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Logic versus Approximation

Essays Dedicated to Michael M. Richter
on the Occasion of his 65th Birthday

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Editor

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Preface

There are prominent moments in time where ongoing scientific work is interrupted for a moment and a more general perspective is sought. The symposion on *Logic versus Approximation* is dedicated to such a moment, namely to reflect influences of the scientific work of Michael M. Richter at the occasion of his 65th birthday. The present collection is a selection of contributions to this symposion.

In focussing on today's knowledge based systems we encounter two major paradigms of reasoning. There are on the one hand the logic-based approaches where 'logic' is to be understood in a rather broad sense. This approach is predominantly deployed in symbolic domains where numerical calculations are not the core challenge. Logic has without any doubt provided a powerful methodological tool. Progress in this area is mainly performed by refining the representation of structural aspects which results in a succession of models that should capture increasingly more aspects of the domain. This may be seen as an approximation process on the meta-level.

There is also some weakness in the logic-based approach, though, which is already due to its very foundation. The semantic theory of truth by Tarski has explicitly eliminated personal influence on the validity of truth as well as the representation of dynamically changing variations of the ground terms inside the theory. It does not allow for adaptive individual behavior per se as it is for example explicitly required in the field of e-commerce. From a methodological point of view *pragmatics* is required as opposed to *semantics*. These aspects make it worth to include rather philosophical and foundational considerations as well.

On the other hand we find approximation oriented reasoning. Methods of this kind are mainly applied in numerical domains where approximation is part of the scientific methodology itself. Here we again distinguish two different basic types, discrete and continuous domains.

However, from a more abstract level all these approaches do focus on similar topics and arise on various levels such as problem modeling, inference and problem solving mechanisms, algorithms and mathematical methods, mathematical relations between discrete and continuous properties, and are integrated in tools and applications.

Research on both kinds of reasoning in these areas has mostly been conducted independently so far. Whereas approaches based on discrete or continuous domains influence each other in a sometimes surprising way, influences between these and the symbolic approach have less intensely been studied. Especially the potentialities of an integration is certainly not understood to a satisfactory content although the primary focus from an abstract point of view is on a similar topic. It requires an unifying vision to which all parts have to contribute from their own perspective.

Scientific work is necessarily always the construction of sense. Progress is by no means arbitrary, but always guided by a quest for a still better understanding of parts of the world. Such construction processes are essentially hermeneutical ones, and an emanating coherent understanding of isolated topics is only guaranteed by a unifying view of a personal vision. Such a vision is especially provided by the research interests of Michael M. Richter that have influenced the overall perspective of the symposion. In this sense his scientific work was present all the time during the symposion.

Michael M. Richter has exerted a wide influence on logic and computer science. Although his productive work is widely spread there are some general interests behind yet. A central interest is certainly in modelling structural aspects of reality for problem solving along with the search for adequate methodologies for this purpose. Michael M. Richter made significant contributions, however, to a wide variety of topics ranging from purely logical problems in model theory and non-standard analysis to representation techniques in computer science that have finally emancipated themselves from their logical origins with special emphasis given on problems in artificial intelligence and knowledge-based systems.

The symposion on *Logic versus Approximation* has brought insight into these different approaches and contributed to the emergence of a unifying perspective. At the same time it reflected the variety of Michael M. Richter's scientific interests. The contributions to this volume range from logical problems, philosophical considerations, applications of mathematics and computer science to real world problems, programming methodologies up to current challenges in expert systems.

The members of the organization and program committee especially wish to thank the authors for submitting their papers and responding to the feedback provided by the referees. We also wish to express our gratitude to the *FAW-Förderkreis e.V.* and the *empolis GmbH* for their valuable support. Finally, we are very grateful to the local organization team of the International Conference and Research Center for Computer Science at Schloß Dagstuhl for their professionalism in handling the local arrangements.

To honor Michael M. Richter the President of the University of Kaiserslautern, Prof. Dr. Helmut J. Schmidt, in his diverting opening talk surveyed the creative powers of Michael M. Richter garnished with concise anecdotes on mutual personal experiences at Kaiserslautern University. To pay special tribute to the work of Michael M. Richter the scientific program of the symposion had been complemented by lively and inspiring after-dinner speeches by Franz Josef Radermacher und Paul Stähly. The surrondings of the International Conference Center of Schloß Dagstuhl provided the appropriate sphere and greatly helped in making the symposion a scientifically intriguing, socially enjoyable, and altogether most memorable occasion. This collection is meant to capture the essence of its scientific aspects.

Kaiserslautern, December 2003   Wolfgang Lenski

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