Past 1.8 year (NII version)

Tenda Okimoto

My history

- **Mar.2012 :** PhD in Kyushu University
- **01. Aug. 2012 - 31.Mar.2014 :** I work as an assistant professor in NII/TRIC.
- **01. Apr. 2014 - :** I will work as an associate professor in Kobe University.

You are always welcome!

Social activities

(2012-2014)

- **International conference**

1. ECAI'14 : PC member
2. AAAI'14 : Subreviewer
3. OPTMAS-DCR'14 : PC member
4. AAMAS'14 : PC member
5. ICTAI'13 (SAT-CSP-Track) : PC member
6. IJCAI'12 : PC member

- **National conference**

7. JSAI'14-15 : PC member
8. JAWS'12- : PC member

Awards

(2012-2014)

1. 2013.12 : **Best Presentation Award**
   The 7th Multi-Disciplinary International Workshop on Artificial Intelligence.
2. 2013.9 : **Excellent Paper Award**
   The 12th Joint Agent Workshop and Symposium.
3. 2013.5 : **Challenges and Visions Papers Prize**
   The 12th International Conference on Autonomous Agents and Multi-Agent Systems.
4. 2012.10 : **IEEE Computer Society Japan Chapter JAWS Young Researcher Award**

Grant, Competitive Research Funds (2012-2014)

1. **2013 NII Grand Challenge, Co-Investigator**
   'Reasoning and Learning for dynamic constraint networks’
2. **2013.04-2014.03 : 1st Transdisciplinary Seeds Research, Principal Investigator**
   'Modeling and Algorithm for Cyber Security Problem based on Decentralised Multi-Dimentional Constraint Optimization’
3. **2012.04-2015.03 : Grants-in-Aid for Scientific Research (B), Co-Investigator**
   ‘CSPSAT2'
4. **2013 NII Collaborative Research Grants, Co-Investigator**
   'Research on dynamic constraint programming’
5. **2011.04-2014.03 : Grants-in-Aid for Scientific Research (B), Co-Investigator**
   'Distributed Green Computing’
6. **2012 Grants-in-Aid for Scientific Research (Start-up), Principal Investigator**
   'Algorithms for CSG based on (distributed) constraint optimisation problem’
7. **2012 NII Collaborative Research Grants, Co-Investigato**r
   'Research on Consequence Finding and SAT/MaxSAT in distributed environment’
8. **2012 NII Grand Challenge, Co-Investigator**
   'Feasibility study for dynamic constraint networks'

