

# Preface to the Proceedings of the 1<sup>st</sup> International Workshop on Computational Intelligence for Process Mining (CI4PM 2022) and 1<sup>st</sup> International Workshop on Pervasive Artificial Intelligence (PAI 2022)

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This CEUR-WS volume contains the joint proceedings of two workshops on the domain of computational intelligence: the first International Workshop on Computational Intelligence for Process Mining (CI4PM 2022) and the first International Workshop on Pervasive Artificial Intelligence (PAI 2022). Both events were co-located with the fortieth IEEE International Joint Conference on Neural Networks (IJCNN 2022), organized within the twelfth IEEE World Congress on Computational Intelligence (WCCI 2022).

The University of Padua (Università degli Studi di Padova) served as the hosting institution for WCCI 2022, which took place between the 18<sup>th</sup> and the 23<sup>rd</sup> of July 2022 in Padua, Italy. The accepted papers of CI4PM were presented on the 18<sup>th</sup> of July, while accepted papers of PAI were presented on the 19<sup>th</sup> of July.

Additional information on the individual events, accepted papers, and the respective committees can be found on the following pages.

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## International Workshop on Computational Intelligence for Process Mining (CI4PM 2022)

The goal of the CI4PM workshop is to facilitate the idea exchange between experts in the area of business process mining and Computational Intelligence, and to provide visibility to the ample research direction that merges the two fields—typically, the application of techniques from the area of computational intelligence to problems and questions characteristic of the field of event data analysis. The event aimed to collect and provide visibility to research ideas that combine computational intelligence approaches to problems in process sciences. The focus was on the use of methods from, e.g., intelligent, heuristic, and evolutionary computing to manage and analyze event data. The final goal was to untap the potential of computational intelligence to solve open problems in process mining, such as predictive process monitoring, design of process-aware recommendation systems, and learning techniques for event and trace abstractions in process mining.

The work of medium-large enterprises is typically governed by business processes that are carried on through a number of information systems. These systems also exchange information with those of external enterprises. The execution of processes via information systems and the data exchange between organizations leaves trails in an ocean of process data. The analysis of this big data enables process stakeholders to gain insights into how processes are really being executed, pinpointing the issues that are typically encountered. The analysis is the first step towards process improvement: the acquired insights need to be actionable and concretely provide directions to ensure a more efficient process execution.

Process Mining is a field of research that aims to analyze event data to ultimately improve how processes are executed. The third execution of the International Conference on Process Mining attracted more than 300 participants “under the same roof” at the end of October 2021, both from the academic and industry sectors. This testifies how Process Mining is gaining more and more momentum: its intrinsic power makes processes and the running organizations more effective and able to win over the potential competitors. More and more software vendors are adding process mining functionality to their tools. Process Mining is closely linked to computation intelligence in that they both aim at computation methods that predominantly rely on data and put human knowledge aside. While Process Mining and Computational Intelligence have shown to be successful *per se*, their ensemble can uncover invaluable potentials. Techniques from the Computational Intelligence domain can be extended and specialized to answer typical business and research questions of the Process Mining domain, e.g. to build process monitoring and recommendation systems, to discover process models, to develop conformance-checking techniques and to correlate process behavior and quantities of interest. Process Mining can provide a new repertoire of research questions, application domains, and showcase to the research area of Computational Intelligence.

Three papers were accepted for publication and presented in the CI4PM workshop:

- Thais Rodrigues Neubauer, Alexandre Gastaldi Lopes Fernandes, Marcelo Fantinato and Sarajane Marques Peres. Interactive Trace Clustering to Enhance Incident Completion Time Prediction in Process Mining.
- Jonghyeon Ko and Marco Comuzzi. Pattern-based Reconstruction of Anomalous Traces

in Business Process Event Logs.

- Alexandre Gastaldi Lopes Fernandes, Thais Rodrigues Neubauer, Marcelo Fantinato and Sarajane Marques Peres. Impact of Non-Fitting Cases for Remaining Time Prediction in a Multi-Attribute Process-Aware Method.

For more information about the CI4PM workshop, please visit <http://ci4pm.science/><sup>1</sup>.

The organizers of CI4PM wish to acknowledge and thank all authors that submitted their work, the CI4PM Program Committee members for their help in reviewing the submissions, and the local organization and chairs of IJCNN and WCCI for making the event possible.

