4th Student Conference on Operational Research

SCOR 2014, May 2–4, 2014, Nottingham, UK

Edited by
Pedro Crespo Del Granado
Martim Joyce-Moniz
Stefan Ravizza

Editors

Pedro Crespo Del Granado
Lancaster University
p.crespodelgranado@lancaster.ac.uk

Martim Joyce-Moniz
Université Libre de Bruxelles
martim.moniz@ulb.ac.be

Stefan Ravizza
IBM Global Business Services
stefan.ravizza@ch.ibm.com

ACM Classification 1998
G.1.6 Optimization, G.1.10 Applications, G.2.2 Graph Theory, G.2.3 Applications, G.3 Probability and Statistics, H.3.5 Web-based services, I.2.3 Deduction and Theorem Proving

ISBN 978-3-939897-67-5

Published online and open access by
Schloss Dagstuhl – Leibniz-Zentrum für Informatik GmbH, Dagstuhl Publishing, Saarbrücken/Wadern, Germany. Online available at http://www.dagstuhl.de/dagpub/978-3-939897-67-5.

Publication date
August, 2014

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

License
This work is licensed under a Creative Commons Attribution 3.0 Unported license (CC-BY 3.0): http://creativecommons.org/licenses/by/3.0/legalcode.

In brief, this license authorizes each and everybody to share (to copy, distribute and transmit) the work under the following conditions, without impairing or restricting the authors' moral rights:

- Attribution: The work must be attributed to its authors.

The copyright is retained by the corresponding authors.

Digital Object Identifier: 10.4230/OASIcs.SCOR.2014.i

OASIcs – OpenAccess Series in Informatics

OASIcs aims at a suitable publication venue to publish peer-reviewed collections of papers emerging from a scientific event. OASIcs volumes are published according to the principle of Open Access, i. e., they are available online and free of charge.

Editorial Board

- Daniel Cremers (TU München, Germany)
- Barbara Hammer (Universität Bielefeld, Germany)
- Marc Langheinrich (Università della Svizzera Italiana – Lugano, Switzerland)
- Dorothea Wagner (*Editor-in-Chief*, Karlsruher Institut für Technologie, Germany)

ISSN 2190-6807

www.dagstuhl.de/oasics

Contents

Preface
Pedro Crespo Del Granado, Stefan Ravizza, and Martim Joyce-Moniz i

A Novel Framework for Quantification of Supply Chain Risks
Abroon Qazi, John Quigley, and Alex Dickson 1

Multilingual Trend Detection in the Web
Jan Stutzki 16

Solving the p-median location problem with the Erlenkotter approach in public service system design
Ján Bendík 25

A new approach to modelling nonlinear time series: Introducing the ExpAR-ARCH and ExpAR-GARCH models and applications
Paraskevi Katsiampa 34

Coordinating push and pull flows in a lost sales stochastic supply chain
Georgios Varlas and Michael Vidalis 52

Mathematical Programming bounds for Large-Scale Unit Commitment Problems in Medium-Term Energy System Simulations
Alberto Ceselli, Alberto Gelmini, Giovanni Righini, and Andrea Taverna 63

A Model-Based Heuristic to the Min Max K-Arc Routing for Connectivity Problem
Vahid Akbari and Sibel Salman 76

A Review of Dynamic Bayesian Network Techniques with Applications in Healthcare Risk Modelling
Mohsen Mesgarpour, Thierry Chaussalet, and Salma Chahed 89

Demand models for the static retail price optimization problem – A Revenue Management perspective
Timo P. Kunz and Sven F. Crone 101

4th Student Conference on Operational Research (SCOR'14).
Editors: Pedro Crespo Del Granado, Martim Joyce-Moniz, and Stefan Ravizza
OpenAccess Series in Informatics
OASICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Preface

We are delighted to present the proceedings of the 4th Student Conference on Operational Research (SCOR 2014). The conference took place from the 2–4 May 2014 at the University of Nottingham (UK) and welcomed PhD students, mainly from European Universities, studying Operational Research, Management Science or a related field. SCOR is a student conference organized by PhD students to showcase their work in a friendly environment while at the same time enabling networking with other researchers in the early stages of their OR careers.