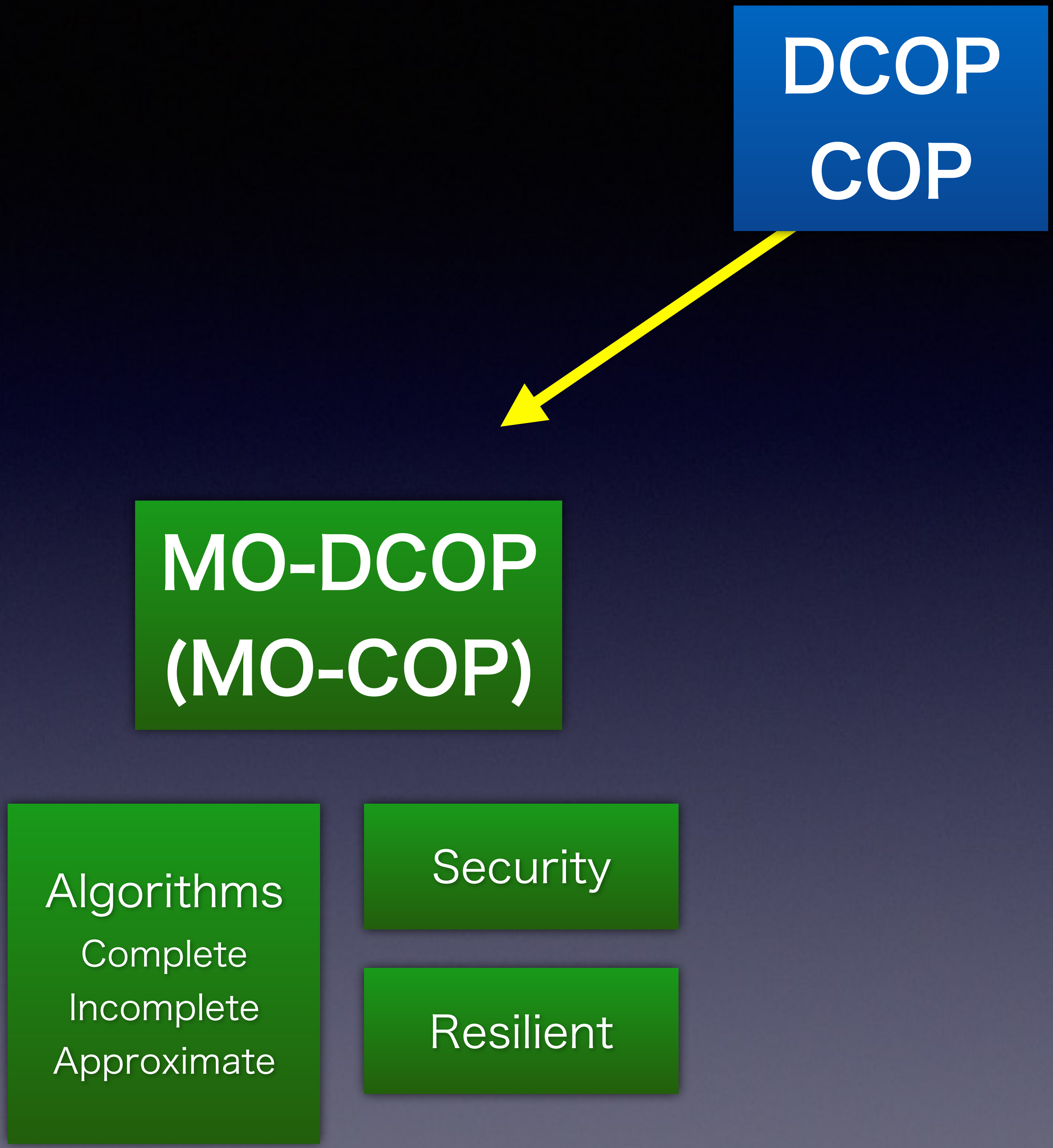
Publications

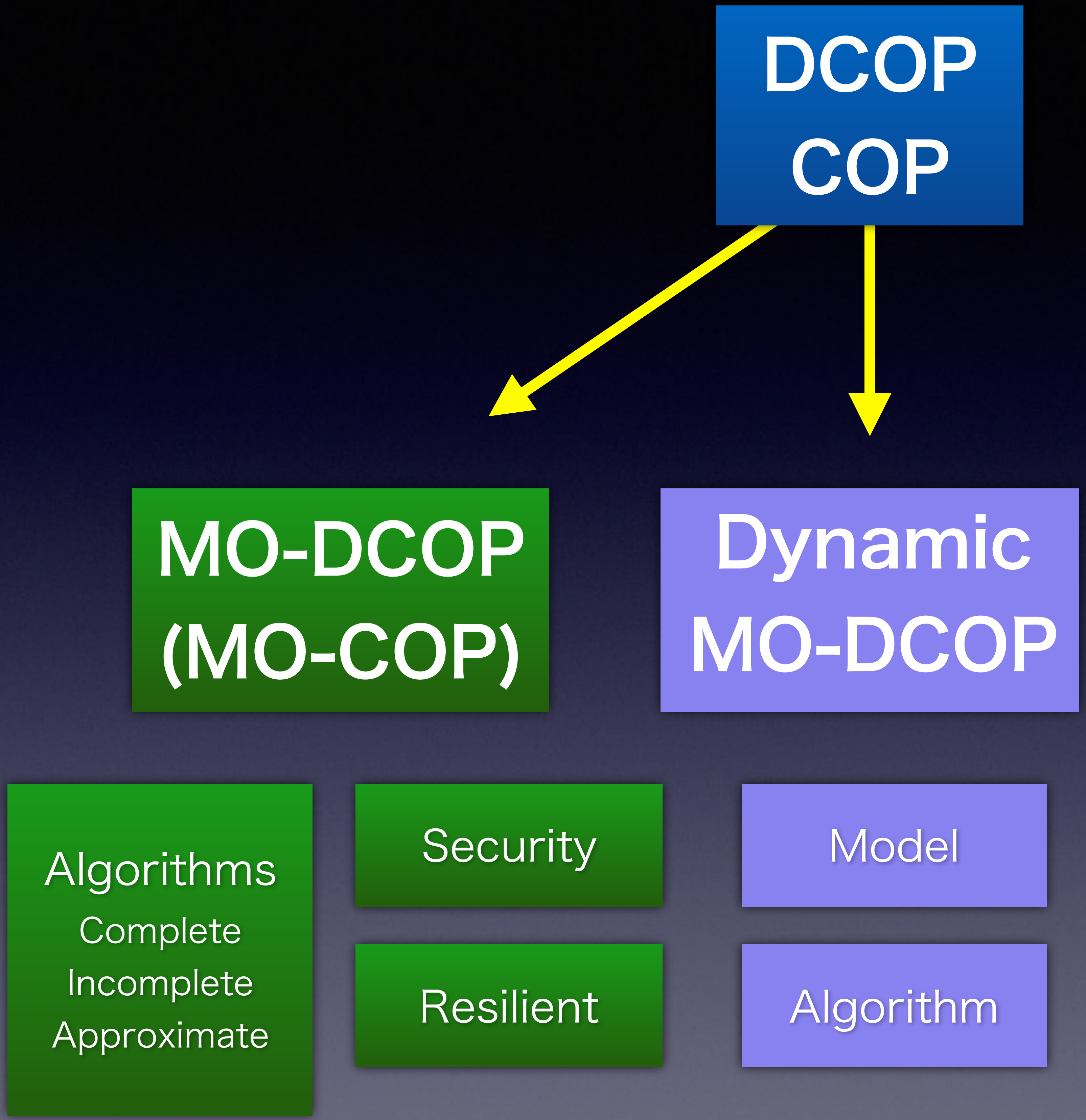
(2012-2014)

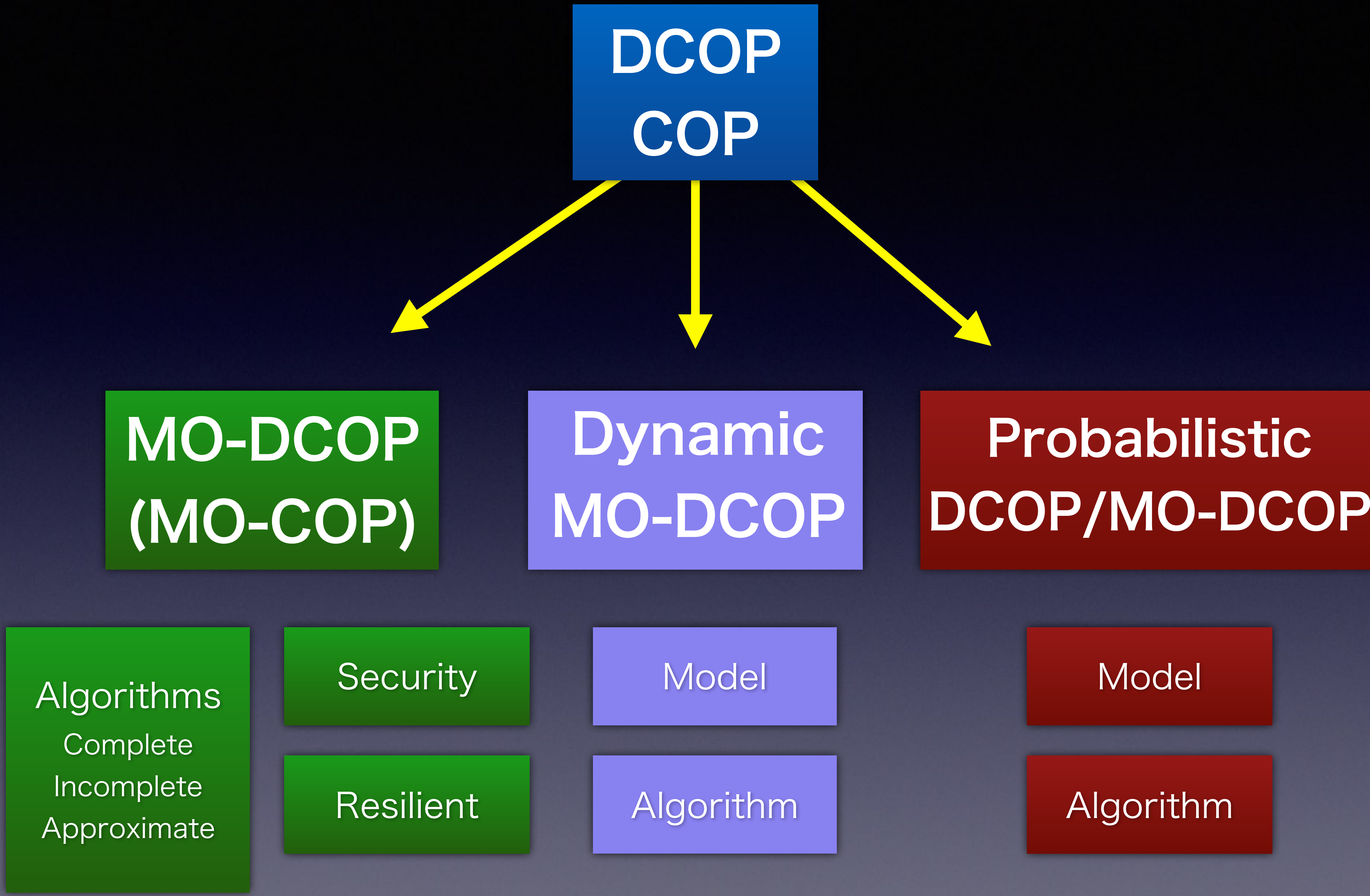
- Journals : 4 papers + 1
- International conferences/workshops : 13 papers
- National conferences : 11 papers
- Others (Business trips):
  - Overseas: 4 meetings
  - Domestic : 7 meetings

What I did ?

