

Argumentation & Multi-Agent Simulation for Natural Resources Management

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1 Context

- Natural resource management

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Context

- Natural resource management

2

Idea

1

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2

Idea

3

Directions

- 1 Context
 - Natural resource management
- 2 Idea
- 3 Directions
- 4 Conclusion & Future work

Common-pool resource

- Used by several actors
- Owned by no one
- Difficult to exclude
- Highly subtractable



Classical problems

- Overexploitation
- Pollution
- Free-riding



1 Context

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Idea

- Information sharing
- How to share?
- Arguments

1 Context

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Can information sharing help manage commons?

- Important hypothesis for tragedy: lack of communication
- Yes
 - Help clarify the global context
 - Increase knowledge of system (by actors)
 - Increase knowledge of constraints and consequences of actions
- But
 - Second order dilemma: free-riding
 - Difficulty to share strategic info (cf KM experiences)

How to share information?

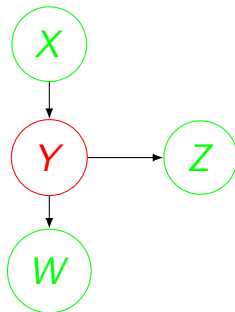
- Guide of good practices and strategies
 - Turn off the light at night
 - Buy your baby oyster at that time of the year
- Measures analyzed with models
 - The rate of *E. Coli* is ... at time ... at place ...
- Arguments
 - Cf. next slides

Formal argumentation theory

Argumentation system

A graph $A = \langle S, \rightarrow, E \rangle$

- S : finite set of arguments
- $\rightarrow \subseteq S \times S$: attack relation
- $E \subseteq S$: extension



Formal argumentation theory

Argumentation system

A graph $A = \langle S, \rightarrow, E \rangle$

Advantage

- Formalization of thoughts
- Ease the understanding of relations and coherence

Argumentation in multi-agent settings

Why?

- Express a community's view
- Allow all to participate

How?

- Building little by little
- Simple union
- Weighting

Formalization of arguments (Examples)

At stake
$A \Rightarrow B$ Obj: B Implement A

Formalization of arguments (Examples)

At stake	Attacks	
	Bad consequence	Better option
$A \Rightarrow B$ Obj: B Implement A	$A \Rightarrow C$ Obj: $\neg C$ Do not implement A	$A' \Rightarrow B$ $A' \geq A$ Implement A'

Formalization of arguments (Examples)

At stake	Attacks	
	Bad consequence	Better option
$A \Rightarrow B$ Obj: B Implement A	$A \Rightarrow C$ Obj: $\neg C$ Do not implement A	$A' \Rightarrow B$ $A' \geq A$ Implement A'

Argumentation framework:

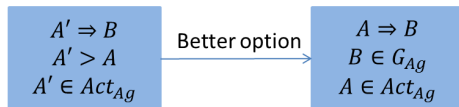
$A \Rightarrow B$
 $B \in G_{Ag}$
 $A \in Act_{Ag}$

Information can support the propositions

Formalization of arguments (Examples)

At stake	Attacks	
	Bad consequence	Better option
$A \Rightarrow B$ Obj: B Implement A	$A \Rightarrow C$ Obj: $\neg C$ Do not implement A	$A' \Rightarrow B$ $A' \geq A$ Implement A'

Argumentation framework:

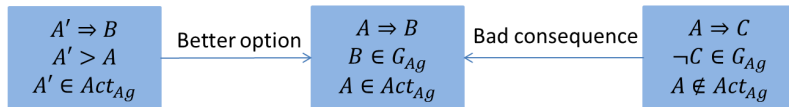


Information can support the propositions

Formalization of arguments (Examples)

At stake	Attacks	
	Bad consequence	Better option
$A \Rightarrow B$ Obj: B Implement A	$A \Rightarrow C$ Obj: $\neg C$ Do not implement A	$A' \Rightarrow B$ $A' \geq A$ Implement A'

Argumentation framework:



Information can support the propositions



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- Case study
- Multi-agent simulation
- Example
- Information as support

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Directions

- Case study
- Multi-agent simulation
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- Information as support

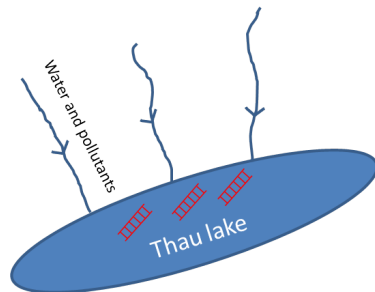
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Conclusion & Future work

Thau basin

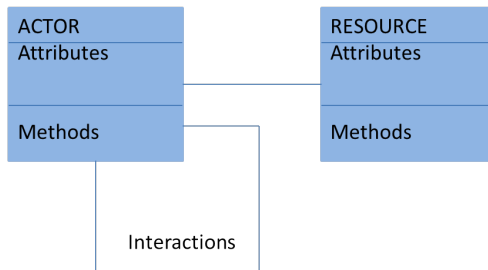
Case study

- Advantages: real settings, deep investigation
- Limits: only one scenario, difficult to explore



Multi-agent simulation

- Advantages: several scenarios
- Limits: difficult to represent suitable behavior (cognitive agents)



Example

3 agents

- Alice: a wine grower
- Bob: an oyster farmer
- Carol: a regulator

Possible dialogue

- Alice: Using fertilizers helps to have a big yield
- Bob: Using fertilizers pollutes the lake and harms the oysters
- Carol: Using organic techniques lead to higher prices

Example

3 agents

- Alice: a wine grower
- Bob: an oyster farmer
- Carol: a regulator

$$\begin{aligned}F &\Rightarrow Y \\ Y &\in G_{Al} \\ F &\in Act_{Al}\end{aligned}$$

F = Fertilizers

Y = Big yield

Example

3 agents

- Alice: a wine grower
- Bob: an oyster farmer
- Carol: a regulator

$F \Rightarrow Y$
 $Y \in G_{Al}$
 $F \in Act_{Al}$

Bad consequence

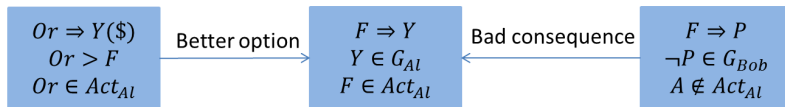
$F \Rightarrow P$
 $\neg P \in G_{Bob}$
 $A \notin Act_{Al}$

F = Fertilizers
Y = Big yield
P = Pollution

Example

3 agents

- Alice: a wine grower
- Bob: an oyster farmer
- Carol: a regulator



F = Fertilizers
 Y = Big yield
 P = Pollution
 Or = Organic

Interaction: going further

Beyond an organized forum

- Possible to share information
- Support arguments

Example

- Counter an implication $A \Rightarrow B$ by observations $A \wedge \neg B$
- Lot of fertilizers and no pollution ($F \wedge \neg P$)



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Conclusion

- Natural resource at risk
- Information sharing
- Arguments

Future work

- Start case study
- Implement the argumentation model for agents