August 2022

Andrea Burattin  
Massimiliano de Leoni  
Marco Pegoraro

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<sup>1</sup>Backup link: <http://mpegoraro.net/ci4pm/2022>

## International Workshop on Pervasive Artificial Intelligence (PAI 2022)

Artificial intelligence (AI) is becoming a pervasive technology in ICT systems development, as well as for its presence in products and services of daily use. In particular, a pervasive use of neural-based methodologies and technologies comes at the cost of increased functional and non-functional requirements related to fundamental properties, such as energy efficiency, ability to continuously adapt to changing conditions and tasks, dependability, security and human-machine interactivity. Such requirements, while compelling, can also be seen as research opportunities to design and develop novel neural network methodologies and architectures which are efficient and effective in meeting such requirements, e.g., developing continual learning strategies for lifelong adaptation, or randomized networks to facilitate learning on constrained devices. Pervasiveness has another side of the coin linked to the need of developing computing and communication technologies specifically meant to support deployment and execution of neural models, e.g., neuromorphic hardware, or high-performance computing for AI acceleration. The PAI workshop provided a first forum of scientific discussion and dissemination for a community and works bringing together the two aspects of the coin, under the umbrella of Pervasive Artificial Intelligence. The workshop hosted contributions related to both novel AI methodologies, models and applications in pervasive scenarios, as well as computing and communication abstractions, infrastructures and applications for AI. Special attention was devoted to contributions tackling the theme of sustainable AI and resulting from academia-industry collaborations.

The PAI workshop included two invited talks:

- “Lifelong visual representation learning”, by Diane Larlus (Naver Labs Europe, France)
- “Temporal Prediction via Temporal Neural Networks”, by Hava T. Siegelmann (University of Massachusetts Amherst, USA)

Three full-length papers were accepted for presentation in the PAI workshop:

- Rudy Semola, Vincenzo Lomonaco and Davide Bacciu. Continual-Learning-as-a-Service (CLaaS): On-Demand Efficient Adaptation of Predictive Models.
- Antonio Carta, Giacomo Carfi, Valerio De Caro and Claudio Gallicchio. Efficient Anomaly Detection on Temporal Data via Echo State Networks and Dynamic Thresholding.
- Deepak Ramegowda and Man Lin. Making FreeRTOS Pervasive Systems Learn to Select Energy Saving Technique for Mixed Taskset.

Six short papers were accepted for presentation in the PAI workshop:

- Jan Philip Göpfert and Christina Göpfert. Boundary-aware visualizations of deep classifiers using adversarial signposting.
- Charalampos Davalas, Dimitrios Michail, Christos Diou, Iraklis Varlamis and Konstantinos Tserpes. A Cloud-based Continual Learning System for Road Sign Classification in Autonomous Driving.

- Claudio Gallicchio and Miguel Cornelles Sorniano. Hardware-Friendly Deep Reservoir Computing.
- Gianluca Milano, Matteo Agliuzza, Natascia De Leo and Carlo Ricciardi. Physical reservoir computing with memristive nanonetworks.
- Claudio Gallicchio. Minimal Euler State Networks.
- Andrea Ceni and Claudio Gallicchio. Orthogonality in Additive Reservoir Computing.

Of these works, the following are novel papers published in this proceedings volume:

- Rudy Semola, Vincenzo Lomonaco and Davide Bacciu. Continual-Learning-as-a-Service (CLaaS): On-Demand Efficient Adaptation of Predictive Models.
- Antonio Carta, Giacomo Carfi, Valerio De Caro and Claudio Gallicchio. Efficient Anomaly Detection on Temporal Data via Echo State Networks and Dynamic Thresholding.
- Deepak Ramegowda and Man Lin. Making FreeRTOS Pervasive Systems Learn to Select Energy Saving Technique for Mixed Taskset.
- Charalampos Davalas, Dimitrios Michail, Christos Diou, Iraklis Varlamis and Konstantinos Tserpes. A Cloud-based Continual Learning System for Road Sign Classification in Autonomous Driving.

For more information about the PAI workshop, please visit <http://pai.di.unipi.it/paiw2022/>.

The organizers of PAI wish to acknowledge and thank all authors that submitted their work, the PAIW Program Committee members for their help in reviewing the submissions, and the local organization and chairs of IJCNN and WCCI for making the event possible. The workshop activities have been supported by the TEACHING project funded by the EU Horizon 2020 under GA n. 871385.

August 2022

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## **PAI 2022 Committees**

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Patrizio Dazzi	Consiglio Nazionale delle Ricerche, Italy
Magdalini Eirinaki	San Jose State University, USA
Iraklis Varlamis	Harokopio University of Athens, Greece

### **Invited Speakers**

Diane Larlus	Naver Labs Europe, France
Hava T. Siegelmann	University of Massachusetts Amherst, USA

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