DCOP
COP


DCOP
COP
MO-DCOP
(MO-COP)
Algorithms
Complete
Incomplete
Approximate
Security
Resilient


DCOP
COP
MO-DCOP
(MO-COP)
Dynamic
MO-DCOP
Algorithms
Complete
Incomplete
Approximate
Security
Resilient
Model
Algorithm


DCOP
COP
MO-DCOP
(MO-COP)
Dynamic
MO-DCOP
Probabilistic
DCOP/MO-DCOP
Algorithms
Complete
Incomplete
Approximate
Security
Resilient
Model
Algorithm
Model
Algorithm

MO-COP/MO-DCOP (2012-2014)

Complete Algorithm

1. Decision Change Costs in Dynamic MO-DCOP (ECAI'2014)
2. Modeling and Algorithm for Dynamic Multi-Objective Weighted Constraint Satisfaction Problem. (ICAART'14)
3. Modeling and Algorithm for Dynamic Multi-Objective Distributed Optimization. (PRIMA'13)
4. Cyber Security Problem based on Multi-Objective Distributed Constraint Optimization Technique. (WSR'13)
5. A Two-phase Complete Algorithm for Multi-objective Distributed Constraint Optimization. (JACIII'13)

MO-COP/MO-DCOP (2012-2014)

Incomplete Algorithm

1. Utilitarian and Egalitarian Solutions for Multi-Objective Constraint Optimization. (AAAI'14)
2. Lp-norm Based Algorithm for Multi-Objective Distributed Constraint Optimization (AAMAS'14)
3. AOF-technique based algorithm for Dynamic Multi-Objective Distributed Constraint Optimization. (MIWAI'13)

MO-COP/MO-DCOP (2012-2014)

Approximate Algorithm

1. A Two-phase Complete Algorithm for Multi-objective Distributed Constraint Optimization. (JACIII'13)

Ongoing
(2014 -)

1. **Local Search Based Incomplete Algorithm for MO-DCOPs** (Maxime Wack, Maxime Clement, Tenda Okimoto, Katsumi Inoue)

2. **Dynamic DCOP** (Maxime Clement, Tenda Okimoto, Katsumi Inoue)

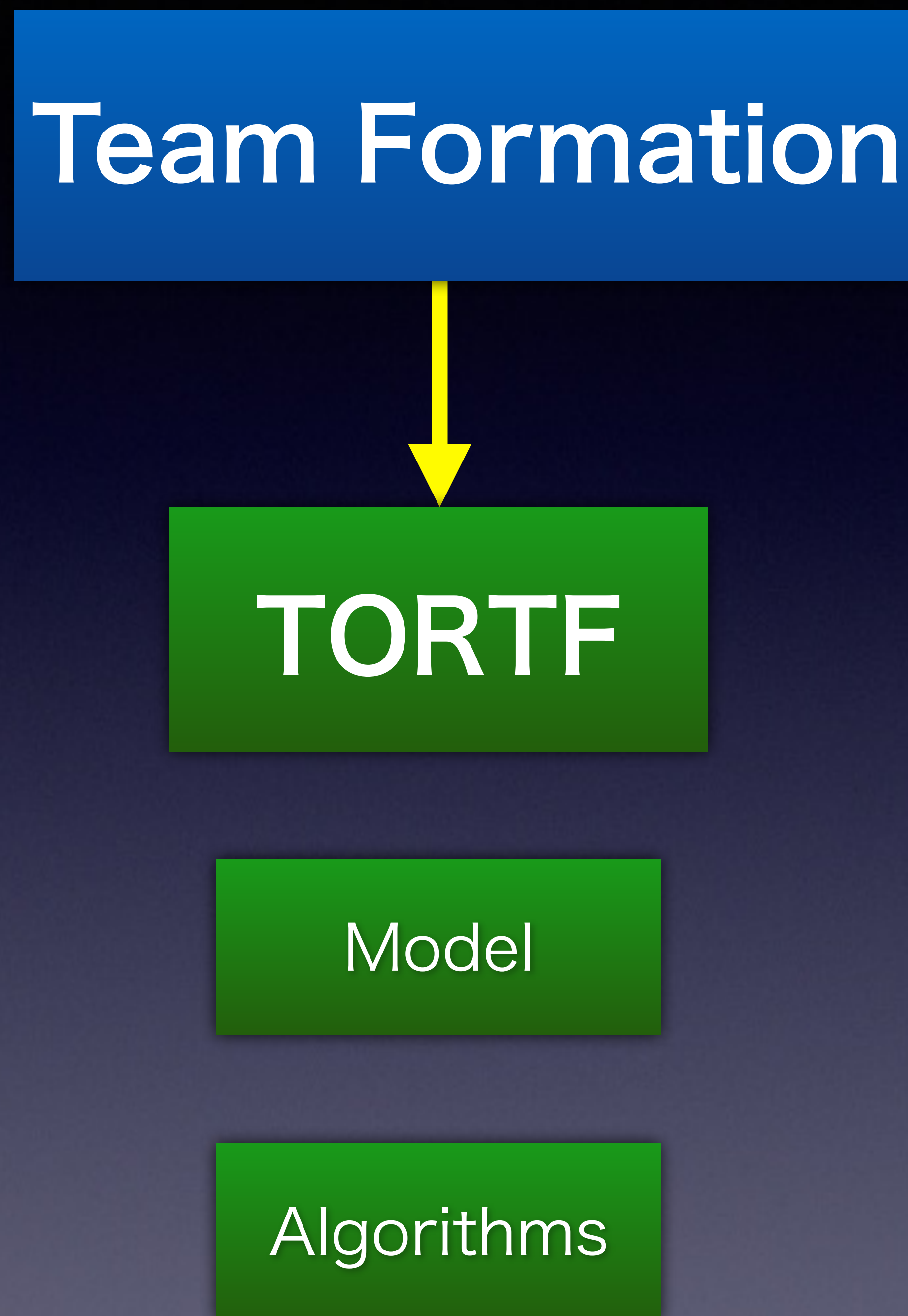
3. **Prob. DCOP/MO-COP** (Damien Bouchabou, Maxime Clement, Tenda Okimoto, Katsumi Inoue)

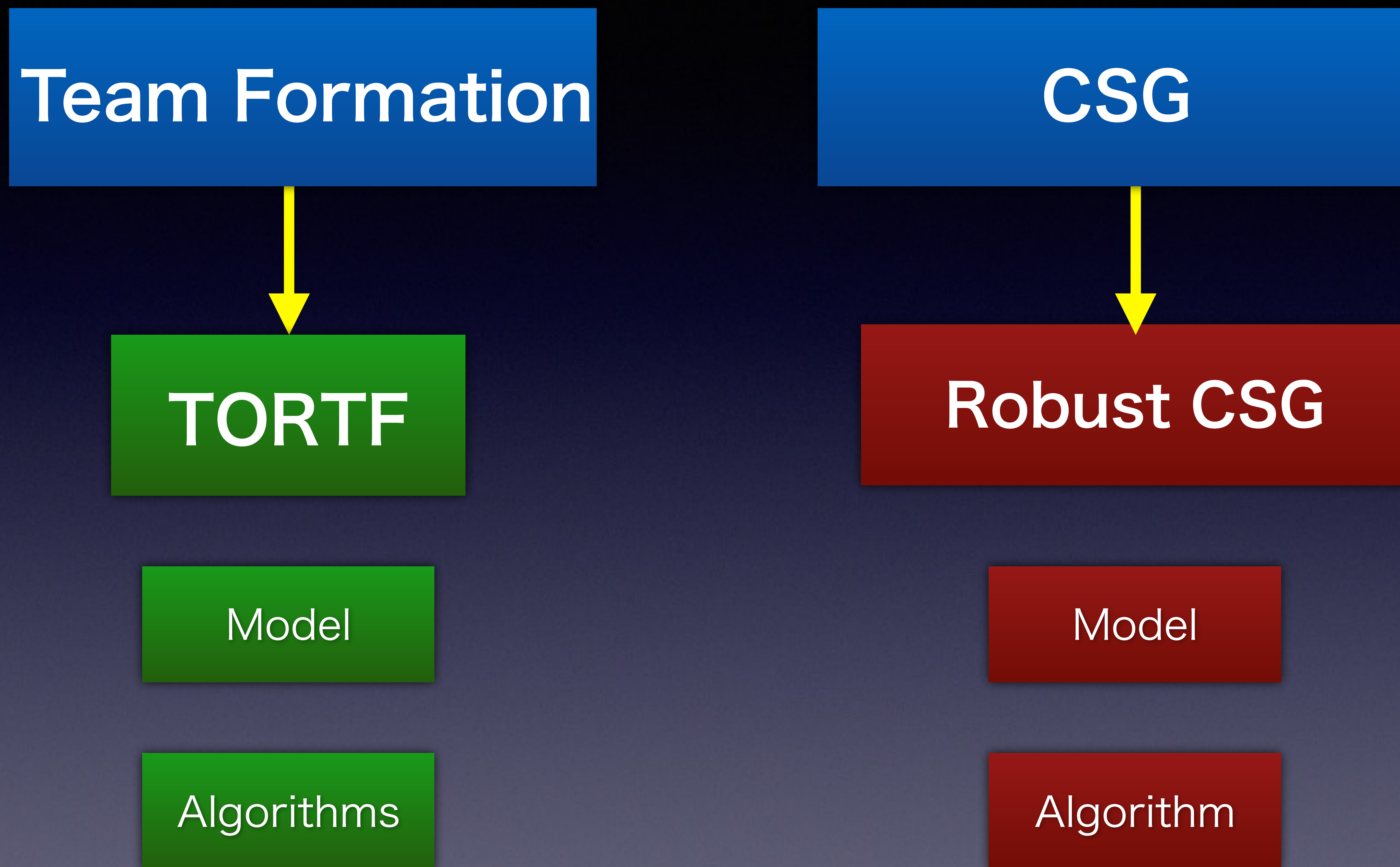
What else ?

