AISB99 Convention
Sixth Automated Reasoning Workshop
Bridging the Gap Between Theory and Practice
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1 Introduction

This year's sixth workshop on "Automated Reasoning – Bridging the Gap between Theory and Practice" took place in Edinburgh as part of the AISB99 Convention. The main organiser of the workshop was Manfred Kerber. Its aim is to provide an opportunity for the researchers from various fields of automated reasoning to come together and present their work, exchange ideas and establish or reinforce the links between various groups in Europe working on similar problems. The aim of the workshop is also to bring together the practicioners and the theoreticians which will hopefully result in more applications of theoretical work, and better understanding of the requirements of the practical applications.

The programme of the workshop was very varied in terms of research topics presented, as well as the variety of different session. In particular, the presentations covered topics such as formal methods and description logics, proof planning, non-classical logics and agents, temporal logic, diagrammatic reasoning, scientific creativity and discovery as well as knowledge representation and reasoning. These topics were presented in a variety of formats: three invited talks, two panel sessions, three poster sessions, a joint sessions with another of AISB99 workshops, namely the "Symposium on AI and Scientific Creativity", and the keynote talk of the AISB99 convention for all the participants of the convention. At the same time, the participants could take advantage of the 1999 International Edinburgh Science Festival and attend talks of some prominent speakers.

2 Invited Talks

The first invited talk was by Andrei Voronkov on "Herbrand's Theorem, Automated Reasoning and Semantic Tableaux". He questioned the efficiency of tableaux and related proof search methods, and pointed out the problem with the formula instantiation and the selection of multiplicity. Voronkov then went on to present many results obtained in solving these problems, and posed some open problem questions. Let us mention some. Is monadic formula instantiation decidable? What happens with formula instantiation when the multiplicity is large? One of the questions asked was whether the results that Voronkov presented helped in the implementation and its efficiency of tableaux-based theorem provers. Voronkov's answer was "not yet", but in principle they should and will be used in the near future.

The second invited speaker was Simon Colton who talked about "Automated Discovery in Mathematics and Other Sciences". This was a joint event with the "Symposium on AI and Scientific Creativity". Colton presented his concept formation system HR which is designed to invent mathematical concepts and assess how interesting these concepts are. For instance, HR rediscovered (initially thought to have discovered) the concept of refactorable number, i.e. integers whose number of divisors is itself a divisor. The most interesting concepts are then used to build new concepts, and a theory consisting of definitions of concepts, calculations, theorems and proofs and open conjectures is created.

The last invited talk was given by Maarten de Rijke and was entitled "Combining Reasoning Systems". He talked about how we can combine logics for modelling belief, knowledge, *etc.* and keep things modular. However, the question is what do we gain by combining logics. When are properties conserved when logics are combined, and when they are not conserved? In particular, do advantages of each logic cancel each other out, or disadvantages multiply when the logics are combined? These are known as transfer problems. The positive proofs in this area are usually based on two methods, divide and conquer, and hide and unpack. These no longer work for combined logical systems in the presence of interaction. De Rijke went on to present how the reasoning tools, each using a different logic, can be plugged together into a combined system. There are some systems which successfully combine logics, however in general a deeper understanding of how to proceed is needed.

There was a special session at the workshop which was held jointly with the "Symposium on AI and Scientific Creativity". The first speaker was John McCarthy who talked about "Creative Solutions to Problems". Mc-

Carthy gave us a definition of a creative solution to a given problem: *a solution to a problem is creative if it involves concepts not present in the statement of the problem and the general knowledge surrounding it.* He presented a number of creative solutions to a mutilated checkboard problem. Most of the questions asked were concerned with the representation of a problem which seems to be crucial to finding its solution. In particular, the difficulty lies in inventing a new representation or choosing the representation from a large repertoire which will allow the discovery of a creative solution. Of course, McCarthy agreed with this comment. The second speaker was Jaap Kamps who spoke "One the Process of Axiomatizing Scientific Theories: Using Justification Criteria in the Context of Discovery". The criteria for evaluating theories are consistency, soundness, falsifiability, satisfiability and further advantages. Assessing theories according to these criteria provides useful feedback on how to formalise, assess and revise a scientific theory.

In addition to these three invited talks, we also had a privilege to attend the AISB99 Convention keynote talk by Margaret Boden on "Creativity and Evaluation". She listed three main characteristics of creativity. These are: how novel the idea is, how surprising it is and how interesting it is. She then proceeded to explain that while we are being creative we are manipulating conceptual spaces. Finally, she indicated how we can asses the novelty, surprisingness and interestingness of an idea.

Finally, as an additional bonus, we had an opportunity to attend a talk by Herold Cohen at the Edinburgh International Science Festival. He presented an artificial artist, a robot called Aaron. By working together, Aaron and his creator can investigate exactly how artists construct and execute paintings, and gain an insight into the relationship between artificial intelligence and visual creativity.

3 Panel Sessions

The workshop consisted also of two panel sessions, the first one on the topic of "Diagrammatic Reasoning" organised by Mateja Jamnik, and the second one on "Proof in Combinations of Modal Logics" organised by Michael Fisher. Both panels consisted of short presentations of some state of the art aspect of the area, followed by an extended discussion at the end. The session on diagrammatic reasoning consisted of talks by Mateja Jamnik, Keith Stenning and Peter Cheng. Rather than explaining in detail the content of the talks (it can be found in the Proceedings of the workshop) I will state some of the open questions in the area:

- Characterisation of problems that can be solved diagrammatically.
- What makes a good representation for reasoning and learning in complex domains?
- Computational classification of differences in cognitive style.
- Can reasoning (human or machine) be understood in terms of representation selection?
- How are multiple representations used in problem solving?

The session on modal logics consisted of talks by Brandon Bennett, Clare Dixon, Enrico Franconi, Ian Horrocks, Ullrich Hustadt and Maarten de Rijke. Some of the questions that the speakers addressed were:

- What are the main areas where combinations of modal logics will be useful in the future (or are now)?
- What reasoning methods can be used successfully for combinations of modal logics?
- Are interactions between modalities important?
- Is there a general framework in which different logics are best represented?
- Will we ever have practical tools that allow us to reason about combined modal logics incorporating interactions?

4 Poster Sessions

There were three poster sessions taking place at the Automated Reasoning workshop. All together there were 18 posters presented. Roughly, the first session consisted of posters in the area of formal methods and description logics, the second in the area of proof planning and formal methods, and the third one in the areas of non-classical logics and agents. Each presenter prepared a short presentation to the interested audience. My impression was that everybody was very well prepared and enthusiastic to tell you about their work. The poster session proved to be a very successful event.

5 Conclusion

The more informal interaction took place during the coffee and lunch breaks. These proved to be ideal for social mingling and making new connections and links with fellow researchers. Topics of talks were discussed further, additional questions were asked, specific issues were clarified and different opinions were exchanged. Best of all, new ideas were emerging from these small chit-chats, some taking place in the selection of numerous pubs and restaurants that Edinburgh has to offer. Amongst the other social events was also the reception for the opening of the AISB99 Convention.

In conclusion, the Sixth Workshop on Automated Reasoning proved to be a very successful event. More information about it can be found on the web `http://www.cs.bham.ac.uk/~mmk/AR99/` and in the Proceedings (available from the AISB and the above web page).