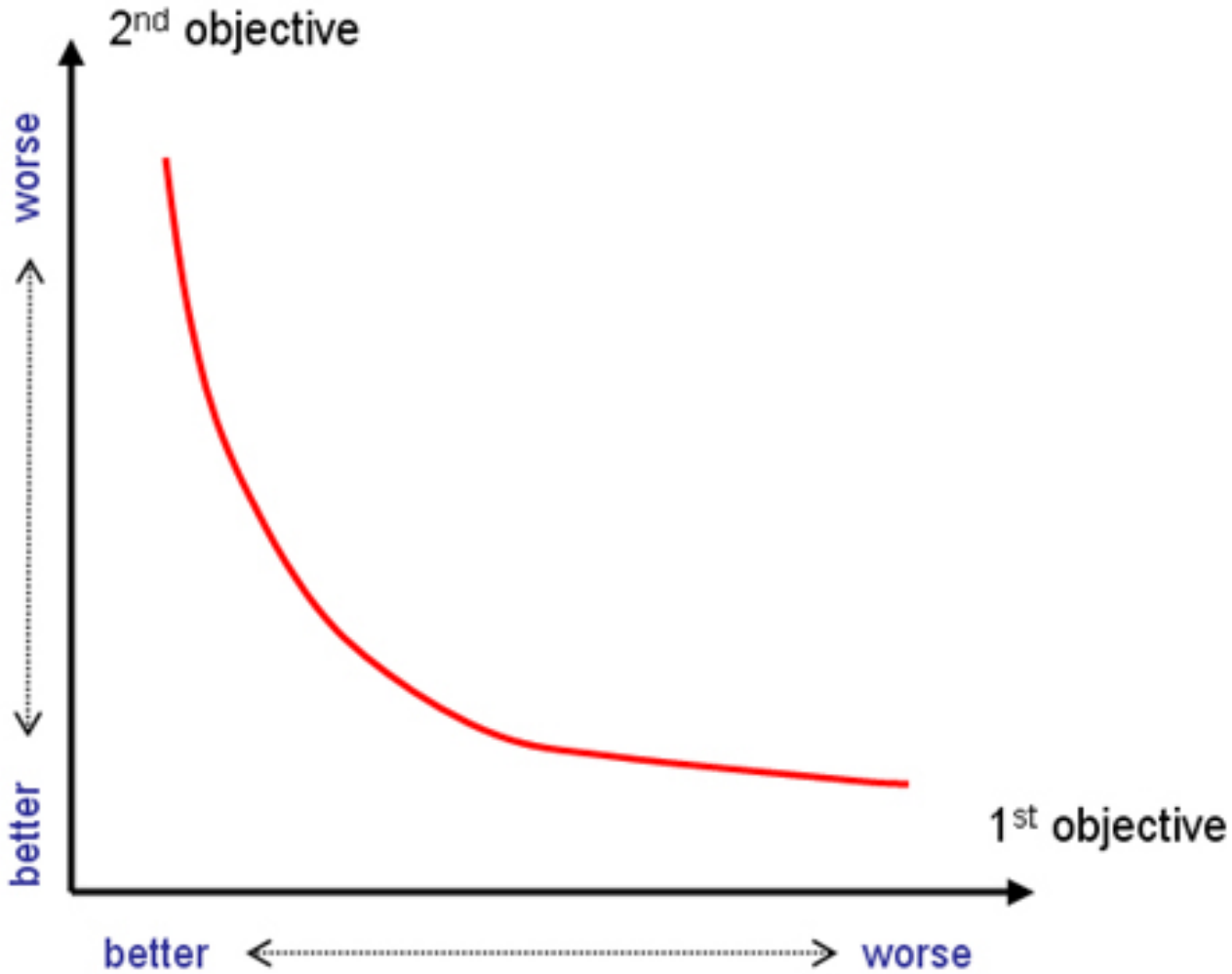
FIGURE : A mono-objective problem

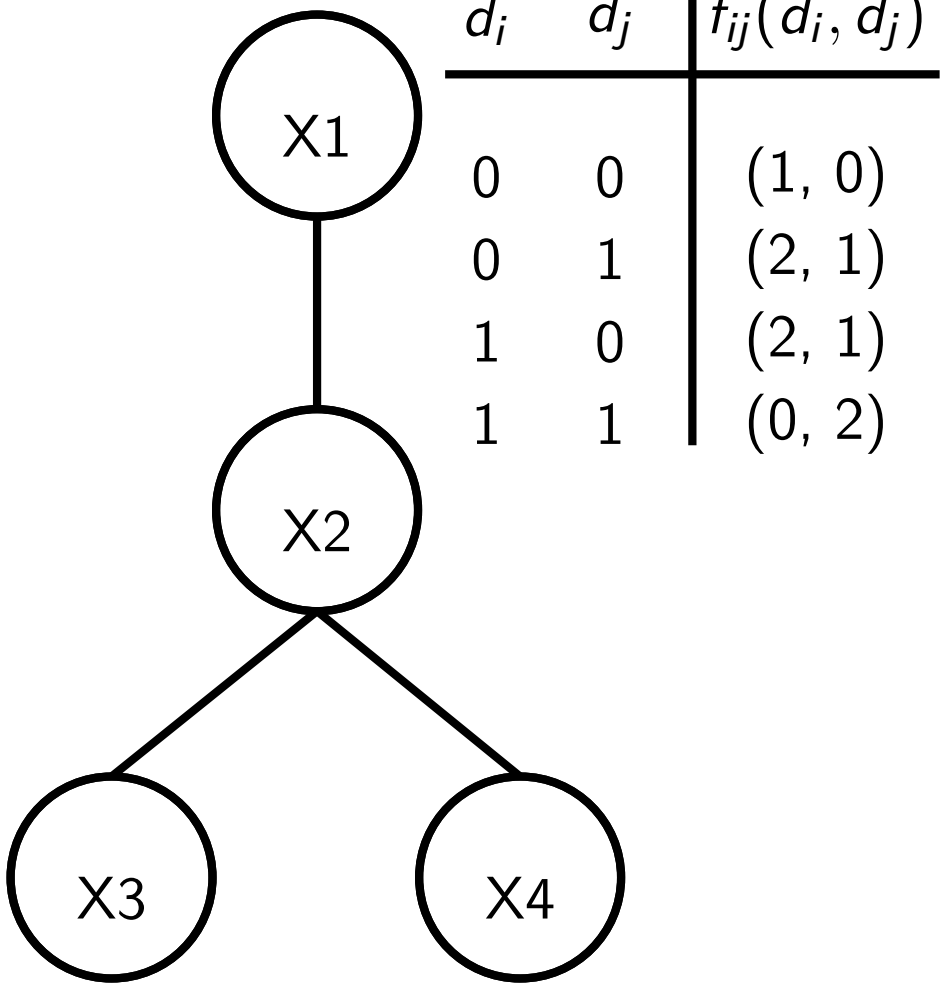
Multi-objective case

Several objectives to consider separately but to optimize simultaneously.



Multi-Objective DCOP

Example of MODCOP



d_i	d_j	$f_{ij}(d_i, d_j)$
0	0	(1, 0)
0	1	(2, 1)
1	0	(2, 1)
1	1	(0, 2)