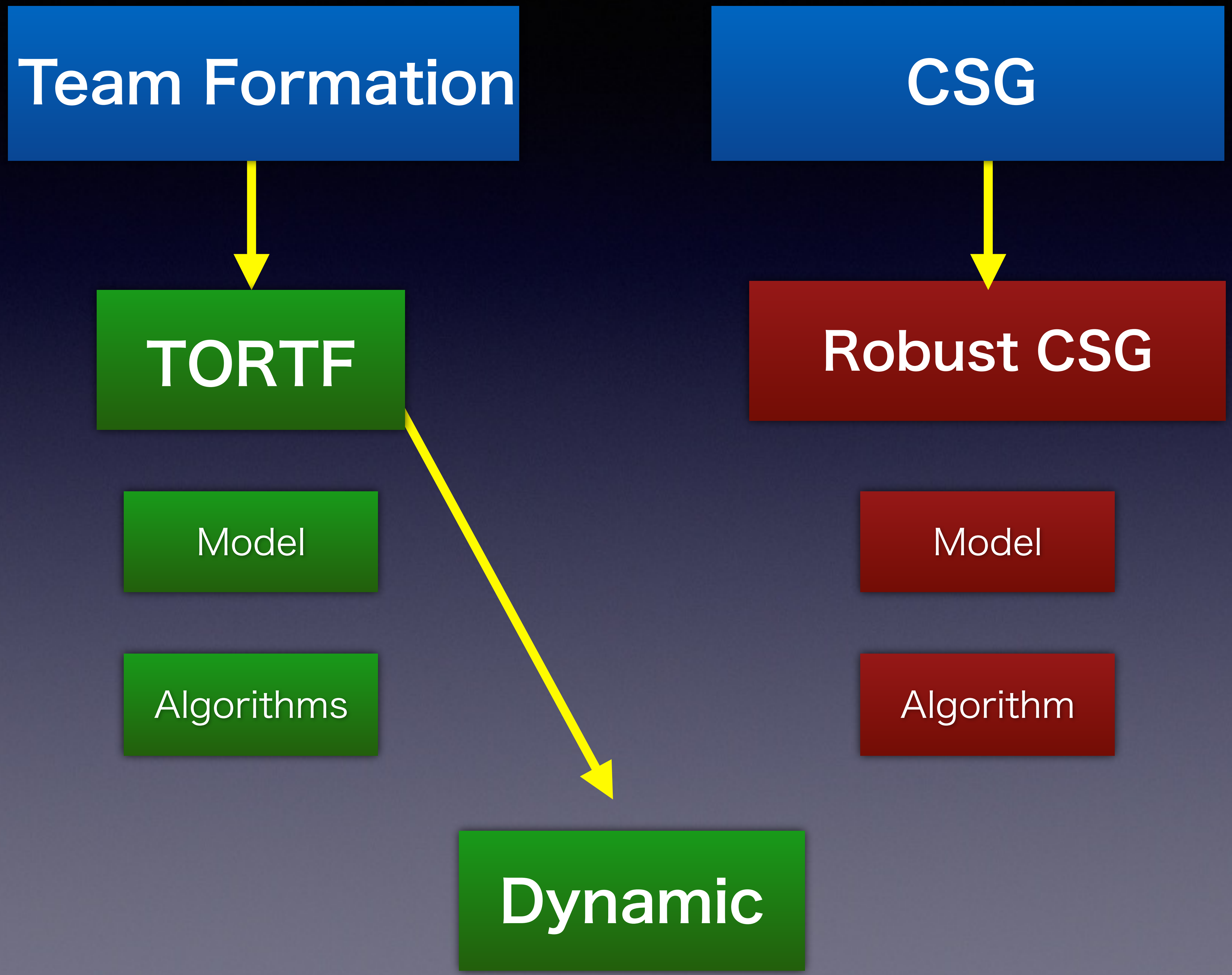
Cooperate Game Theory

(2014)

1. Task-Oriented Robust Team Formation Problem (AAAI'2014)


Team Formation
TORTF
Model
Algorithms


Team Formation
CSG
TORTF
Robust CSG
Model
Model
Algorithms
Algorithm


Team Formation
CSG
TORTF
Robust CSG
Model
Algorithms
Model
Algorithm
Dynamic

Adaptable Team Formation Problem

Tenda Okimoto (✡,✣), Nicolas Schwind (✣,✶), Maxime Clement (✶), Tony Ribeiro (❊), Katsumi Inoue (✶), Pierre Marquis (♦)

✡ Kobe University,
✣ Transdisciplinary Research Integration Center,
✶ National Institute of Informatics
❊ The Graduate University for Advanced Studies,
♦ CRIL-CNRS/Université d'Artois

Team Formation

(Example)

- Given : a set of agents, $G = \{p_1, p_2, p_3, p_4, p_5\}$, $c = 8$.
- Goal : find a team that can achieve the goal and that the cost is less than c.

$\{p_1, p_2\}$
$c=4$

$\{p_1, p_3\}$
$c=3$

$\{p_1, p_2, p_3\}$
$c=5$

$\{p_3, p_4\}$
$c=2$

$\{p_1, p_2, p_4, p_5\}$
$c=9$

$\{p_5\}$
$c=1$

Team Formation

(Example)

- Given : a set of agents, $G = \{p_1, p_2, p_3, p_4, p_5\}$, $c = 8$.
- Goal : find a team that can achieve the goal and that the cost is less than c.

