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Machine Learning, Optimization, and Data Science

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Revised Selected Papers, Part I

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Preface

LOD is an international conference embracing the fields of machine learning, optimization, and data science. The seventh edition, LOD 2021, took place during October 4–8, 2021, in Grasmere (Lake District), UK. LOD 2021 was held successfully online and onsite to meet challenges posed by the worldwide outbreak of COVID-19. This year the scientific program of the conference was even richer than usual; LOD 2021 hosted the first edition of the Advanced Course and Symposium on Artificial Intelligence & Neuroscience – ACAIN 2021. In fact, this year, in the LOD proceedings we decided to also include the papers of the first edition of the Symposium on Artificial Intelligence and Neuroscience (ACAIN 2021). The symposium was scheduled for 2020, but due to the COVID-19 pandemic until we were forced to postpone it to 2021.

The review process for the papers submitted to ACAIN 2021 was double blind, performed rigorously by an international Program Committee consisting of leading experts in the field. The following three articles in this volume comprise the articles accepted to ACAIN 2021:

- Effect of Geometric Complexity on Intuitive Model Selection by Eugenio Piasini, Vijay Balasubramanian, and Joshua Gold.
- Training Convolutional Neural Networks with Competitive Hebbian Learning Approaches by Gabriele Lagani, Giuseppe Amato, Fabrizio Falchi, and Claudio Gennaro.
- Towards Understanding Neuroscience of Realisation of Information Need in Light of Relevance and Satisfaction Judgement by Sakrapee Paisalnan, Frank Pollick, and Yashar Moshfeghi.

Since 2015, the LOD conference has brought academics, researchers, and industrial researchers together in a unique multidisciplinary community to discuss the state of the art and the latest advances in the integration of machine learning, optimization, and data science to provide and support the scientific and technological foundations for interpretable, explainable, and trustworthy AI. In 2017, LOD adopted the Asilomar AI Principles.

The annual conference on machine Learning, Optimization, and Data science (LOD) is an international conference on machine learning, computational optimization, and big data that includes invited talks, tutorial talks, special sessions, industrial tracks, demonstrations, and oral and poster presentations of refereed papers.

LOD has established itself as a premier multidisciplinary conference in machine learning, computational optimization, and data science. It provides an international forum for presentation of original multidisciplinary research results, as well as exchange and dissemination of innovative and practical development experiences.

The manifesto of the LOD conference is as follows:

> "The problem of understanding intelligence is said to be the greatest problem in science today and "the" problem for this century – as deciphering the genetic code

was for the second half of the last one. Arguably, the problem of learning represents a gateway to understanding intelligence in brains and machines, to discovering how the human brain works, and to making intelligent machines that learn from experience and improve their competences as children do. In engineering, learning techniques would make it possible to develop software that can be quickly customized to deal with the increasing amount of information and the flood of data around us."

The Mathematics of Learning: Dealing with Data

Tomaso Poggio (MOD 2015 and LOD 2020 Keynote Speaker) and Steve Smale

"Artificial Intelligence has already provided beneficial tools that are used every day by people around the world. Its continued development, guided by the Asilomar principles of AI, will offer amazing opportunities to help and empower people in the decades and centuries ahead."

The Asilomar AI Principles

The Asilomar AI Principles were adopted by the LOD conference following their inception (January 3–5, 2017). Since then these principles have been an integral part of the manifesto of the LOD conferences.

LOD 2021 attracted leading experts from industry and the academic world with the aim of strengthening the connection between these institutions. The 2021 edition of LOD represented a great opportunity for professors, scientists, industry experts, and research students to learn about recent developments in their own research areas and to learn about research in contiguous research areas, with the aim of creating an environment to share ideas and trigger new collaborations.

As chairs, it was an honour to organize a premier conference in these areas and to have received a large variety of innovative and original scientific contributions.

During LOD 2021, 12 plenary talks were presented by leading experts:

LOD 2021 Keynote Speakers:

- Ioannis Antonoglou, DeepMind, UK
- Roberto Cipolla, University of Cambridge, UK
- Panos Pardalos, University of Florida, USA
- Verena Rieser, Heriot Watt University, UK

ACAIN 2021 Keynote Lecturers:

- Timothy Behrens, University of Oxford, UK
- Matthew Botvinick, DeepMind, UK
- Claudia Clopath, Imperial College London, UK
- Ila Fiete, MIT, USA
- Karl Friston, University College London, UK
- Rosalyn Moran, King's College London, UK
- Maneesh Sahani, University College London, UK
- Jane Wang, DeepMind, UK

LOD 2021 received 215 submissions from authors in 68 countries in five continents, and each manuscript was independently reviewed by a committee formed by at least

five members. These proceedings contain 86 research articles written by leading scientists in the fields of machine learning, artificial intelligence, reinforcement learning, computational optimization, neuroscience, and data science presenting a substantial array of ideas, technologies, algorithms, methods, and applications.

At LOD 2021, Springer LNCS generously sponsored the LOD Best Paper Award. This year, the paper by Zhijian Li, Bao Wang, and Jack Xin, titled "An Integrated Approach to Produce Robust Deep Neural Network Models with High Efficiency", received the LOD 2021 Best Paper Award.

This conference could not have been organized without the contributions of exceptional researchers and visionary industry experts, so we thank them all for participating. A sincere thank you goes also to the 41 subreviewers and to the Program Committee, comprising more than 250 scientists from academia and industry, for their valuable and essential work of selecting the scientific contributions.

Finally, we would like to express our appreciation to the keynote speakers who accepted our invitation, and to all the authors who submitted their research papers to LOD 2021.

October 2021

Giuseppe Nicosia
Varun Ojha
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Best Paper Awards

LOD 2021 Best Paper Award

"An Integrated Approach to Produce Robust Deep Neural Network Models with High Efficiency"
Zhijian Li[1], Bao Wang[2], and Jack Xin[1]
[1] University of California, Irvine, USA
[2] University of Utah, USA
Springer sponsored the LOD 2021 Best Paper Award with a cash prize.

Special Mention

"Statistical Estimation of Quantization for Probability Distributions: Best Equivariant Estimator of Principal Points"
Shun Matsuura[1] and Hiroshi Kurata[2]
[1] Keio University, Japan
[2] University of Tokyo, Japan

"Neural Weighted A*: Learning Graph Costs and Heuristics with Differentiable Anytime A*"
Alberto Archetti, Marco Cannici, and Matteo Matteucci
Politecnico di Milano, Italy

LOD 2021 Best Talk

"Go to Youtube and Call me in the Morning: Use of Social Media for Chronic Conditions"
Rema Padman[1], Xiao Liu[2], Anjana Susarla[3], and Bin Zhang[4]
[1] Carnegie Mellon University, USA
[2] Arizona State University, USA
[3] Michigan State University, USA
[4] University of Arizona, USA

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