LOGCONS: LOGICAL CONSEQUENCE, REASONING AND COMPUTATION

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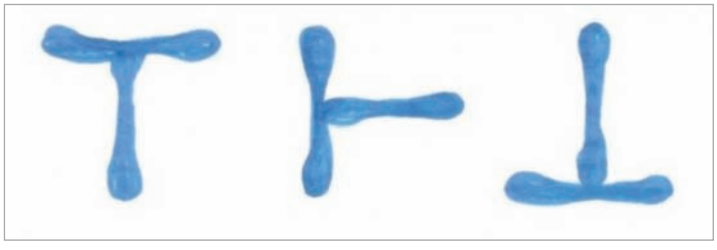

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The notion of logical consequence, in the classical tradition, is the fundamental relationship between premises and conclusions in any valid piece of reasoning. The foundations of logical consequence can be observed in two main areas: model theoretic and proof theoretic. However, there are many general problems with both approaches, which we investigate in the present project.

Issues related to combining semantics and non-classical logics provide a new and very promising impetus to the research on new models of computation, such as quantum computation and information, and on quantum algorithms and quantum cryptography. The impact of practical applications of combinations of logics into the fields of theorem proving, AI, belief revision, probability and possibility will continue to be studied. Interest in this subject begins from the perspective of combining notions of logical consequence to investigate probabilistic, computational and philosophical topics.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

Many of the results in the following paragraphs have been published in prestigious journals in different fields, such as philosophy, mathematics, and computer science. The results achieved through this project have been relevant in three main areas: the conceptions and structure of logical consequence (logical aspects, philosophical and epistemological perspectives); combined logical consequence and combined reasoning (proof theoretic and semantic aspects, statistical countenance, algebraic approaches); and computation and logical consequence (new models of computation inspired by logic, quantum computing, quantum algorithms, and agent interactions).

Regarding the combining of logic systems, a significant amount of results were obtained. Two of these results may be mentioned. (a) It was found that fibring preserves the finite model property under mild conditions, and (b) a generalization of the method for combining sequent calculi, known as meta-fibring, was proposed for hypersequents.

The representation and development of deduction systems based on non-classical logics was also a productive topic, with results obtained through the so-called logics of formal inconsistency (LFI).

Stretching the limits of classical logic and deriving from them techniques that are usually associated with non-classical logics has been a challenge that has produced successful results.

With respect to the combination of belief calculi, a new class of crossover operator for genetic programming, called self-adaptive semantic crossover, was introduced. It was designed to induce the emergence and to preserve good building blocks using metacontrol techniques based on semantic compatibility measures.

Concerning algebraic semantics for modal logics and modulated logics, a particular algebraic structure was developed, the quasi-lattice, which can be modeled by an algebraic structure built into quasi-set theory.

Finally, a task in progress is the possibility of building a theory of computation based on quantum logic, inasmuch as mathematics can be built on non-classical logics.

MAIN PUBLICATIONS

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