$\{p_1, p_2\}$

$c=4$

$\{p_1, p_3\}$

$c=3$

$\{p_1, p_2, p_3\}$

$c=5$

$\{p_3, p_4\}$

$c=2$

$\{p_1, p_2, p_4, p_5\}$

$c=9$

$\{p_5\}$

$c=1$

Team Formation (Formalization)

A team formation problem is a tuple TF = <A, P, f, $\boldsymbol{\alpha}$> where $A = \{a_1, a_2, \cdots, a_n\}$ is a set of agents, $P = \{p_1, p_2, \cdots, p_m\}$ is a set of tasks, $f : 2^A \rightarrow \mathbb{N}$ is a cost function, $\boldsymbol{\alpha}$ is a mapping from A to 2^P. Both of f and $\boldsymbol{\alpha}$ are supposed to be computed in polynomial time. A set of $T \subseteq A$ is called a **team**, and a set of $G \subseteq P$ is called a **goal**.

Example

(Team affordability)

- Given : a set of agents, $G = \{p_1, p_2, p_3, p_4, p_5\}$, $c = 8$.

Given a team $T \subseteq A$ and a non-negative integer c, T is said to be c-costly, if the cost of T is less than c : $f(T) \leq c$.

$\{p_1, p_2\}$

$c=4$

$\{p_1, p_3\}$

$c=3$

$\{p_1, p_2, p_3\}$

$c=5$

$\{p_3, p_4\}$

$c=2$

$\{p_1, p_2, p_4, p_5\}$

$c=9$

$\{p_5\}$

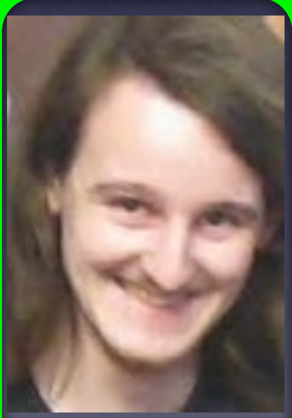
$c=1$

Example

(Team efficiency)

- Given : a set of agents, $G = \{p_1, p_2, p_3, p_4, p_5\}$, $c = 8$.

Given a team $T \subseteq A$ and a goal $G \subseteq P$, T is said to be efficient w.r.t. G, if T can accomplish G : $G \subseteq \bigcup_{a_i \in T} \boldsymbol{\alpha}(a_i)$.



$\{p_1, p_2\}$
$c=4$

$\{p_1, p_3\}$
$c=3$

$\{p_1, p_2, p_3\}$
$c=5$

$\{p_3, p_4\}$
$c=2$

$\{p_1, p_2, p_4, p_5\}$
$c=9$

$\{p_5\}$
$c=1$

Task-Oriented Robust Team Formation
(Robustness)

Team robustness

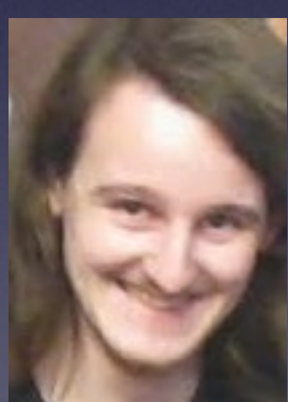
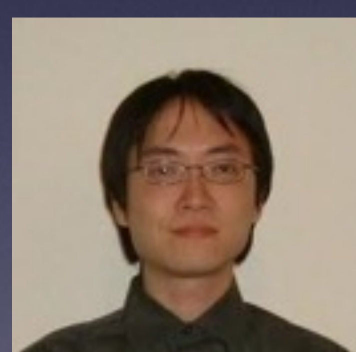
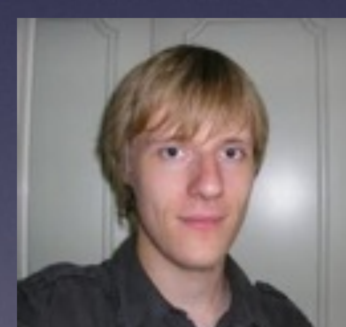
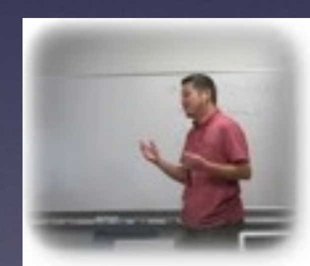
Let $TF = \langle A, P, f, \boldsymbol{\alpha} \rangle$ be a team formation. Given a team $T \subseteq A$, a goal $G \subseteq P$ and a non-negative integer k, T is said to be k-robust w.r.t. G if for every set of agents $T' \subseteq T$, such that $|T'| \leq k$, the team $T \setminus T'$ is efficient w.r.t. G.

Example

(TORTF)

- Given : TF = <A={a_1,a_2,a_3,a_4,a_5,a_6}, P={p_1,p_2,p_3,p_4,p_5}, f, α>, G={p_1,p_3}, c = 8, k=1.

Question : Is there exist a team T ⊆ A such that T is 8-costly and 1-robust w.r.t. G ?

{p_1,p_2}	{p_1,p_3}	{p_1,p_2,p_3}	{p_3,p_4}	{p_1,p_2,p_4,p_5}	{p_5}
c=4	c=3	c=5	c=2	c=9	c=1

Example

(TORTF)

- Given : TF = <A={a_1,a_2,a_3,a_4,a_5,a_6}, P={p_1,p_2,p_3,p_4,p_5}, f, α>, G={p_1,p_3}, c = 8, k=1.

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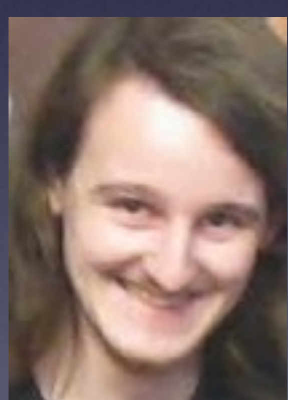
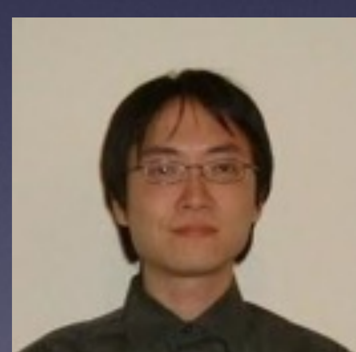
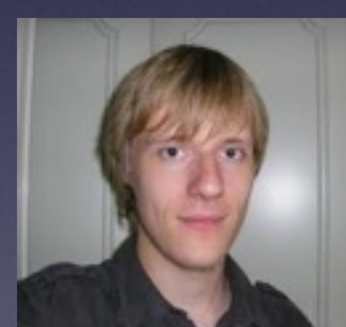


{p_1,p_2}
c=4



{p_1,p_3}
c=3



{p_1,p_2,p_3}
c=5

{p_3,p_4}
c=2

{p_1,p_2,p_4,p_5}
c=9

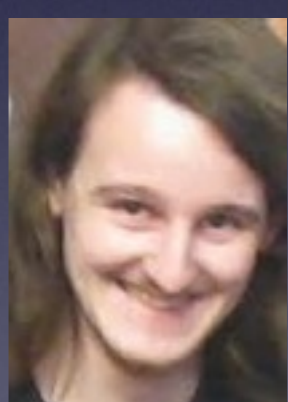
{p_5}
c=1

Example

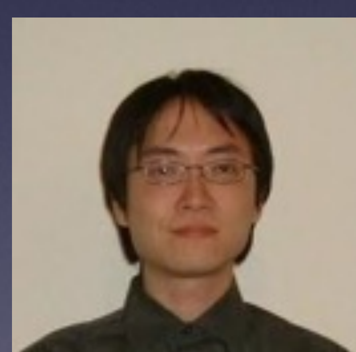
(TORTF)

- Given : TF = <A={a_1,a_2,a_3,a_4,a_5,a_6}, P={p_1,p_2,p_3,p_4,p_5}, f, $\boldsymbol{\alpha}$>, G={p_1,p_3}, c = 8, k=1.

