



## First Workshop about the SparCity framework and the modeling tools

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List of partners:

Participant no.	Participant organisation name	Short name	Country
1 (Coordinator)	Koç University	KU	Turkey
2	Sabancı University	SU	Turkey
3	Simula Research Laboratory AS	Simula	Norway
4	Instituto de Engenharia de Sistemas e Computadores, Investigação e Desenvolvimento em Lisboa	INESC-ID	Portugal
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6	Graphcore AS	Graphcore	Norway

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# 1 INTRODUCTION

The SPARCITY project is funded by EuroHPC JU (the European High Performance Computing Joint Undertaking) under the 2019 call of Extreme Scale Computing and Data Driven Technologies for research and innovation actions. SPARCITY aims to create a supercomputing framework that will provide efficient algorithms and coherent tools specifically designed for maximizing the performance and energy efficiency of sparse computations on emerging High Performance Computing (HPC) systems, while also opening up new usage areas for sparse computations in data analytics and deep learning.

Sparse computations are commonly found at the heart of many important applications, but at the same time it is extremely challenging to achieve high performance when performing the sparse computations. SPARCITY delivers a coherent collection of innovative algorithms and tools for enabling high efficiency of sparse computations on emerging hardware platforms. More specifically, the objectives of the project are:

- to develop a comprehensive application and data characterization mechanism for sparse computation based on the state-of-the-art analytical and machine-learning-based performance and energy models,
- to develop advanced node-level static and dynamic code optimizations designed for massive and heterogeneous parallel architectures with complex memory hierarchy for sparse computation,
- to devise topology-aware partitioning algorithms and communication optimizations to boost the efficiency of system-level parallelism,
- to create digital SuperTwins of supercomputers to evaluate and simulate what-if hardware scenarios,
- to demonstrate the effectiveness and usability of the SPARCITY framework by enhancing the computing scale and energy efficiency of challenging real-life applications.
- to deliver a robust, well-supported and documented SPARCITY framework into the hands of computational scientists, data analysts, and deep learning end-users from industry and academia.

## 1.1 OBJECTIVES OF THIS DELIVERABLE

The objective of this deliverable is to describe the efforts in organizing the First Workshop about the SparCity framework and the modeling tools. The workshop will be held as the “Workshop on Machine Learning Techniques for Software Development and Optimization (MLOpt 2023)” on Monday Jan. 16, 2023 at the HiPEAC conference in Toulouse, France. To foster collaboration between EuroHPC projects, the workshop is co-organized with the DComEX project and centers around the cross-cutting theme of Machine Learning Techniques for Software Development and Optimization. The workshop co-organizers are Karl Furlinger (SparCity) and George Stavroulakis (DComEX).

## 1.2 WORK PERFORMED

### 1.2.1 TOPIC OF THE WORKSHOP

Machine learning and AI techniques for program development and optimization has been chose as a topic for the workshop because these technologies have shown considerable promise in

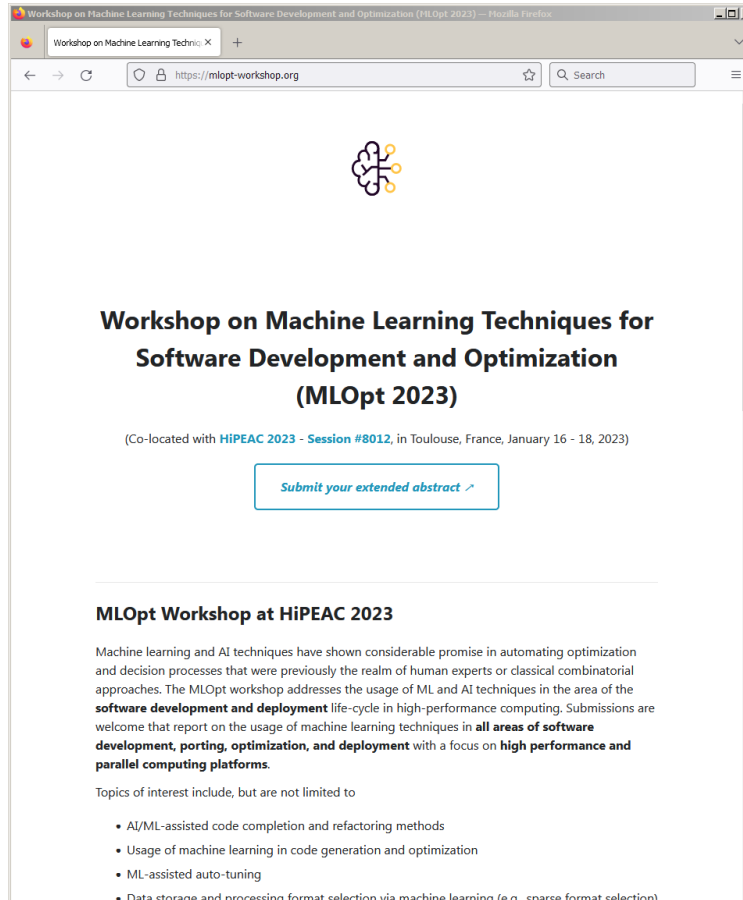


Figure 1 Screenshot of the MLOpt Workshop Webpage.

