Università degli Studi di Verona

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Dottorato di ricerca in Informatica

Graduate course in

"Deduction systems for non-classical logics"

29 Aprile – 4 Giugno 2008 (20 ore)

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Università degli Studi di Verona

Non-classical logics such as modal, temporal or substructural logics are extensions or restrictions of classical logic that provide languages for reasoning about knowledge, belief, time, space, resources, and other dynamic `state oriented' properties. As such, they are increasingly finding applications in various fields of computer science, artificial intelligence, cognitive science and computational linguistics. Driven in part by the rising demands of practitioners, there has been an explosion of research in non-classical logics and the development of new application-driven logics. However, developing such logics is a specialized activity that is largely restricted to experts: each new logic demands, at a minimum, a semantics, a deduction system, and metatheorems connecting the two together. This is non-trivial and there is often an ad hoc nature to the entire enterprise where one is forced to find new ways to extend old results or even to start from scratch. A number of non-standard deduction systems have thus been proposed for non-classical logics. In particular, in this course, we will focus on Labelled deduction systems (e.g. natural deduction, sequent and tableaux systems), which exploit additional information of a semantic or proof-theoretic nature to provide a means of formalizing and implementing non-classical logics in a uniform, modular and `natural' way.

The course is organized in three modules. In the first module, I briefly introduce non-classical logics (their syntax and semantics, and their applications), and then present various labelled deduction systems for them, focusing in particular on modal and substructural logics. I also briefly present implementations of these systems in a typical logical framework such as Isabelle or the Edinburgh LF, and how to use them for semi-automated theorem proving. In the second module, I discuss the proof-theory and semantics of labelled deduction systems, focusing on completeness and normalization results. I also discuss proof-theoretical and semantical limitations of the systems (i.e. what one cannot do with them), especially in comparison with standard approaches, such as Hilbert-style axiomatizations, `unlabelled' natural deduction, and semantics-based translations.
In the final module, I show how labelled deduction systems provide a basis for the combination and fibring of logics. I also show how to establish (un)decidability and complexity results for non-classical logics by means of a proof-theoretical analysis of the corresponding labelled deduction systems.

CALENDARIO

GIORNO	ORA	AULA
Martedì 29 Aprile	10.00-11.30	Aula M
Mercoledì 30 Aprile	11.00-12.30	Aula L
Martedì 6 Maggio	10.00-11.30	Aula M
Mercoledì 7 Maggio	11.00-12.30	Aula L
Martedì 13 Maggio	10.00-11.30	Aula M
Mercoledì 14 Maggio	11.00-12.30	Aula L
Martedì 27 Maggio	10.00-11.30	Aula M
Mercoledì 28 Maggio	11.00-12.30	Aula L
Martedì 03 Giugno	10.00-11.30	Aula M
Mercoledì 4 Giugno	11.00-12.30	Aula L
Martedì 10 Giugno (data di riserva)	10.00-11.30	Aula M
Mercoledì 11 Giugno (data di riserva)	11.00-12.30	Aula L

BIBLIOGRAPHY:
the course is based on recent and ongoing work by the lecturer and colleagues. Some relevant publications can be found on my webpage http://profs.sci.univr.it/~vigano, e.g.

* Luca Vigano`, Labelled non-classical logics, Kluwer Academic Publishers, 2000.
* David Basin, Marcello D'Agostino, Dov M. Gabbay, Sean Matthews, Luca Vigano` (eds.). Labelled Deduction. Kluwer Academic Publishers, 2000.

as well as

* Patrick Blackburn, Johan Van Benthem, Frank Wolter, editors, Handbook of Modal Logic Elsevier Science, 2007.
* Dov M. Gabbay, Labelled deductive systems, Clarendon Press, 1996.
* Melvin Fitting, Proof methods for modal and intuitionistic logics, Kluwer Academic Publishers, 1983.
* Lincoln A. Wallen, Automated deduction in non-classical logics, MIT Press, 1990.

Web info: http://www.di.univr.it/dol/main?ent=ava&cs=108