Following the success of previous SCOR conferences, 45 participants attended SCOR 2014, with 20 universities across 9 countries being represented. A number of invited speakers gave exciting plenary talks covering a variety of the latest hot topics in OR. Professor Stewart Robinson, President of the OR Society, gave a talk about how simple models can often deliver insight and good results faster than their more complex counterparts. Delegates took away the important message that the inclusion of every single detail in a model can at some point become detrimental to the modelling process, and that sometimes simple is best! In contrast, we then had a talk from Jacqui Taylor, CEO of Flying Binary and the co-chair of the Analytics Network, a data scientist community supported by the OR Society. Jacqui presented some of her work as a data journalist and gave examples on how Big Data, when presented with tools that allow their exploration, can promote reaction and engagement on important issues. For something a little different at the end of the first day, Piero Vitelli, a freelance trainer at Island 41, gave a fantastic talk on presentation skills. As a new addition to a SCOR conference, the idea behind inviting Piero was to expose delegates to techniques to improve the delivery of their presentations and to provide the opportunity to incorporate some of these techniques when presenting their work at the conference. On the second day, Graham Rand of Lancaster University took us on a journey back to the early days of OR and presented the history of OR arising from the conflicts of war to how its popularity spread in more recent times.

SCOR 2014 consisted of 13 research streams and 40 talks; details about the streams and presentations can be found on the website by downloading the conference booklet `http://www.scor2014.com`. Popular streams included Healthcare, Vehicle Routing problems, Analytics, Heuristics, Optimization, OR in energy, Mathematical Programming, Multicriteria Decision Analysis and Forecasting. Another new addition to the conference this year was a question and answer panel session. Members of the panel consisted of two representatives from industry and two from academia, all of whom had completed a PhD in OR. It was interesting to hear the careers paths of the panel members and delegates were keen to ask about their different experiences.

No conference is complete without an exciting array of social activities! These included dinner on Friday at a local restaurant which was followed by a pub quiz organised by the committee. On Saturday, thanks to the great weather, delegates enjoyed a walk around nearby Wollaton Park. The Hall hosts Nottingham Natural History Museum, but is perhaps more popular for being Bruce Wayne's mansion in the recent Batman movies. Delegates enjoyed a three course meal at the conference dinner, the seating plan of which posed an intriguing optimisation problem for the organising committee; each table should have a balance between UK and European university students, no students of the same university should sit next to each other with the aim of promoting networking, and there should be a balance between students who prefer alcoholic and non-alcoholic drinks. The seating plan proved an optimal solution as many new friendships were made!

4th Student Conference on Operational Research (SCOR'14).
Editors: Pedro Crespo Del Granado, Martim Joyce-Moniz, and Stefan Ravizza
OpenAccess Series in Informatics
OASICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

On behalf of the organising committee, we would like to thank our main sponsor, The OR Society, for enabling us to offer affordable fees to participants and finance this conference proceedings, GOAL (Gower Optimal Algorithms Ltd) for sponsoring the best presentation award, and Prospect Recruitment. In addition, we would like to thank the members of the organising committee, without whose extraordinary efforts, this conference could not have happened. Thanks go to our fellow organizing committee members: Gulmira Khussainova , Franklin Djeumou, Elizabeth Rowse, J. Arturo Castillo-Salazar, and Michael Mortenson.

Lastly, we would like to give a special thanks to all authors who submitted a paper for SCOR 2014, the review process was based on the presentation, quality and originality of the research and there were at least two referees assigned to each paper.

