

IP proposal of the Barcelona Group

LoCoMoTion

Logics for combining models of reasoning under imperfect information

Focus of the project

Three notions mainly involved when modelling reasoning with imperfect information

- **uncertainty**
to deal with incomplete information states,
related to notions of belief
intensional, modal-like, logics
- **truthlikeness**
related to similarity-based reasoning
truthlike-value as degree of *proximity to the truth*
intensional nature
- **vagueness / graduality**
graduality calls for intermediate truth states
systems of mathematical fuzzy logic

Aims of the project

1. Develop t-norm based fuzzy logics as a basis for a full fledged information-based model of reasoning under vagueness
2. Developing formal systems combining fuzziness with both uncertainty and truthlikeness.

The (official) members of the Barcelona research team are:

- Teresa Alsinet (University of Lleida),
- Félix Bou (IIIA - CSIC),
- Pilar Dellunde (Autonomous University of Barcelona),
- Francesc Esteva (IIIA - CSIC),
- Lluís Godo (IIIA - CSIC),
- Enrico Marchioni (Open University of Catalonia)
- Carles Noguera (University of Lleida).

Further members:

- Angel García-Cerdaña (IIIA - CSIC)
- Pere Pardo (IIIA - CSIC), Ph.D. student
- Marco Cerami (IIIA - CSIC), Ph. D. Student

Research tasks proposed

T1: *Study of (epistemic) modal logics over BL extensions: semantics, completeness, decidability, complexity issues*

Aim: explore fuzzy modal logics from different points of views as a tool for modelling vagueness.

Alternative semantics: dialogue game approaches.

Emphasis will be specially put on epistemic motivations in a vagueness context.

Participants: Bou, Godo, Marchioni and Noguera.

Duration: from month 1 to month 18.

T2: *Study of different uncertainty logics over BL for vague events: completeness, decidability, complexity issues*

Aim: Fuzzy modal-like operators to represent measures of uncertainty (belief) have been studied in papers by Hájek, Godo, Esteva and Marchioni, to suitable theories mainly over Lukasiewicz logic to reason about the belief of crisp (non-vague) events.

In this task, the aim is to extend this approach to deal with **vague events** under various uncertainty frameworks.

Participants: Esteva, Godo, Marchioni.

Duration: from month 1 to month 18.

T3: *Integration of various belief and approximation fuzzy modalities.*

Aim: Fuzzy modal operators have also been used to model truthlikeness (associated to similarity-based reasoning).

The goal of this task is to explore modal systems combining belief and truthlikeness.

Participants: Bou, Dellunde, Esteva, Godo.

Duration: from month 12 to month 36

T4: *Study of the fragments of fuzzy modal logics corresponding to fuzzy description logic constructs*

Aim: (Classical) description logics correspond to fragments of (classical) modal logic.

In this task: study of the relationship between fuzzy modal logics and some notions of fuzzy description logics as proposed by Hájek

Participants: Bou, Esteva, Noguera.

Duration: from month 12 to month 36

T5: *Generalized argumentation systems over fuzzy logics*

Aim: Argumentation systems is a framework of increasing interest to come up with plausible conclusions from contradictory information.

In this task: extension of this framework when the information contains vague knowledge and is formalized in some t-norm based fuzzy logic.

Participants: Alsinet, Dellunde, Godo.

Duration: from month 6 to month 24

T6: *Temporal aspects in logics of vagueness: the case of t-norm based fuzzy logics*

Aim: The temporal aspects when formalizing vagueness has received little attention in the literature. Here we will explore the addition to t-norm based logics of a temporal dimension.

Participants: Alsinet, Dellunde, Esteva.

Duration: from month 18 to month 36

Notions involved / techniques proposed

- vagueness (gradedness)
 - uncertainty, incompleteness, truthlikeness
 - inconsistent, contradictory information
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- Fuzzy modal logics : T1, T2 (in wide sense), T3, partially T4
 - Fuzzy description logics: T4
 - Argumentation systems: T5
 - Temporal dimension: T6