automating optimization and decision processes that were previously the realm of human experts or classical combinatorial approaches. The workshop addresses the usage of ML and AI techniques in the area of the software development and deployment life-cycle in high-performance computing. Submissions are welcome that report on the usage of machine learning techniques in all areas of software development, porting, optimization, and deployment with a focus on high performance and parallel computing platforms.

### 1.2.2 ADVERTISEMENT OF THE WORKSHOP

A website for the workshop was created at <https://mlopt-workshop.org/> in addition to the session webpage created at the HiPEAC website (<https://www.hipeac.net/2023/toulouse/#/program/sessions/8012/>).

The workshop was advertised on the WikiCFP website (<http://www.wikicfp.com/>) and via the [hpc-announce@mcs.anl.gov](mailto:hpc-announce@mcs.anl.gov) and [mycolleagues@mailman.ufsc.br](mailto:mycolleagues@mailman.ufsc.br) mailing lists. A screenshot of the workshop webpage as of November 30, 2022 is shown in Fig. 1.

### 1.2.3 SUBMISSION AND REVIEW PROCESS

To support the presentation of work-in-progress results, especially from students and early-career researchers, the workshop seeks submissions of two-page extended abstracts, formatted in IEEE Conference Proceedings format. There are no published proceedings from the workshop participation but the extended abstracts will be made available to workshop participants to foster

discussion during the event.

Submissions for the workshop are encouraged for the following topics:

- AI/ML-assisted code completion and refactoring methods
- Usage of machine learning in code generation and optimization
- ML-assisted auto-tuning
- Data storage and processing format selection via machine learning (e.g., sparse format selection)
- Dynamic algorithm selection and tuning using ML approaches
- ML-guided automated scheduling in runtime systems
- ML-techniques in performance and correctness tools (e.g., automated data analysis)
- Data driven and ML enhanced mathematical models and algorithms improving energy efficiency, robustness and scalability for extreme computational mechanics problems

To ensure a fair and balanced workshop program, each submission will be reviewed by at least two members of the MLOpt workshop program committee. The program committee members are recruited from the two organizing project consortia but also contain external experts.

- Kamer Kaya (Sabancı University, Turkey)
- Didem Unat (Koç University, Turkey)
- Xing Cai (Simula Research Laboratory, Norway)
- Johannes Langguth (Simula Research Laboratory, Norway)
- Aleksandar Ilic (INESC-ID, Portugal)
- Leonel Sousa (INESC-ID, Portugal)
- Karl Fuerlinger (LMU Munich, Germany)
- Vissarion Papadopoulos (National Technical University of Athens)
- George Stavroulakis (National Technical University of Athens)
- Benjamin Cumming (Swiss National Supercomputing Centre)
- Triantafyllos Stylianopoulos (University of Cyprus)
- Ilias Hatzakis (Greek Research and Technology Network)
- Ali Jannesari (Iowa State University, USA)

#### 1.2.4 WORKSHOP PROGRAM

The workshop program is not available at the time of submission of this deliverable, as the extended-abstract submission deadline for the MLOpt workshop is Nov 30, 2022 (anywhere on earth). We will report on the workshop program in the next Communication and Dissemination Report and/or together with Deliverable 7.9, covering the Second Workshop about the SparCity framework and the modeling tools.

### 1.2.5 REPORT FROM THE WORKSHOP

We will include a report from the workshop in the next Communication and Dissemination Report and/or together with Deliverable 7.9, covering the Second Workshop about the SparCity framework and the modeling tools.

### 1.3 DEVIATIONS AND COUNTER MEASURES

Due to the limited number of suitable venues to host our workshop, it was not possible to hold the workshop before the deliverable submission deadline. The workshop will be held on Monday Jan. 16, 2023 as a session at the HiPEAC conference. HiPEAC is an excellent venue for the workshop because of the large number of people attending and the excellent visibility across academia and industry of events held there. We will include a report about the workshop in the next Communication and Dissemination Report and/or together with Deliverable 7.9, covering the Second Workshop about the SparCity framework and the modeling tools.

### 1.4 RESOURCES

The workshop webpage can be found here: <https://mlopt-workshop.org/>. The corresponding website for the MLOpt session at the HiPEAC 2023 conference (session 8012) is located here: <https://www.hipeac.net/2023/toulouse/#/program/sessions/8012/>.