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First International Summer School on Runtime Verification

as part of the ArVi COST Action 1402

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Abstract. This paper briefly reports on the first international summer school on Runtime Verification: Branches of practical topics rooted in theory, co-organized and sponsored by COST Action IC1402 ArVi which was held September 23-25, Madrid, Spain as part of the 16th international conference on Runtime Verification (RV 2016).

Runtime Verification [1, 3–5, 2] is an umbrella term usually denoting the languages, techniques, and tools related to the verification of system executions against formally-specified behavioral properties. This field of research has been mainly represented by the Runtime Verification (RV) conference³ which was held yearly for the last 16 years. As the field is growing and the techniques are becoming more and more mature, there is a pressing need in the community for documentation and lecture material to help students and practitioners entering the field, in spite of the existing (incomplete) tutorials and short overviews of the field. We foresee the organization of this summer school as one of the steps towards achieving this goal. By organizing the summer school, we wanted to build a short theoretical and practical program allowing to give in 3 days the necessary introductory knowledge to a practitioner or student entering the field.

Objectives. As the name of the summer school suggests, the summer school aimed to provide a balance of theory and practice: In the theoretical aspect, while all the core concepts were covered, participants were also exposed to cutting edge advances in the field. At the same time, the summer school was very hands-on and students followed up with practical work in the evenings so that by the end of the summer school, participants had created their own basic runtime verification tool.

For PhD students and researchers entering the field of RV, the school was a great opportunity to get to know other people working in the area, to meet distinguished scholars, and to establish contacts that may lead to research collaborations in the future. For people coming from industry, the school provided an exposition of the major challenges as well as possible solutions to the application of RV in industry, an exposition to the major tools, as well as the basics of RV tool-building.

³ See <http://runtime-verification.org>.

Table 1. Programme overview - Day 1 - 23rd September

| Time | Topic | Lecturer |
|-------------|--|------------|
| 09:00 09:45 | RV overview, RV vs other verification techniques | Y. Falcone |
| 09:45 10:30 | Summer school Overview and manual monitoring | |
| 11:00 11:45 | Monitoring with AOP | G. Pace |
| 11:45 12:30 | Towards monitoring specification languages | |
| 14:00 14:45 | Monitoring LTL specifications | M. Leucker |
| 14:45 15:30 | Monitorability | |
| 16:00 16:45 | Hands on | C. Colombo |
| 16:45 17:30 | | |
| 18:00 | Optional further assistance with hands on | |

Table 2. Programme overview - Day 2 - 24th September

| Time | Topic | Lecturer |
|-------------|---|-------------|
| 09:00 09:45 | Handling data | K. Havelund |
| 09:45 10:30 | in user-provided specifications | |
| 11:00 11:45 | Monitoring concurrency errors: | J. Lourenco |
| 11:45 12:30 | deadlocks, atomicity violations, and data races | |
| 14:00 14:45 | Performance issues and optimizations | G. Reger |
| 14:45 15:30 | | |
| 16:00 16:45 | Hands on | C. Colombo |
| 16:45 17:30 | | |
| 18:00 | Optional further assistance with hands on | |

Table 3. Programme overview - Day 3 - 25th September

| Time | Topic | Lecturer |
|-------------|---|-----------------|
| 09:00 09:45 | Design and Monitoring of Component-Based Systems | M. Bozga |
| 09:45 10:30 | Distributed monitoring & monitoring distributed systems | B. Bonakdarpour |
| 11:00 11:45 | Time-Triggered monitoring | |
| 11:45 12:30 | From Monitoring quantitative properties to testing | D. Nickovic |
| 14:00 14:45 | Combined Static and Runtime Verification | W. Ahrendt |
| 14:45 15:30 | Bytecode manipulation for Runtime Verification | W. Binder |
| 16:00 16:45 | Runtime enforcement | Y. Falcone |
| 16:45 17:30 | A Theory of Monitors | A. Francalenza |

Lecturers. The following researchers lectured at the summer school:

- Prof. Wolfgang Ahrendt, Chalmers University of Technology and University of Gothenburg (Sweden).
- Prof. Ezio Bartocci, TU Wien (Austria).
- Prof. Borzoo Bonakdarpour, University of MacMaster (Canada).
- Dr. Marius Bozga, CNRS, Vérimag (France).
- Dr. Christian Colombo, University of Malta (Malta).
- Dr. Yliès Falcone, University of Grenoble (France).
- Dr. Adrian Francalanza, University of Malta (Malta).
- Dr. Klaus Havelund, NASA Jet Propulsion Laboratory (USA).
- Prof. Martin Leucker, University of Lübeck (Germany).
- Prof. Joao Loureno, Universidade Nova de Lisboa (Portugal).
- Dr. Dejan Nickovic, Austrian Institute of Technology (Austria).
- Prof. Gordon Pace, University of Malta (Malta).
- Dr. Giles Reger, University of Manchester (UK).

Program overview. The Summer School was organised over three days with a series of lectures from international experts during the day and a follow up practical session in the evening to enable the participants to incorporate the covered knowledge into their tool (see Tables 1-3). The first day covered the fundamentals of runtime verification: starting with the basic concept of what is runtime verification, moving on to instrumentation techniques, and property specification languages. The second day covered the major practical aspects of runtime verification: handling data through monitor parametrisation, monitoring concurrency errors, and performance issues of monitors. The second day ended with a session on RV tools, giving the participants time to try tools and interact with their creators. Finally, the third day covered advanced and cutting-edge research in the field with topics ranging from runtime enforcement to the combination of static and dynamic analysis, and from monitoring of distributed and transaction-based systems to low-level hardware monitoring.

Acknowledgment. We would like to warmly thank all the researchers for their lectures and all the participants to the summer school. We hope that the summer school will be continued in the future by becoming a regular event.

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