Report on the 13th International Conference on Unconventional Computation and Natural Computation UCNC'14, London, Ontario, Canada, July 14-18, 2014

The conference series on Unconventional Computation and Natural Computation (UCNC) is centered on computation in its most general form, uncoupling it from the classical paradigms. UCNC is an interdisciplinary meeting where scientists with different backgrounds, yet sharing a common interest in novel forms of computation, human-designed computation inspired by nature, and the computational aspects of processes taking place in nature, present their latest theoretical or experimental results. Each year, the conference introduces new ideas that challenge the way we think about computation, with topics such as:

Molecular computing
Quantum computing
Optical computing
Chaos computing
Physarum computing
Hyperbolic space
    computation
Collision-based
    computing
Super-Turing
    computation

Cellular automata
Neural computation
Evolutionary
    computation
Swarm intelligence
Ant algorithms
Artificial immune
    systems
Artificial life
Membrane computing
Amorphous computing

Computational
    systems biology:
∘ genetic networks
∘ protein-protein
    networks
∘ transport networks
Computational
    neuroscience
Synthetic biology
Cellular (in vivo)
    computing

UCNC'14 is the thirteenth occurrence in this long-standing series. The first meeting was held in 1998 in Aukland, New Zealand, at the Centre for Discrete Mathematics and Theoretical Computer Science, and indeed the logo for the series was adopted from that of the centre. The series, initially named "Unconventional Models of Computation" and then "Unconventional Computation" was renamed "Unconventional Computation and Natural Computation" in 2012 and has been known by this appellation ever since. Other sites of the conference

were Brussels, Belgium (2000), Kobe, Japan (2002), Seville, Spain (2005), York, UK (2006), Kingston, Canada (2007), Vienna, Austria (2008), Ponta Delgada, Portugal (2009), Tokyo, Japan (2010), Turku, Finland (2011), Orléans, France (2012), and Milan, Italy (2013).

This year's vibrant conference edition took place in London, Ontario, Canada, in the Deparment of Computer Science of the University of Western Ontario, during the week of July 14–18, 2014. The Program Committee was co-chaired by Oscar H. Ibarra (U.S.A.) and Lila Kari (Canada), and the Organizing Committee was chaired by Lila Kari (Canada).

The high level of participation was foreshadowed by year-long detailed preparations, including wide advertizing and a visible social media presence on Facebook and Twitter. Lila Kari and her team created a top-notch conference experience, combining an exceptionally high scientific level with an inspiring discussion atmosphere that allowed senior researchers and novices to interact and new international cooperations to form. This was further enhanced by delicious food, attentiveness to all the needs of the participants (thanks to Cheryl McGrath and the Student Volunteer Team), and a first-rate social program.

UCNC'14 featured a set of captivating invited talks by outstanding speakers, internationally recognized as leaders with transformational contributions to their field: Yaakov Benenson – *Molecular Computing Meets Synthetic Biology*; Charles H. Bennett – *From Quantum Dynamics to Physical Complexity*; Hod Lipson – *The Robotic Scientist: Distilling Natural Laws from Experimental Data, from Cognitive Robotics to Computational Biology*; Nadrian C. Seeman – *DNA: Not Merely the Secret of Life – Using the Information in DNA to Control Molecular Structure.*

Since UCNC covers a large number of scientific areas, three distinguished speakers were invited to give tutorials focussed on introducing their field of research: Anne Condon – *Programming with Chemical Reaction Networks and DNA Strand Displacement Systems*; Ming Li – *Approximating Semantics*; Tommaso Toffoli – *Do We Compute to Live, or Live to Compute? Entropy pumps, evolution vs. emergence, and the risks of success.*

The conference has a long history of hosting workshops, and this year was no exception. UCNC'14 hosted three workshops: "DNA Computing by Self-Assembly" (organized by Matthew Patitz, with invited speakers Scott Summers and Damien Woods), "Computational Neuroscience" (organized by Mark Daley, with invited speaker Randy McIntosh), and "Unconventional Computation in Europe" (organized by Martyn Amos and Susan Stepney, with invited speaker Ricard Solé).

This year, in response to the Call for Papers, there were 79 articles submitted by authors from 30 countries. Each paper was reviewed by at least three referees and discussed by the members of the Program Committee. Finally, 31 papers were selected for oral presentation at the conference and inclusion in the conference proceedings which appeared as volume 8553 (2014) of *Lecture Notes in Computer Science*, (Oscar H. Ibarra, Lila Kari, Steffen Kopecki, Eds.) Springer Verlag. Selected papers will appear in a special issue of the journal *Natural Com-*

puting. The Program Committee awarded the prestigious UCNC'14 Best Paper Score Award to the two submissions tied for the highest review score: *Languages Associated with Crystallographic Symmetry* by Nataša Jonoska, Mile Krajcevski, and Gregory McColm, and *Pseudo-Inversion on Formal Languages* by Da-Jung Cho, Yo-Sub Han, Shin-Dong Kang, Hwee Kim, Sang-Ki Ko, and Kai Salomaa.

A total of around 120 participants attended the conference; they not only enjoyed the exciting invited talks, but also the oral presentations of the accepted papers covering a variety of fascinating new ideas in the topics of UCNC. The talks of the main conference took place in the Conron Hall of University College Building, offering a theatre-style environment that enhanced the atmosphere of the presentations. All participants stood in a moment of remembrance of Yurii Rogozhin, a computer scientist whose work (joint with Rudolf Freund and Artiom Alhazov) was presented at the meeting, but who passed away prior to the meeting taking place.

The social program started on Sunday, July 13, with a welcome reception in the Grad Club which brought together people for an informal discussion as well as viewing of the final match of the FIFA World Cup in Brazil. On Wednesday, the excursion brought the participants to the spectacular Niagara Falls. After a boat trip to the Falls, the conference banquet took place in the Skylon Tower, offering a great view of the Falls as well as excellent food. On Friday, the conference found a relaxing end at the Grad Club.

UCNC'14 received notable media coverage. The work on Super-Turing hardware development – presented by Arthur Steven Young, Emmett Redd, and Hava Siegelmann – was the topic of a *New Scientist* article titled "Turing's Oracle" and featured on the journal's cover. The article made note of UCNC'14, where the aforementioned work was first presented. The University of Western Ontario newspaper *Western News* also mentioned the conference, as did the local newspaper, *The London Free Press (LFP)*. The summary of the interviews with the invited speakers was part of a LFP July 17 article titled "Exploring the digital you", which introduced UCNC'14 to the readers as follows: *Forget smartphones, laptops and the Internet: The human body is the digital revolution's next frontier. Hank Daniszewski profiles what three of more than 100 participants at a London conference are up to, as they turn the stuff of science fiction into reality.* The full conference program and photo gallery can be found on the website of the conference, http://conferences.csd.uwo.ca/ucnc2014/.

The UCNC Annual General Meeting took place on Thursday, July 17, and was led by the UCNC Steering Committee Co-chair Nataša Jonoska. After the highly successful UCNC'14 in London, Ontario, the next edition of UCNC will take place at its place of origin in Auckland, New Zealand, at the beginning of September 2015.

Hava Siegelmann   *Rudolf Freund*
University of Massachusetts Amherst   Technische Universität Wien

UCNC'14

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Nadrian C. Seeman, Lila Kari

Da-Jung Cho
(Best Paper Score Award)

Lila Kari, Nataša Jonoska
(Best Paper Score Award)