Pedro Crespo Del Granado
Stefan Ravizza
Martim Joyce-Moniz

Organisation

Conference Committee

- Pedro Crespo del Granado, Lancaster University, UK (Program Chair)
- Gulmira Khussainova, University of Nottingham , UK (Local Chair)
- Franklin Djeumou Fomeni, Lancaster University , UK
- Martim Joyce-Moniz, Université Libre de Bruxelles, Belgium
- Michael Mortenson, Loughborough University, UK
- Elizabeth Rowse, Cardiff University, UK
- Arturo Castillo Salazar, University of Nottingham , UK
- Stefan Ravizza, IBM Global Business Services, Switzerland (Chair of the Steering Committee)

Sponsors and Partners

- The OR Society
- A National Taught Course Center in Operational Research (NATCOR)
- Prospect Recruitment
- Gower Optimal Algorithms Ltd. (GOAL)
- Divide by Two

4th Student Conference on Operational Research (SCOR'14).
Editors: Pedro Crespo Del Granado, Martim Joyce-Moniz, and Stefan Ravizza
OpenAccess Series in Informatics
OASICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

List of Authors

Akbari, Vahid
College of Engineering, Koc University
Istanbul, Turkey
vakbarighadkolaei@ku.edu.tr

Bendík, Ján
Faculty of Management Science and Informatics, University of Žilina
Univerzitná 8215/1, 010 26 Žilina, Slovak Republic
Jan.Bendik@fri.uniza.sk

Ceselli, Alberto
Dipartimento di Informatica, Università degli Studi di Milano
Via Bramante 65 – 26013 Crema (CR), Italy
alberto.ceselli@unimi.it

Chahed, Salma
HSCMG, Faculty of Science and Technology, University of Westminster
115 New Cavendish Street, London, W1W 6UW, UK
mohsen.mesgarpour@my.westminster.ac.uk

Chaussalet, Thierry
HSCMG, Faculty of Science and Technology, University of Westminster
115 New Cavendish Street, London, W1W 6UW, UK
mohsen.mesgarpour@my.westminster.ac.uk

Crone, Sven F.
Department of Management Science, Lancaster University
Lancaster LA1 4YX, United Kingdom
s.crone@lancaster.ac.uk

Dickson, Alex
Department of Economics, University of Strathclyde
130 Rottenrow, Glasgow, G4 0GE, UK
alex.dickson@strath.ac.uk

Gelmini, Alberto
Ricerca sul Sistema Energetico
RSE S.p.A., Via Rubattino 54 – 20134 Milano, Italy
alberto.gelmini@rse-web.it

Katsiampa, Paraskevi
Loughborough University
Loughborough, England
P.Katsiampa@lboro.ac.uk

Kunz, Timo P.
Department of Management Science, Lancaster University
Lancaster LA1 4YX, United Kingdom
t.p.kunz@lancaster.ac.uk

Mesgarpour, Mohsen
HSCMG, Faculty of Science and Technology, University of Westminster
115 New Cavendish Street, London, W1W 6UW, UK
mohsen.mesgarpour@my.westminster.ac.uk

Qazi, Abroon
Department of Management Science, University of Strathclyde
40 George Street, Glasgow, G1 1QE, UK
abroon.qazi@strath.ac.uk

Quigley, John
Department of Management Science, University of Strathclyde
40 George Street, Glasgow, G1 1QE, UK
j.quigley@strath.ac.uk

Righini, Giovanni
Dipartimento di Informatica, Università degli Studi di Milano
Via Bramante 65 – 26013 Crema (CR), Italy
giovanni.righini@unimi.it

Salman, Sibel
College of Engineering, Koc University
Istanbul, Turkey
ssalman@ku.edu.tr

Stutzki, Jan
Universität der Bundeswehr München
Werner-Heisenberg-Weg 39, Germany
jan.stutzki@unibw.de

4th Student Conference on Operational Research (SCOR'14).
Editors: Pedro Crespo Del Granado, Martim Joyce-Moniz, and Stefan Ravizza
OpenAccess Series in Informatics
OASICS Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany

Taverna, Andrea
Dipartimento di Matematica, Università
degli Studi di Milano
Via Saldini 50 – 20133 Milano, Italy
andrea.taverna@unimi.it

Varlas, Georgios
Department of Business Administration,
University of the Aegean
Michalon 8, Chios 82100, Greece
g.varlas@aegean.gr

Vidalis, Michael
Department of Business Administration,
University of the Aegean
Michalon 8, Chios 82100, Greece
m.vidalis@aegean.gr