

Preface to the CLEI 2024 Special Issue (Volume I)

This special issue of the CLEI Electronic Journal is devoted to extended and revised papers of selected works presented at the 50th Latin American Computing Conference (CLEI 2024), held at the Universidad Nacional del Sur, SADIO - Bahía Blanca, Argentina, from the 12th to the 16th of August, 2024.

The CLEI 2024 conference included five tracks on different computer science and informatics areas and a series of associated events, and was co-located with the 53rd Jornadas Argentinas de Informática (JAIIO 53).

The five research tracks at CLEI 2024 focused on the state-of-the-art in different fields: Computer Science Education, Computer Technology, Intelligent Systems, Software Systems, and Systems In Practice.

The associated events organized within CLEI 2024 were:

- III Latin American School in Informatics (ELI)
- XVI Latin American Congress of Women in Computing (LAWCC)
- XXXI Latin American Contest of Master's Thesis (CLTM)
- X Latin American Contest of Doctoral Thesis (CLTD)
- 13th Latin American Networking Conference (LANC)
- II Workshop on Cybersecurity in Latin America and the Caribbean (CIBERLAC)
- I Latin American Workshop in Quantum Software Engineering (TLISC)

CLEI 2024 received a total of 268 submissions across its main research tracks, comprising 207 full papers and 61 short work-in-progress papers. From these submissions, 96 were accepted for publication, resulting in an acceptance rate of 35% overall. Following the conference and based on their evaluations by the conference General Chairs and this special issue's guest editors, the authors of the 24 selected papers from the five research tracks were invited to extend their work and submit it to this special issue. Of these, 18 papers were extended and submitted, and went through a new review process with invited reviewers from CLEI 2024 and the wider academic community. As a result of the reviewing process, the following seven papers were accepted to appear in this first volume. A second volume will follow with the remaining accepted papers.

In the following paragraphs, the articles of this first volume are presented in order of publication:

"A Pipeline for Multivariate Time Series Forecasting of Gas Consumption in Pelletization Process": This study investigates the application of a multivariate time series forecasting pipeline for predicting gas consumption in pelletizing plants. The pipeline consists of: (i) data preprocessing, (ii) conversion of the dataset into a tabular format, (iii) application of feature selection methods, and (iv) application of machine learning tuned via AutoML. The methodology was tested on an industrial plant. Two AutoML approaches were used: neural architecture search using AutoKeras and the DEAP (Distributed Evolutionary Algorithm) framework. The DEAP framework in combination with LSTM networks achieved the best performance. This optimized the use of computational resources and allowed faster model adaptation. These results confirm the generalizability of the pipeline and its applicability in different industrial environments.

"AI-Based Point Cloud Upsampling for Autonomous Driving Systems": Autonomous driving is transforming the automotive industry, but high-end LiDAR sensors for perception remain expensive and computationally intensive. This work presents an interpolation-based method to enhance low-cost LiDAR sensors, aiming to match the performance of 64-channel systems. The approach includes LiDAR data analysis, an interpolation technique using 1D convolutional and fully connected layers, and evaluation through PR curves. Results show detection and classification improvements between 1.92% and 30.98%.

"Developing an Ontology to Enhance Semantic Interoperability in IoT Environments": This paper describes the development and validation of IoTO++, an enhanced ontology designed to improve semantic interoperability within Internet of Things (IoT) environments. The paper addresses limitations of existing IoT ontologies by

incorporating aspects such as interoperability, security, privacy, energy efficiency and ethics. Through a rigorous development and evaluation methodology, the paper provides evidence of IoTO++'s competence and quality.

“Enhancing Real-Time Detection Transformer (RT-DETR) for Handgun Detection on Nvidia Jetson”: This paper addresses the increasing concern over firearm-related violence and the need for effective public safety solutions through real-time handgun detection systems. It focuses on the development and evaluation of advanced object detection models based on Transformer architectures, particularly building upon the Real-Time Detection Transformer (RT-DETR) and its enhanced version, RT-DETR v2. The proposed improvements include the integration of the Bidirectional Feature Pyramid Network (BiFPN), which significantly boosts the detection of small objects. Additionally, the authors introduce dynamic batch processing, allowing the model to optimize computational efficiency and resource use, especially on edge devices such as the Nvidia Jetson AGX Xavier, making the system viable for real-time, on-site deployment. To validate performance, the model is benchmarked against state-of-the-art detectors like YOLOv10.

“Exploring Alternative Microservice Decompositions using Data-driven Techniques and LLMs”: This paper proposes the combination of data-driven techniques and LLMs to help software developers navigate microservice decomposition alternatives generated by automated tools for monolithic applications. The LLM-powered semantic layer allows developers to ask natural language questions about decompositions and receive textual and graphical answers. This approach is designed to help developers understand and interpret the landscape of possible decompositions produced by automated tools and its effectiveness is demonstrated using two real-world case studies.

“Ontological Concepts of Non-Functional Requirements Applied to Particular Situations in Measurement and Evaluation Projects”: This paper explores the ontology of Non-Functional Requirement (NFRs) within a five-tier ontological architecture for knowledge specification, placing NFRs at the top-domain level. In this framework, NFRs are not seen as tangible entities but rather as human assertions about qualities or constraints of a system that need to be evaluated. These assertions may apply not only to individual entities but also to categories of entities—universal abstractions—allowing the consideration of NFRs for classes and their instances. To demonstrate the real-world relevance and application of this ontological model, the paper discusses three case studies involving measurement and evaluation scenarios.

“Solving implementation issues of Permutation Monte Carlo in different network reliability contexts”: Reliability estimation in networks with probabilistic link failures is an NP-hard problem, so Monte Carlo estimation methods are widely used. This work proposes a reformulation of the Permutation Monte Carlo method, which is highly numerically unstable in large networks, to improve its numerical stability. It also introduces a specialized implementation for homogeneous networks, where all links share the same probability of failure. Experimental results demonstrate that the proposal improves the computational efficiency and accuracy of reliability estimation.

We would like to thank the CLEI 2024 Track Chairs for their great work throughout the paper reviewing process and played a crucial role in evaluating and selecting the papers invited to extend their work for this special issue: Alejandra Garrido and Breno Miranda (Software Systems Track), Ana Maguitman, Silvio Gonnet and Carlos Brizuela (Intelligent Systems), Jessica Carballido, Pablo Turjanski and Diego Pedro Pinto Roa (Systems in Practice), Javier Orozco, Patricia Bazán and Jesús Carretero (Computer Technologies) and Ismar Frango and María Gómez (Computer Science Education).

We also wish to express our sincere gratitude to all the reviewers who generously volunteered their time and expertise to evaluate the content and quality of the papers included in this special issue.

Lastly, we thank all the authors for accepting our invitation to extend and revise their conference submissions, enhancing their papers with the conference reviewers' feedback to produce these high-quality extended versions of their work.

We hope you find this special issue as enriching and enjoyable as we do, as it contributes to the dissemination of important research from our Latin American community.

José Aguilar, Universidad de Los Andes, Venezuela; IMDEA Networks Institute, Spain

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CLEIej Guest Editors for CLEI 2024 Special Issue