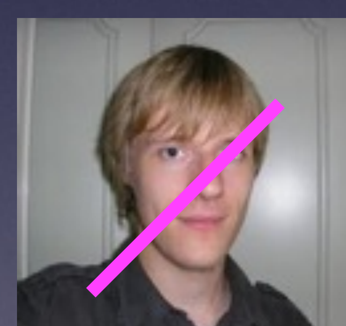
Question : Is there exist a team T ⊆ A such that T is 8-costly and 1-robust w.r.t. G ?



{p_1,p_2}
c=4



{p_1,p_3}
c=3



{p_1,p_2,p_3}
c=5

{p_3,p_4}
c=2

{p_1,p_2,p_4,p_5}
c=9

{p_5}
c=1

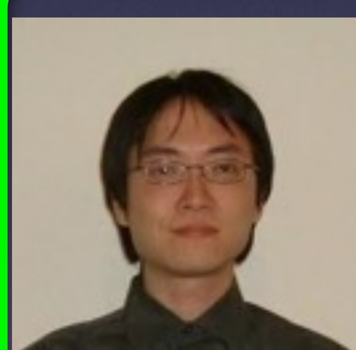
Example

(TORTF)

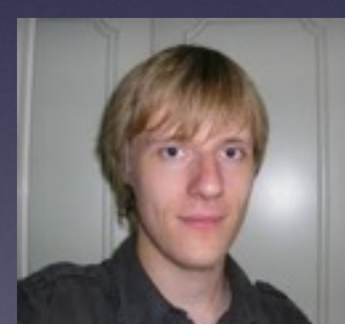
- Given : TF = $<A=\{a_1,a_2,a_3,a_4,a_5,a_6\}, P=\{p_1,p_2,p_3,p_4,p_5\}, f, \boldsymbol{\alpha}>$, $G=\{p_1,p_3\}$, $c = 8$, $k=1$.

Question : Is there exist a team $T \subseteq A$ such that T is 8-costly and 1-robust w.r.t. G ? -> **YES!**

$\{p_1,p_2\}$
$c=4$



$\{p_1,p_3\}$
$c=3$



$\{p_1,p_2,p_3\}$
$c=5$

$\{p_3,p_4\}$
$c=2$

$\{p_1,p_2,p_4,p_5\}$
$c=9$

$\{p_5\}$
$c=1$

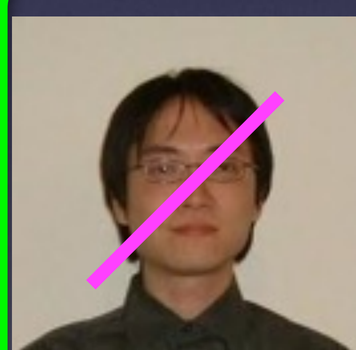
Example

(TORTF)

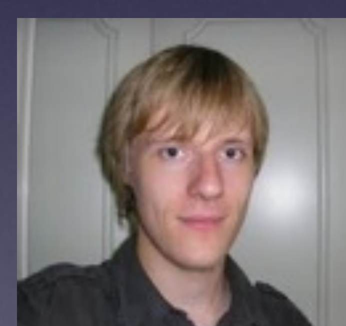
- Given : TF = $\langle A=\{a_1,a_2,a_3,a_4,a_5,a_6\}, P=\{p_1,p_2,p_3,p_4,p_5\}, f, \boldsymbol{\alpha}\rangle$, $G=\{p_1,p_3\}$, $c = 8$, $k=1$.

Question : Is there exist a team $T \subseteq A$ such that T is 8-costly and 1-robust w.r.t. G ? -> **YES!**

$\{p_1,p_2\}$
$c=4$



$\{p_1,p_3\}$
$c=3$



$\{p_1,p_2,p_3\}$
$c=5$

$\{p_3,p_4\}$
$c=2$

$\{p_1,p_2,p_4,p_5\}$
$c=9$

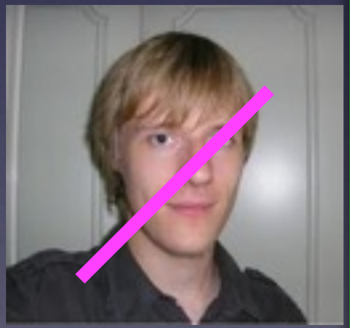
$\{p_5\}$
$c=1$

Example

(TORTF)

- Given : TF = $\langle A=\{a_1,a_2,a_3,a_4,a_5,a_6\}, P=\{p_1,p_2,p_3,p_4,p_5\}, f, \boldsymbol{\alpha}\rangle$, $G=\{p_1,p_3\}$, $c = 8$, $k=1$.

Question : Is there exist a team $T \subseteq A$ such that T is 8-costly and 1-robust w.r.t. G ? -> **YES!**

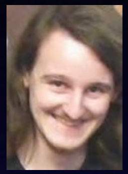


$\{p_1,p_2\}$	$\{p_1,p_3\}$	$\{p_1,p_2,p_3\}$	$\{p_3,p_4\}$	$\{p_1,p_2,p_4,p_5\}$	$\{p_5\}$
c=4	c=3	c=5	c=2	c=9	c=1

Extension!

Team Formation

(Example)



{p3}
c=1

{p1,p2}
c=1

{p1,p4}
c=1

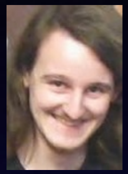
{p2,p3}
c=1

{p2,p3,p4,p5}
c=3

{p5}
c=1

Team Formation

(Example)



{p3}
c=1

{p1,p2}
c=1

{p1,p4}
c=1

{p2,p3}
c=1

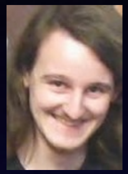
{p2,p3,p4,p5}
c=3

{p5}
c=1

$G = \{p_1, p_2, p_3\}$

Team Formation

(Example)



{p3}
c=1

{p1,p2}
c=1

{p1,p4}
c=1

{p2,p3}
c=1

{p2,p3,p4,p5}
c=3

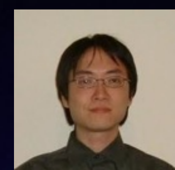
{p5}
c=1

$G = \{p_1, p_2, p_3\} \longrightarrow G = \{p_2, p_3, p_4\}$

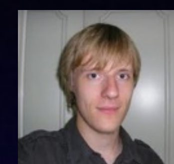
Team Formation

(Example)

{p3}
c=1



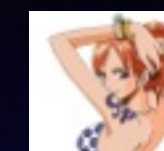
{p1,p2}
c=1



{p1,p4}
c=1

{p2,p3}
c=1

{p2,p3,p4,p5}
c=3

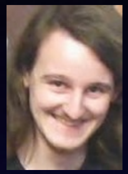


{p5}
c=1

$G = \{p_1, p_2, p_3\} \rightarrow G = \{p_2, p_3, p_4\} \rightarrow G = \{p_3, p_4, p_5\}$

Team Formation

(Example)



{p3}
c=1

{p1,p2}
c=1

{p1,p4}
c=1

{p2,p3}
c=1

{p2,p3,p4,p5}
c=3

{p5}
c=1

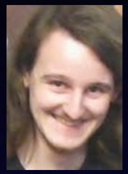
$G = \{p_1, p_2, p_3\} \longrightarrow G = \{p_2, p_3, p_4\} \longrightarrow G = \{p_3, p_4, p_5\}$

