Lecture Notes in Computer Science 9826

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

More information about this series at http://www.springer.com/series/7407

Gul Agha · Benny Van Houdt (Eds.)

Quantitative Evaluation of Systems

13th International Conference, QEST 2016
Quebec City, QC, Canada, August 23–25, 2016
Proceedings

Springer

Editors
Gul Agha
University of Illinois
Urbana, IL
USA

Benny Van Houdt
University of Antwerp
Antwerp
Belgium

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-43424-7 ISBN 978-3-319-43425-4 (eBook)
DOI 10.1007/978-3-319-43425-4

Library of Congress Control Number: 2015944718

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG Switzerland

Preface

Welcome to the proceedings of QEST 2016, the 13th International Conference on Quantitative Evaluation of Systems. QEST is a leading forum on quantitative evaluation and verification of computer systems and networks, through stochastic models and measurements. QEST was first held in Enschede, The Netherlands (2004), followed by meetings in Turin, Italy (2005), Riverside, USA (2006), Edinburgh, UK (2007), St. Malo, France (2008), Budapest, Hungary (2009), Williamsburg, USA (2010), Aachen, Germany (2011), London, UK (2012), Buenos Aires, Argentina (2013), Florence, Italy (2014) and, most recently, in Madrid, Spain (2015).

This year's QEST was held in Quebec City, Canada, and colocated with the 27th International Conference on Concurrency Theory (CONCUR 2016) and the 14th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2016).

As one of the premier fora for research on quantitative system evaluation and verification of computer systems and networks, QEST covers topics including classic measures involving performance and reliability, as well as quantification of properties that are classically qualitative, such as safety, correctness, and security. QEST welcomes measurement-based studies and analytic studies, diversity in the model formalisms and methodologies employed, as well as development of new formalisms and methodologies. QEST also has a tradition in presenting case studies, highlighting the role of quantitative evaluation in the design of systems, where the notion of system is broad. Systems of interest include computer hardware and software architectures, communication systems, embedded systems, infrastructural systems, and biological systems. Moreover, tools for supporting the practical application of research results in all of the aforementioned areas are also of interest to QEST. In short, QEST aims to encourage all aspects of work centered around creating a sound methodological basis for assessing and designing systems using quantitative means.

The Program Committee (PC) consisted of 30 experts and we received a total of 46 submissions. Each submission was reviewed by three reviewers, either PC members or external reviewers. The review process included a one-week PC discussion phase. In the end, 21 full papers and three tool demonstration papers were selected for the conference program. The program was greatly enriched by the QEST keynote talk of Carey Williamson (University of Calgary, Canada), the joint keynote talk with FORMATS 2016 of Ufuk Topcu (University of Texas at Austin, USA), and the joint FORMATS 2016 and CONCUR 2016 keynote of Scott A. Smolka (Stony Brook University, USA). We believe the overall result is a high-quality conference program of interest to QEST 2016 attendees and other researchers in the field.

We would like to thank a number of people. Firstly, thanks to all the authors who submitted papers, as without them there simply would not be a conference. In addition, we would like to thank the PC members and the additional reviewers for their hard work and for sharing their valued expertise with the rest of the community, as well as

EasyChair for supporting the electronic submission and reviewing process. We are also indebted to our proceedings chair, Karl Palmskog, and to Alfred Hofmann and Anna Kramer for their help in the preparation of this volume. Thanks also to the Web manager, Andrew Bedford, the local organization chair, and general chair, Josée Desharnais, for their dedication and excellent work. Finally, we would like to thank Joost-Pieter Katoen, chair of the QEST Steering Committee, for his guidance throughout the past year, as well as the members of the QEST Steering Committee.

We hope that you find the conference proceedings rewarding and will consider submitting papers to QEST 2017.

August 2016

Gul Agha
Benny Van Houdt

Organization

General Chair

Josée Desharnais	Université Laval, Canada

Program Committee Co-chairs

Gul Agha	University of Illinois, USA
Benny Van Houdt	University of Antwerp, Belgium

Local Organization Chair

Josée Desharnais	Université Laval, Canada

Proceedings and Publications Chair

Karl Palmskog	University of Illinois, USA

Steering Committee

Alessandro Abate	University of Oxford, UK
Luca Bortolussi	University of Trieste, Italy
Javier Campos	University of Zaragoza, Spain
Pedro D'Argenio	Universidad Nacional de Córdoba, Argentina
Boudewijn Haverkort	University of Twente, The Netherlands
Jane Hillston	University of Edinburgh, UK
Andras Horvath	University of Turin, Italy
Joost-Pieter Katoen	RWTH Aachen University, Germany
William Knottenbelt	Imperial College London, UK
Gethin Norman	University of Glasgow, UK
Anne Remke	University of Twente, The Netherlands
Enrico Vicario	University of Florence, Italy

Program Committee

Alessandro Abate	University of Oxford, UK
Nail Akar	Bilkent University, Turkey
Christel Baier	Technical University of Dresden, Germany
Nathalie Bertrand	Inria Rennes, France
Luca Bortolussi	University of Trieste, Italy
Peter Buchholz	Technical University of Dortmund, Germany