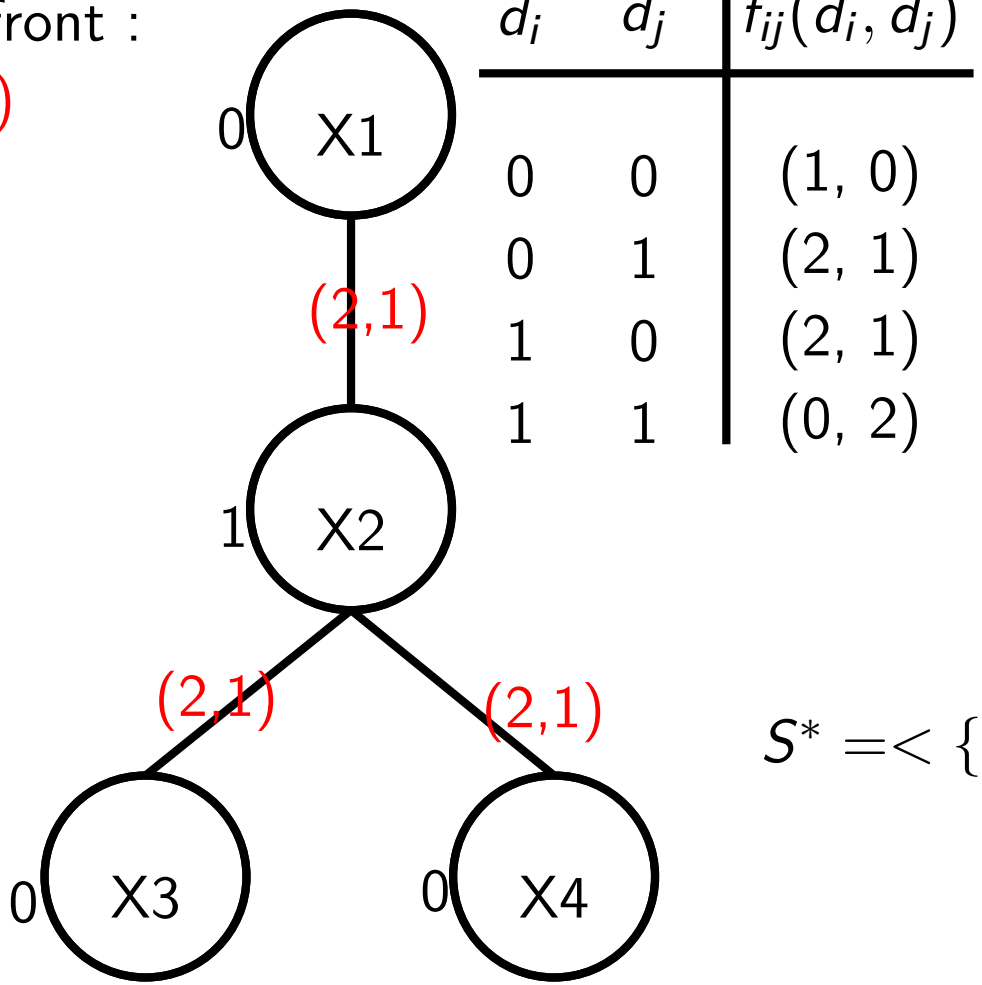
FIGURE : A multi-objective problem

Multi-Objective DCOP

Example of MODCOP

Pareto front :

(6,3)