7-costly

1-robust

Team Formation

(Example)



{p3}
c=1

{p1,p2}
c=1

{p1,p4}
c=1

{p2,p3}
c=1

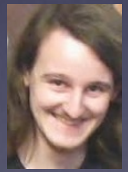
{p2,p3,p4,p5}
c=3

{p5}
c=1

$G = \{p_1, p_2, p_3\} \longrightarrow G = \{p_2, p_3, p_4\} \longrightarrow G = \{p_3, p_4, p_5\}$

7-costly

1-robust



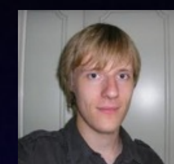


Team Formation

(Example)

{p3}
c=1

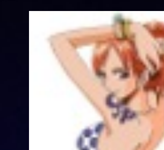
~~{p1,p2}~~
c=1



{p1,p4}
c=1

{p2,p3}
c=1

{p2,p3,p4,p5}
c=3

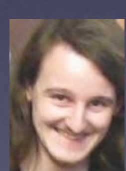
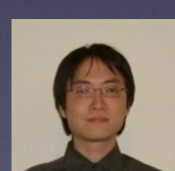


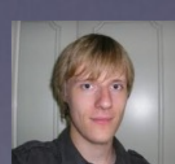
{p5}
c=1

$G = \{p_1, p_2, p_3\} \longrightarrow G = \{p_2, p_3, p_4\} \longrightarrow G = \{p_3, p_4, p_5\}$

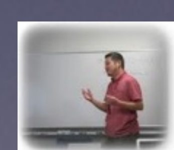
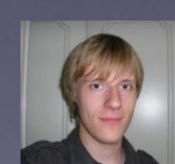
7-costly

1-robust






Team Formation

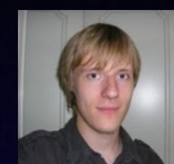
(Example)

{p3}

c=1

{~~p1~~,p2}

c=1



{p1,p4}

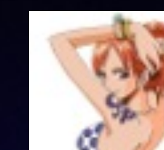
c=1

{p2,p3}

c=1

{p2,p3,p4,p5}

c=3



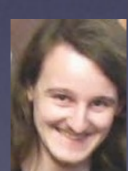
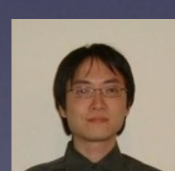
{p5}

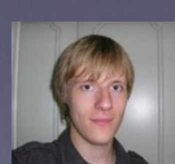
c=1

$G = \{p_1,p_2,p_3\}$ → $G = \{p_2,p_3,p_4\}$ → $G = \{p_3,p_4,p_5\}$

7-costly

1-robust

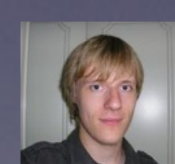






7-costly

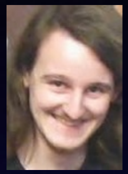
1-robust






Team Formation

(Example)



{p3}

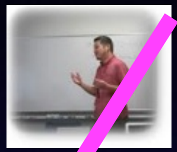
c=1

~~{p1,p2}~~

c=1

{p1,p4}

c=1



~~{p2,p3}~~

c=1

{p2,p3,p4,p5}

c=3

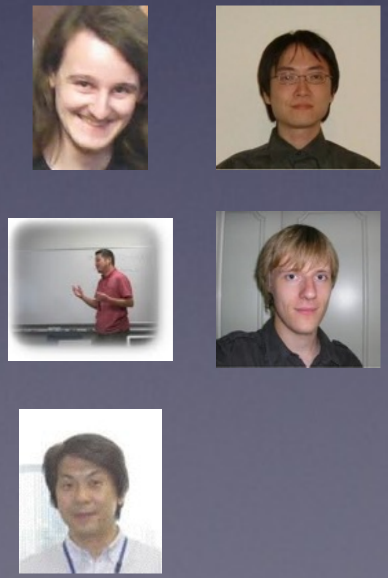
{p5}

c=1

$G = \{p_1, p_2, p_3\} \longrightarrow G = \{p_2, p_3, p_4\} \longrightarrow G = \{p_3, p_4, p_5\}$

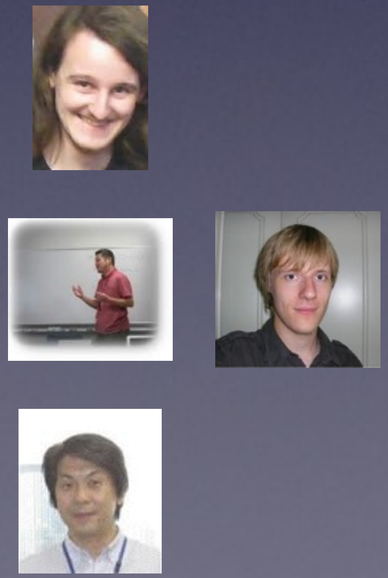
7-costly

1-robust



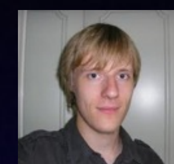
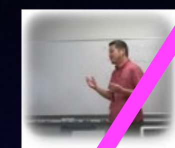
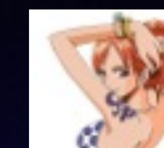
7-costly

1-robust

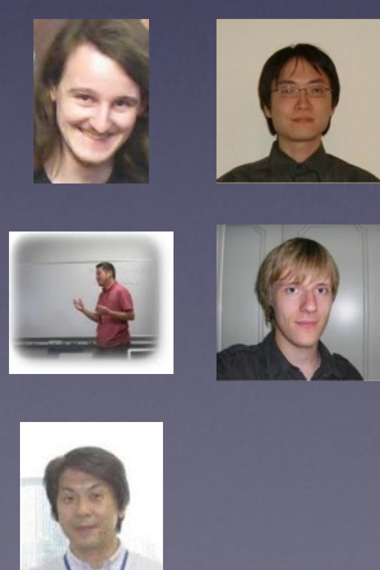
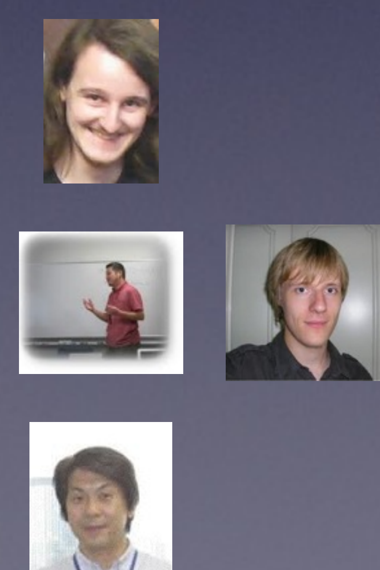
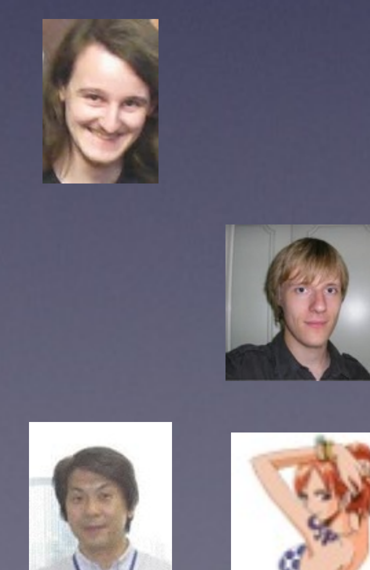


Team Formation

(Example)