Ana Bušic	Inria Paris, France
Javier Campos	University of Zaragoza, Spain
Rohit Chadha	University of Missouri, USA
Florin Ciucu	University of Warwick, UK
Andres Ferragut	Universidad ORT, Uruguay
Dieter Fiems	Ghent University, Belgium
Anshul Gandhi	Stony Brook University, USA
Tingting Han	Birkbeck, University of London, UK
John Hasenbein	University of Texas, USA
Jane Hillston	University of Edinburgh, UK
William Knottenbelt	Imperial College London, UK
Sasa Misailovic	MIT, USA
Pavithra Prabhakar	Kansas State University, USA
Sriram Sankanarayanayan	University of Colorado Boulder, USA
M. Zubair Shariq	University of Iowa, USA
Evgenia Smirni	College of William and Mary, USA
Mark Squillante	IBM, USA
Tetsuya Takine	Osaka University, Japan
Peter Taylor	University of Melbourne, Australia
Miklós Telek	Technical University of Budapest, Hungary
Enrico Vicario	University of Florence, Italy
Mahesh Viswanathan	University of Illinois, USA

Additional Reviewers

Alexander Andreychenko	Elena Gómez-Martínez	Laura Nenzi
Benoît Barbot	Illes Horvath	Marco Paolieri
Simona Bernardi	Jean-Michel Ilié	Elizabeth Polgreen
Laura Carnevali	Nadeem Jamali	Daniël Reijsbergen
Nathalie Cauchi	Jorge Julvez	Ricardo J. Rodríguez
Diego Cazorla	Charalampos Kyriakopulous	Andreas Rogge-Solti
Milan Ceska	Wenchao Li	Dimitri Scheftelowitsch
Taolue Chen	Andras Meszaros	Sadegh Soudjani
Daniel Gburek	Dimitrios Milios	Max Tschaikowski
Blaise Genest		Feng Yan

Abstracts of Invited Talks

A Stroll Down Speed-Scaling Lane

Carey Williamson

Department of Computer Science, University of Calgary, Calgary, AB, Canada
carey@cpsc.ucalgary.ca

Abstract. This talk provides a retrospective look at the past, present, and future of speed scaling systems. Such systems have the ability to auto-scale their service capacity based on demand, which introduces many interesting tradeoffs between response time (a classic performance metric) and energy efficiency (a relatively recent performance metric of growing interest).

The talk highlights key results and observations from the past two decades of speed scaling research, which appears in both the theory and systems research communities. One theme in the talk is the dichotomy between the assumptions, approaches, and results in these two research communities. Another theme is that modern processors support surprisingly sophisticated speed scaling functionality, which is not yet well-harnessed by current algorithms or operating systems.

During the stroll, I will also share some insights and observations from our own work on speed scaling designs, including coupled, decoupled, and turbo-charged systems. This work includes analytical and simulation modeling, as well as empirical system measurements. The talk closes with thoughts about future opportunities in speed scaling research.

V-Formation as Optimal Control

Scott A. Smolka

Department of Computer Science, Stony Brook University,
Stony Brook, NY, USA
sas@cs.stonybrook.edu

Abstract. In this talk, I will present a new formulation of the V-formation problem for migrating birds in terms of model predictive control (MPC). In this approach, to drive a flock towards a desired formation, an optimal *velocity adjustment* (acceleration) is performed at each time-step on each bird's current velocity using a model-based prediction window of T time-steps. I will present both centralized and distributed versions of this approach. The optimization criteria used is based on fitness metrics of candidate accelerations that V-formations are known to exhibit. These include *velocity matching*, *clear view*, and *upwash benefit*. This MPC-based approach is validated by showing that for a significant majority of simulation runs, the flock succeeds in forming the desired formation. These results help to better understand the emergent behavior of formation flight, and provide a control strategy for flocks of autonomous aerial vehicles. This talk represents joint work with Radu Grosu, Ashish Tiwari, and Junxing Yang.

Adaptable Yet Provably Correct Autonomous Systems

Ufuk Topcu

Department of Aerospace Engineering and Engineering Mechanics,
University of Texas at Austin, Austin, TX, USA
utopcu@utexas.edu

Abstract. Acceptance of autonomous systems at scales at which they can make societal and economical impact hinges on factors including how capable they are in delivering complicated missions in uncertain and dynamic environments and how much we can trust that they will operate safely and correctly. In this talk, we present a series of algorithms recently developed to address this need. In particular, these algorithms are for the synthesis of control protocols that enable agents to learn from interactions with their environment and/or humans while verifiably satisfying given formal safety and other high-level mission specifications in nondeterministic and stochastic environments.

We take two complementing approaches. The first approach merges data efficiency notions from learning (e.g., so-called probably approximate correctness) with probabilistic temporal logic specifications. The second one leverages permissiveness in temporal-logic-constrained strategy synthesis with reinforcement learning.

Contents

Tools

Sampling, Inference, and Optimization Methods

Markov Decision Processes and Markovian Analysis

Networks