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$S^* =< \{0, 1, 0, 0\} >$

FIGURE : A multi-objective problem

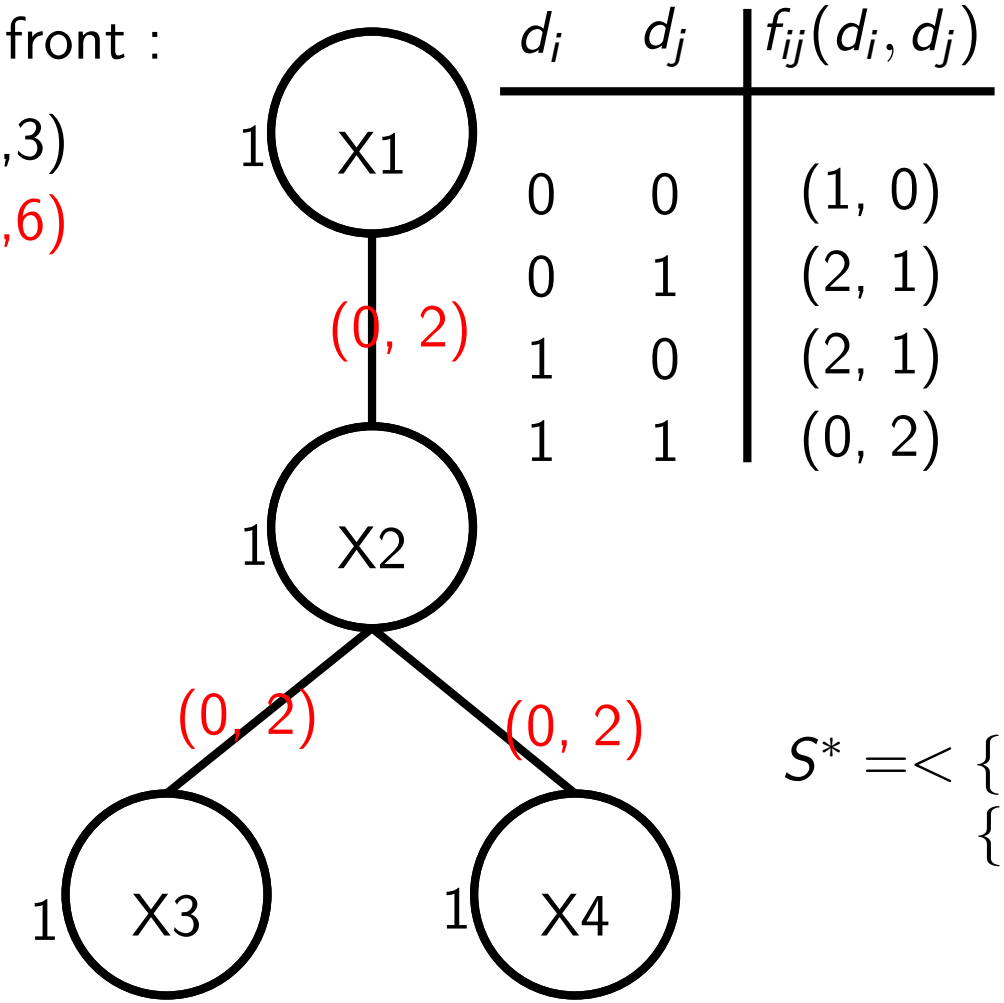
Multi-Objective DCOP

Example of MODCOP

Pareto front :

(6,3)

(0,6)



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1	1	(0, 2)

$$S^* =< \{0,1,0,0\}, \{1,1,1,1\} >$$

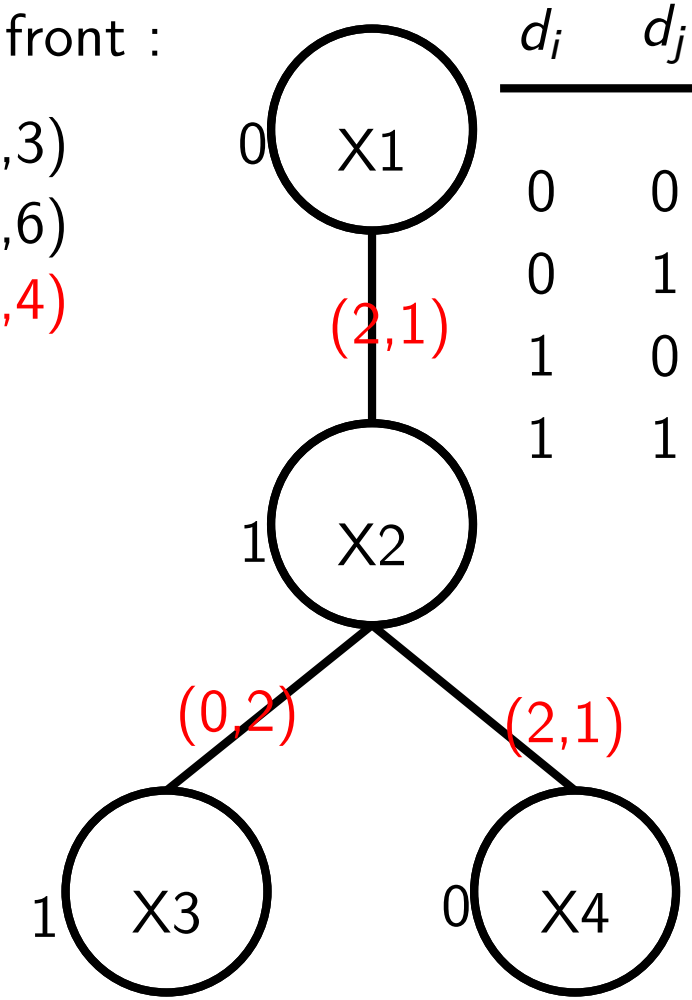
FIGURE : A multi-objective problem

Multi-Objective DCOP

Example of MODCOP

Pareto front :

(6,3)
(0,6)
(4,4)



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1	1	(0, 2)

$$S^* =< \{0,1,0,0\}, \{1,1,1,1\}, \{0,1,1,0\} >$$

FIGURE : A multi-objective problem

Dynamic problems

Many real-life problems are *dynamic*, they change at runtime.

