Lecture Notes in Artificial Intelligence 7362

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Intelligent Computer Mathematics

11th International Conference, AISC 2012
19th Symposium, Calculemus 2012
5th International Workshop, DML 2012
11th International Conference, MKM 2012
Systems and Projects, Held as Part of CICM 2012
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Preface

As computers and communications technology advance, greater opportunities arise for intelligent mathematical computation. While computer algebra, automated deduction, mathematical publishing and novel user interfaces individually have long and successful histories, we are now seeing increasing opportunities for synergy among these areas. The series of Conferences on Intelligent Computer Mathematics (CICM) hosts collections of co-located meetings, allowing researchers and practitioners active in these related areas to share recent results and identify the next challenges.

The fifth in this series of Conferences on Intelligent Computer Mathematics was held in Bremen, Germany, in 2012. Previous conferences, all also published in Springer's *Lecture Notes in Artificial Intelligence* series, were held in the UK (Birmingham, 2008: LNAI 5144), Canada (Grand Bend, Ontario, 2009: LNAI 5625), France (Paris, 2010: LNAI 6167) and Italy (Bertinoro, 2011: LNAI 6824). CICM 2012 included four long-standing international meetings:

- 11th International Conference on Mathematical Knowledge Management (MKM 2012)
- 19th Symposium on the Integration of Symbolic Computation and Mechanized Reasoning (Calculemus 2012)
- 11th International Conference on Artificial Intelligence and Symbolic Computation (AISC 2012)
- 5th Workshop/Conference on Digital Mathematics Libraries (DML 2012)

Since 2011, CICM also offers a track for brief descriptions of systems and projects that span the MKM, Calculemus, AISC, and DML topics, the "Systems and Projects" track. The proceedings of the four international meetings and the Systems and Projects track are collected in this volume.
CICM 2012 also contained the following activities:

- Demonstrations of the systems presented in the Systems and Projects track
- Less formal "work in progress" sessions

We used the "multi-track" features of the EasyChair system, and our thanks are due to Andrei Voronkov and his team for this and many other features. The multi-track feature also allowed transparent handling of conflicts of interest between the Track Chairs and submissions: these submissions were moved to a separate track overseen by the General Chair. There were 60 submissions, eight of which were withdrawn. Each of the remaining 52 submission was reviewed by at least two, and on average three, Program Committee members. The committee decided to accept 38 papers. However, this is a conflation of tracks with different acceptance characteristics. The track-based acceptance rates were:

MKM	13 acceptances out of 19 submissions
Calculemus	6 acceptances out of 9 submissions
AISC	6 acceptances out of 8 submissions
DML	2 acceptances out of 3 submissions
S & P	11 acceptances out of 12 submissions

One paper was not submitted to a particular track, and was rejected.

Three invited talks were given. The first one was by Conor McBride from the Department of Computer and Information Sciences, University of Strathclyde, and was entitled "A Prospection for Reflection":

> Gödel's incompleteness theorems tell us that there are effective limitations on the capacity of logical systems to admit reasoning about themselves. However, there are solid pragmatic reasons for wanting to try: we can benefit considerably by demonstrating that systematic patterns of reasoning (and programming, of course) are admissible. It is very useful to treat goals as data in order to attack them with computation, adding certified automation to interactive proof tools, delivering the efficiency required to solve compute-intensive problems with no loss of trust.
>
> Dependent type theory provides a ready means of reflection: goals become types, and types may be computed from data. This technique has proven highly successful when tightly targeted on specific problem domains. But we may yet ask the bold question of how large a universe of problems we can effectively reflect: how much of our type theory can we encode within its own notion of data? To what extent can our type theory capture its own typing discipline? Might we construct a hierarchy of type theories where the whole of each lower level can be reflected at higher levels? In this talk, I shall outline grounds for modest optimism and propose a plan of campaign. The obstacles may turn out to be as fascinating as the objective. The reward, if we can reach it, is a flexible technology for certified automation in problem-solving, honestly articulating what at least computers can do.

The second invited talk was by Cezar Ionescu from the Potsdam Institute for Climate Impact Research, on "Increasingly Correct Scientific Programming":

> Dependently typed languages promise an elegant environment for programming from specifications: the properties that a program should satisfy are expressed as logical formulas and encoded via the Curry–Howard isomorphism as a type, a candidate implementation should be a member of this type, and the type checker verifies whether this is indeed the case. But sometimes the type checker demands "too much": in particular, in scientific programming, it often seems that one must formalize all of real analysis before writing a single line of useful code. Alternatively, one can use mechanisms provided by the language in order to circumvent the type checker, and confirm that "real programmers can write Fortran in any language." We present an example of navigating between these

extremes in the case of economic modeling. First, we use postulates in order to be able to reuse code, and achieve a kind of conditional correctness (for example, we can find a Walrasian equilibrium if we are able to solve a convex optimization problem). We then remove more and more of the postulates, replacing them with proofs of correctness, by using interval arithmetic methods.

Finally, Yannis Haralambous, Département Informatique, Télécom Bretagne, gave a talk on "Text Mining Methods Applied to Mathematical Texts."

April 2012

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Organization

CICM 2012 was organized by the Conference on Intelligent Computer Mathematics Steering Committee, which was formed at CICM 2010 as a parent body to the long-standing Calculemus and Mathematical Knowledge Management special interest groups. The conferences organized by these interest groups continue as special tracks in the CICM conference. The AISC conference, which is only organized every other year, and DML workshop were organized in 2012 too. These tracks and the Systems and Projects track had independent Track Chairs and Program Committees. Local arrangements, the life-blood of any conference, were handled by the Department of Computer Science of the Jacobs University Bremen, Germany, and DFKI, Bremen, Germany.

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Additional Referees

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