ABSTRACTS

Marta Bílková: Two-layered Belnapian logics for uncertainty
(joint work with Sabine Frittella, Daniil Kozhemiachenko, Ondrej Majer and Sajad Nazari)

Petr Cintula: Abstract algebraic theory of modal logic with two-layered syntax
(joint work with Carles Noguera)

Two-layered modal syntax is given by three propositional languages: the lower one (also known as language of events), the modal one (whose connectives are actually called modalities), and the upper one (also known as language of statements). Early examples of logics with two-layered syntax were modal logics of probability developed by Hamblin, Fagin, Halpern (e.g. in [1,2]) governed by classical logic on both lower and upper level. Later Hajek with his coauthors (e.g. in [3,4]) considered alternative non-classical logics for both the upper level (to speak directly about probabilities of events) and lower level (to speak about uncertainty of vague events).
Subsequently, numerous other examples of such logics were described and developed in the literature (see survey [5]) thus constituting an area of logic screaming for systematization through the development and application of uniform, general, and abstract methods. The first steps towards such theory were taken in our paper [6], the aim of this talk is to present the state of the art of its develoment.

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Esther Anna Corsi: When Belief Functions and Lower Probabilities are Indistinguishable

This work reports on a geometrical investigation of de Finetti's Dutch Book method as an operational foundation for a wide range of generalisations of probability measures, including lower probabilities, necessity measures and belief functions. Our main result identifies a number of non-limiting circumstances under which de Finetti's coherence fails to lift from less to more general models. In particular our result shows that rich enough sets of events exist such that the coherence criteria for belief functions and lower probability collapse.

Andrea De Domenico: Algorithmic correspondence and analytic rules
(Joint work with Giuseppe Greco)

I will present an algorithm (REL-ALBA) that associates so-called analytic inductive modal formulas with both their corresponding analytic rules of a relational labeled sequent calculus and their first order correspondents, now also syntactically characterized (we refer to them as simple Kracht formulas).

Didier Dubois: A unified view of some formalisms handling incomplete and inconsistent information

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- Davide Ciucci, Didier Dubois: A capacity- based framework encompassing Belnap-Dunn logic for reasoning about multisource information. Int. J. Approx. Reason. 106: 107-127 (2019)

Paul Égre, Lorenzo Rossi and Jan Sprenger: Conditionals: From Trivalent Semantics to Probabilistic Reasoning

This paper proposes a unified account of the truth conditions and probability of conditionals. We present and explain the relationship between two logics, here called Q and A, both of which rely on the trivalent account of conditionals as conditional assertions (as originally outlined by Reichenbach and de Finetti). Logic Q basically corresponds to Cooper's system OL for suppositional reasoning, and the logic A to a strengthening of it, outlined by Belnap. System A can be motivated in terms of probability preservation, it is closely related but extends the trivalent system investigated by Dubois and Prade 1994 for flat conditionals and matching system P. We use both systems to discuss the status of Modus Ponens in conditional reasoning.

Tommaso Flaminio: Local Reduction of Probabilistic Reasoning to Lukasiewicz Logic and MV-algebras

We will present proof-theoretical and algebraic properties for the probability logic FP(L,L), meant for reasoning on the uncertainty of Lukasiewicz events. Methodologically speaking, we will consider a translation function between formulas of FP(L,L) to the propositional language of Lukasiewicz logic that allows us to apply the latter and the well developed theory of MV-algebras directly to probabilistic reasoning. More precisely, leveraging on such translation map, we will show proof-theoretical properties for FP(L,L) and introduce a class of algebras with respect to which FP(L,L) will be proved to be locally sound and complete. Finally, we will apply these previous results to investigate what we called “probabilistic unification problem”. In this respect, we will prove that Ghilardi’s algebraic view on unification can be extended to our case and, on par with the Lukasiewicz propositional case, we show that probabilistic unification is of nullary type.