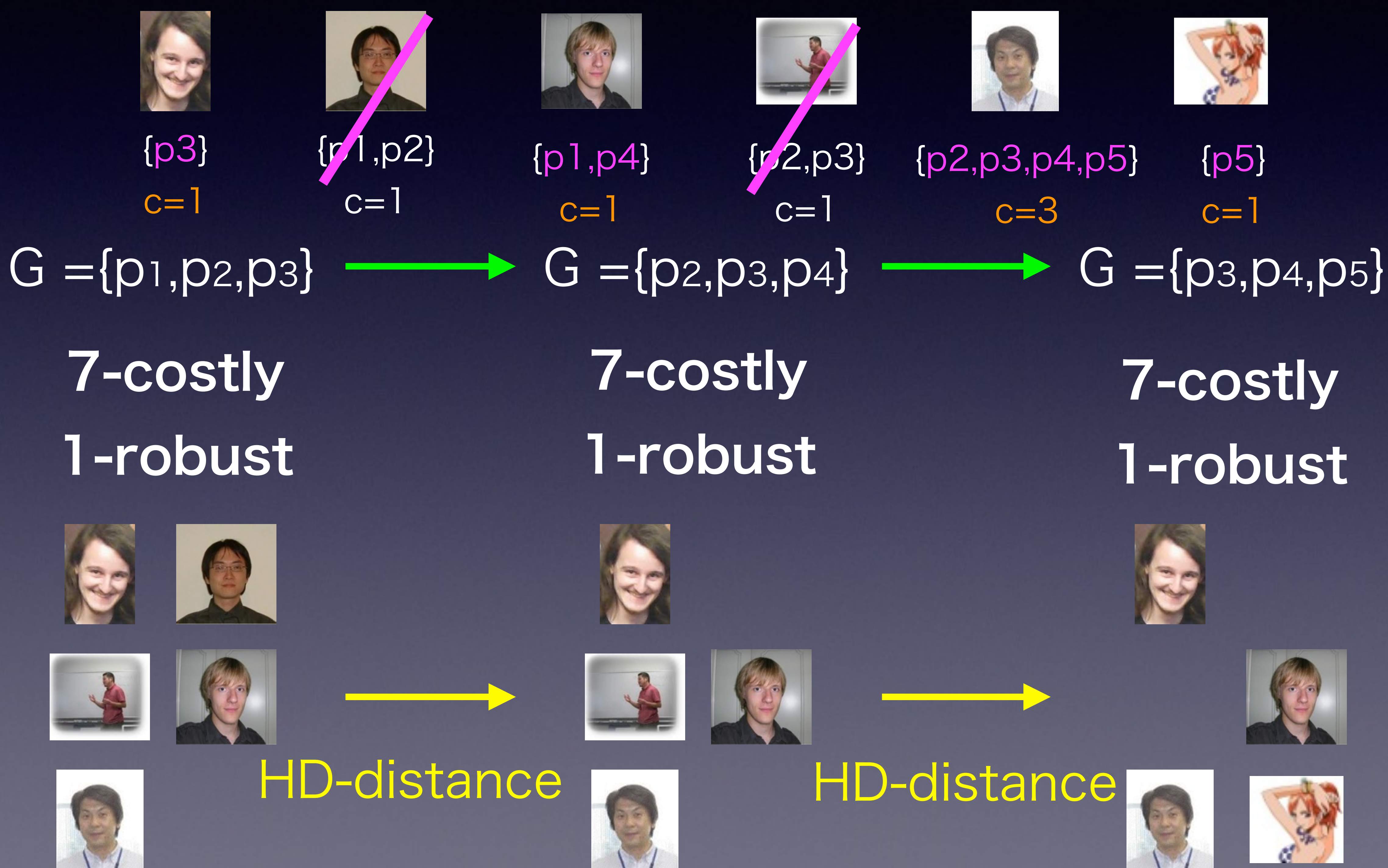
					
{p3}	~~{p1,p2}~~	{p1,p4}	~~{p2,p3}~~	{p2,p3,p4,p5}	{p5}
c=1	c=1	c=1	c=1	c=3	c=1

$G = \{p_1, p_2, p_3\}$ → $G = \{p_2, p_3, p_4\}$ → $G = \{p_3, p_4, p_5\}$

7-costly	**7-costly**	**7-costly**
1-robust	**1-robust**	**1-robust**
		

Team Formation

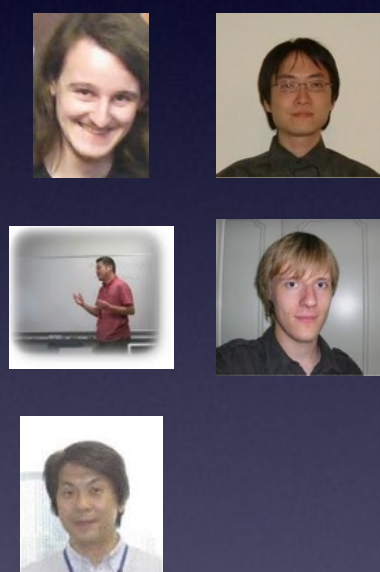
(Example)

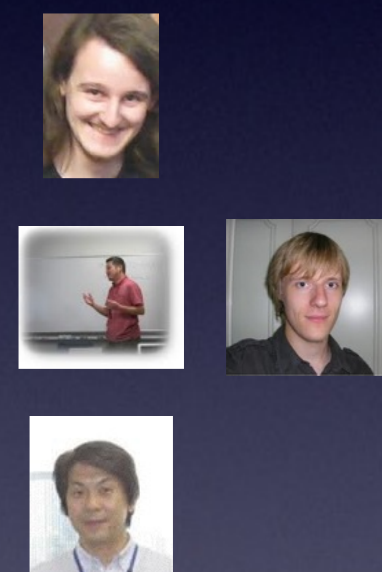


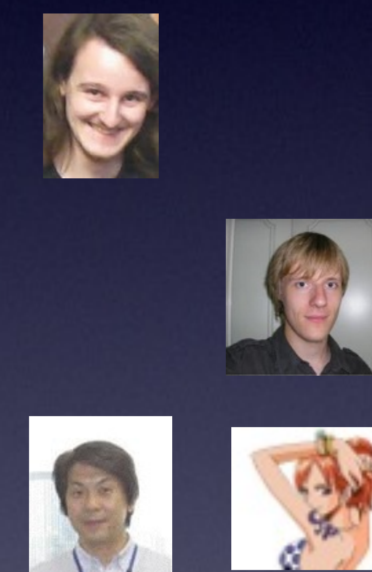
Team Formation

(Example)

$G = \{p_1, p_2, p_3\}$ → $G = \{p_2, p_3, p_4\}$ → $G = \{p_3, p_4, p_5\}$







c-costly c-costly c-costly

k-robustness k-robustness k-robustness

HD-distance HD-distance HD-distance

Ongoing Researches (2014 -)

1. **Robust Coalition Structure Generation** (Tenda Okimoto, Nicolas Schwind, Maxime Clement, Katsumi Inoue) + Suguru Ueda, Katsutoshi Hirayama

2. **MOMO-Project** (Marcus Voelker, Maxime Clement, Tony Ribeiro, Maxime Wack, Tenda Okimoto, Katsumi Inoue)

3. **Systems Resilience : A Challenge Problem for Dynamic Constraint-Based Agent Systems** (AI Review)

Acknowledgement

- **Thank you very much Prof. Inoue**
- **Congratulation** for 10th anniversary of Inoue Lab.
  - I was/am/will be very happy to work with you and my colleagues.
- Thanks for my colleagues.
- Thank you very much Kato san.

Au revoir