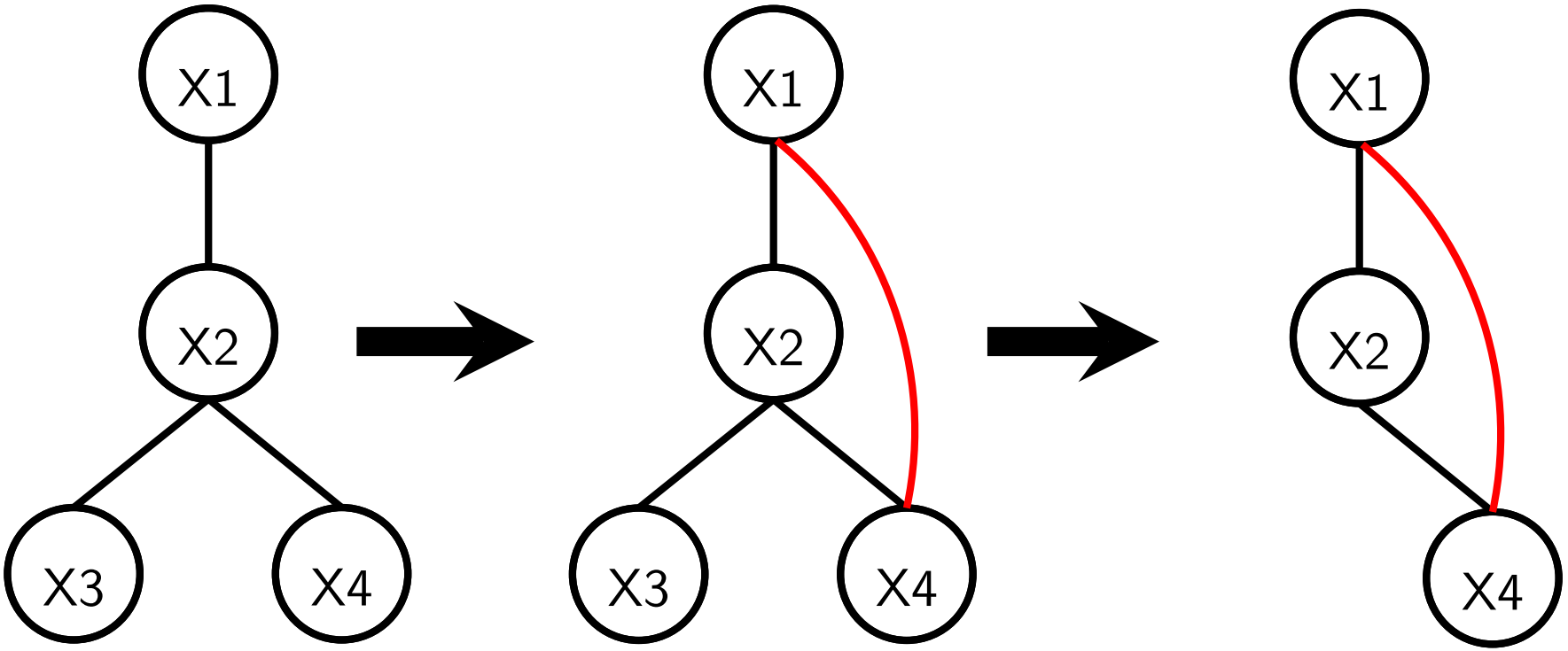

FIGURE : Dynamic DCOP

Applications

DCOP :

- Multi-agent coordination.
- Sensor networks.
- Meeting scheduling.

MO-DCOP :

- Cybersecurity (privacy, cost, security).

Dynamic DCOP :

- Dynamic environment.

Dynamic MO-DCOP

Short paper at PRIMA 2013.

- Only the number of objectives changes.
- A problem in the sequence is known only once the previous one is solved (Reactive approach).
- Complete algorithm.

Focusing on a change of objectives still make the problem hard to solve.

Dynamic MO-DCOP

Submitted to ECAI 2014.

- Everything can change.
- Reactive approach.
- Consider decision change cost.
- Adjustable parameter to limit the new cost.
- Approximation algorithm.

The new cost can be used to implement heuristics to find good solutions in a reduced runtime.

Approximation Algorithms for MO-DCOP

The state of the art approximation algorithm :

- The Bounded Multi-Objective Max-Sum Algorithm (**B-MOMS**).
- Find a solution with a guarantee on its quality.
- Good quality for low density graphs.

A complete MO-DCOP algorithm :

- The Two Phase algorithm (Medi and al, JAWS 2013).
- **First phase** uses local search to compute initial bounds on the solutions.

The goal is to show that **First phase** is faster and gives better solutions than **B-MOMS**.

Dynamic-DCOP

- Uses Dynamic Programming.
- Compile changes that occurred to compute the new optimal solution.
- Should be very efficient for small changes.

Can be used to design an approximation algorithm whose quality increases overtime until reaching exactness.

Merci !

I hope to be back soon.