

# Information fusion Discussion @ SUM 2010

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### Aim of multi-sources fusion

#### global point of view

- exploiting the complementarity between sources
- solving different existing conflicts
- reducing the possible redundancies

### Nature of information

- beliefs, observations
- generic knowlege
- goals, preferences
- laws, regulations
- other ?

### Sources: validity of the provided information

- quality ?
- reliability ?
- trust ?
- uncertainty ?

**how to compute it ?**

- qualitative uncertainty
  - disjunctions
  - partial preorders
  
- quantitative uncertainty
  - probabilities
  - possibilities
  - belief functions
  - Dempster Shafer theory

- qualitative
  - simple strategies: conjunctive, disjunctive rules
  - more complex strategies: sum, card, max, gmax
- quantitative
  - Dempster Shafer's combination rule
  - Yager's combination rule

**how to combine the information provided by the sources ?  
which objective ? which context ? which strategy ?**

## Traditional Basic assumptions for qualitative approaches

- mutually independent sources, no implicit link between the information from the different sources assumed
- same level of importance of sources that provide consistent belief bases
- same level of reliability or priority of the information from a source

### Symbolic approaches : Two families

- **semantic (or model-based)**: select interpretations that are the "closest" to the original belief bases  
(Fagin, Kuper Ullman Vardi 89, Konieczny Pino Perez 98, Lafage Lang 00, Konieczny 00, Delgrande Dubois Lang 06, Konieczny Lang Marquis 02, Lang Bloch 02, ...)
- **syntactic (or formula-based)**: select some formulas from the initial bases  
(Dubois Lang Prade 94, Meyer Ghose Chopra 01, Liu Yue Hunter 07, Hue Papini Wurbel 07, Benferhat Dubois Kaci Prade 02, ...)



## Prioritized merging

- **stratified beliefs**
- **preference relation between sources**

**combining belief bases taking into account the stratification of the belief bases or the preference relation**

- **propositional logic**  
(Delgrande Dubois Lang 06, Liu Yue Hunter 07, Hunter Liu 09)
- **possibilistic logic**  
(Benferhat Dubois Kaci Prade 02, Benferhat Kaci 03)
- **links between iterated revision and fusion**  
(Delgrande Dubois Lang 06)

## Computational complexity

**Worst case : second level of polynomial hierarchy**

### **few implementations**

- model-based fusion in terms of dilatation with BDD
- Removed Sets Fusion with ASP

## Some open issues for information fusion

### **qualitative frameworks**

- tractability
  - theoretical complexity: systematic study
  - benchmarks
  
- extension to partially preordered information

## Some open issues for information fusion

### quantitative frameworks

#### implementation with

- possibilistic ASP ?
- probabilistic Logic Programming ?
- fuzzy ASP ?

## Some open issues for information fusion

### Other logic frameworks

- description logic
- non-monotonic frameworks, (fusion of logic programs)
- spatial frameworks with uncertainty
- temporal frameworks with uncertainty