Sabine Frittella: Non standard probabilities and belief functions over Belnap Dunn logic (joint work with Marta Bílková, Daniil Kozhemiachenko, Ondrej Majer and Sajad Nazari)

Belnap Dunn logic [1] is a four-valued logic introduced in order to reason with incomplete and/or inconsistent information. It relies on the idea that pieces of evidence supporting a statement and its negation can be independent. Non-standard probabilities were proposed in [2] to generalize the notion of probabilities over formulas of Belnap Dunn logic. Here, we continue this line of research and study the implications of using mass functions, belief functions and plausibility functions [3] to formalize reasoning with incomplete/contradictory evidence within the framework of Belnap Dunn logic.

References

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Giuseppe Greco: Łukasiewicz logic properly displayed
(joint work with Daniil Kozhemiachenko and Apostolos Tzimoulis)

The distinctive axiom of Łukasiewicz logic represents the main obstacle to a uniform and modular proof-theoretic treatment. Pivoting on an algebraic analysis of Lukasiewicz logic, we introduce a refinement of the general theory that surpasses this problem.
I will introduce a sequent calculus for Lukasiewicz logic, where all the logical introduction rules are standard and reflect the minimal order-theoretic properties of the operators, while the specific features of the logic are captured by so-called structural rules. Moreover, all the structural rules are automatically generated via (a specialization of) the algorithm ALBA (to so-called regular operators).

Krishna Manoorkar: Toward Dempster-Shafer theory of categorization

Toward Dempster-Shafer theory of categorization Dempster-Shafer theory is a generalization of probability theory extended to reason with uncertainty. We consider extension of mass, belief and plausibility functions to general concept lattices (finite). We show that similar to the case of power-set algebra, belief and plausibility functions can be considered as an inner and outer measure on a larger algebra. We then mention the generalization of Dempster's rule of combination to general concept lattices and show its applications to preference aggregation and categorization scenarios involving multiple agents. Finally, a possible application of this generalization is hinted at in interpreting results of evidential clustering methods in a formal structure.

Niki Pfeifer: Probability logic as a rationality framework

I present probability logic as a rationality framework for human reasoning under uncertainty. In my talk, I discuss selected formal-normative aspects of probability logic in the light of experimental evidence. Specifically, I characterize probability logic as a generalization of bivalent truth-functional propositional logic (short "logic"), as being connexive, and as being nonmonotonic. Moreover, I discuss selected argument forms and associated uncertainty propagation rules. Throughout my talk, I compare the descriptive validity of probability logic to logic, which was used as the gold standard of reference for assessing the rationality of human reasoning in the 20th century.

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Mattia Panettiere: Modal reduction principles: a parametric shift to graphs

We present systematic connections between first-order correspondents of inductive modal reduction principles in the semantic settings of Kripke frames and graph-based frames. By making use of suitable relational languages and unified correspondence theory, our result makes it possible to meaningfully transfer and represent well known relational properties such as reflexivity, transitivity, seriality, confluence, density, across different semantic contexts. This result is part of a research program that aims at extending (unified) correspondence theory making it parametric. In the case of graph-based frames, the parameter is the set of edges of the underlying reflexive graph.

Keywords: Correspondence theory, Sahlqvist theory, graph-based frames, modal logic, modal reduction principles

Umberto Rivieccio: Twist-Algebras and Nuclei

The twist-algebra is a construction used (since at least Kalman in the 1950s) to represent an algebra as a subalgebra of a special binary power of some other (usually, better-known) algebra. This construction offers a powerful representation for various classes of bilattices, for (paraconsistent) Nelson algebras and for some varieties of residuated lattices. Traditionally, the algebra obtained through the twist construction always carries an involutive negation. In this talk we show how to define a non-necessarily involutive negation, we consider the classes of algebras which arise in this way, and we look at which of the traditional results can be extended to non-involutive algebras. We do so by means of an asymmetrical twist construction, whose factors are intuitionistic algebras expanded with a nucleus (i.e. a multiplicative closure operator).

Giuseppe Sanfilippo: Compound conditionals and conditional random quantities in the setting of coherence

Apostolos Tzimoulis: ALBA for non-normal modal logics

I will discuss modifications of ALBA, that allows the algorithm to capture logics with regular modalities. Furthermore, I will discuss how to apply the ALBA methodology and its established connection to display calculi to analyze monotone modal logic, via appropriate translations. Finally, combining these ideas, I will present a sequent calculus that captures various probabilistic logics.

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