

Fast Machine Learning for Science Workshop @ ICCAD 2023

Organizers:

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Nhan Tran, Fermilab and Northwestern University <ntran@fnal.gov>

Paolo D'Alberto, AMD

Ryan Kastner, UC San Diego

Miaoyuan Liu, Purdue University

Seda Ogrenci, Northwestern University



Accelerated AI
Algorithms for
Data-Driven
Discovery

Reminders

- Speakers, please send us your final slides for uploading to our workshop webpage: <https://fastmachinelearning.org/iccad2023/program.html>
 - Thank you to those that have already done so!
- Please follow the [IEEE code of conduct](#):
 - Be respectful of others
 - Treat people fairly
 - Avoid injuring others, their property, reputation or employment
 - Refrain from retaliation
 - Comply with applicable laws
- Today's schedule:

	Sculptor	Artisan	Salon I	Salon II	Atelier I & II
7:30 - 8:00	Breakfast (3rd Floor Foyer)				
8:00 - 10:00	Fast ML for Science	System Level Interconnect Path Finding	VLSI Education Community	Zero Trust Hardware Architectures	SUSHI
10:00 - 10:30	Coffee Break (3rd Floor Foyer)				
10:30 - 12:00	Fast ML for Science	System Level Interconnect Path Finding	VLSI Education Community	Zero Trust Hardware Architectures	SUSHI
12:00 - 13:00	Lunch (Buffet: 3rd Floor Foyer - Meals to be taken back to breakout rooms)				
13:00 - 15:00	Fast ML for Science	System Level Interconnect Path Finding		Zero Trust Hardware Architectures	SUSHI
15:00 - 15:30	Coffee Break (3rd Floor Foyer)				
15:30 - 17:00	Fast ML for Science	System Level Interconnect Path Finding		Zero Trust Hardware Architectures	SUSHI

Introduction

- Welcome to Fast Machine Learning for Science Workshop @ ICCAD!
- Builds on ideas in "[Applications and Techniques for Fast Machine Learning in Science](#)" [white paper](#) and corresponding Fast Machine Learning for Science conference series
 - 2023 @ Imperial College: <https://indico.cern.ch/e/fastml2023>
 - 2022 @ SMU: <https://indico.cern.ch/e/fml2022>
 - 2020 online: <https://indico.cern.ch/event/924283/>
 - 2019 @ Fermilab: <https://indico.cern.ch/event/822126/>



Fast Machine Learning for Science
Real-time and accelerated ML for fundamental sciences
Imperial College London
25-28 September 2023

Scientific Committee
Tao Aamodt (ETH Zurich)
Javier Duarte (UCSD)
Phil Harris (MIT)
Burt Holzman (Fermilab)
Scott Hucks (U. Washington)
Shih-Chieh Hsu (U. Washington)
Sergio Jindariani (Fermilab)
Mia Liu (Purdue University)
Alison McCam Delaine (Southern Methodist University)
Mark Neubauer (U. Illinois Urbana-Champaign)
Jennifer Ngadike (Fermilab)
Mauricio Pellen (CERN)
Sven Seifert (CERN)
Alex Tapper (Imperial College)
Nhan Tran (Fermilab)

Organizing Committee
Sanku Aibaruk
Robert Bamberger
David Colling
Patrick Dornan
Wayne Luk
Andrew Rose
Sven Seifert (co-chair)
Alex Tapper (co-chair)
Yoshi Ueda
Isamu Yoneda

indico.cern.ch/e/fastml23
fastmachinelearning.org





FAST MACHINE LEARNING FOR SCIENCE
SOUTHERN METHODIST UNIVERSITY
OCTOBER 3-4, 2022

ORGANIZING COMMITTEE
MOHAMED ABDEL-ILIA
SOUTHERN METHODIST UNIVERSITY
SUSHI MUKAI
SOUTHERN METHODIST UNIVERSITY
TOMOKO OGI
SOUTHERN METHODIST UNIVERSITY
KYLEEN MCCORMACK
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FRED LI NEEL
SOUTHERN METHODIST UNIVERSITY
DANIELA PARALE
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EDGARD TREIBER
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SCIENTIFIC COMMITTEE
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JAMES DAVIES
UNIVERSITY OF CALIFORNIA SAN DIEGO
PHIL HARRIS
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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UNIVERSITY OF WASHINGTON
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INTERNATIONAL ACCELERATOR LABORATORY
SERGIO JINDARIANI
UNIVERSITY OF WASHINGTON
MIA LIU
PURDUE UNIVERSITY
MARK NEUBAUER
UNIVERSITY OF ILLINOIS
JENNIFER NGADIKE
CERN
MAURICIO PELLEN
CERN
SVEN SEIFERT
CERN
ALEX TAPPER
INTERNATIONAL ACCELERATOR LABORATORY
NHAN TRAN
INTERNATIONAL ACCELERATOR LABORATORY

Scan the QR Code and the link below for registration information
<https://indico.cern.ch/e/fml2022>


FAST MACHINE LEARNING FOR SCIENCE
A Virtual Event Hosted by Southern Methodist University at Dallas, Texas
November 30 to December 3



Organizing Committee:
Alison Delaine (SMU)
Robin Narayan (SMU)
Thomas Coan (SMU)
Elizabeth Feider (SMU)

Scientific Committee:
Javier Duarte (UCSD)
Phil Harris (MIT)
Burt Holzman (Fermilab)
Scott Hucks (U. Washington)
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Mia Liu (Purdue University)
Alison McCam Delaine (SMU)
Mark Neubauer (UIC)
Mauricio Pellen (CERN)
Nhan Tran (Fermilab)

REGISTER AND MORE INFORMATION
<http://indico.cern.ch/e/fml2020>

World Changers Shaped Here 

Fast Machine Learning
September 10-13, 2019 at Fermilab

Sept. 10-11
IRIS-HEP Blueprint Meeting

Sept. 12-13
Developer Bootcamp





Accelerating ML in science:
Ultrafast on-detector inference and real-time systems
Acceleration as-a-service
Hardware platforms
Coprocessor technologies (CPU/GPU/TPU/FPGAs)
Distributed learning



Local Organization:
Gabriel Benati (Brown U.)
Javier Duarte (Fermilab)
Lindsay Gray (Fermilab)
Mia Liu (Fermilab)
Kevin Pardo (Fermilab)
Alex Tapper (CERN)
Zhenhui Wu (U. Illinois Chicago)

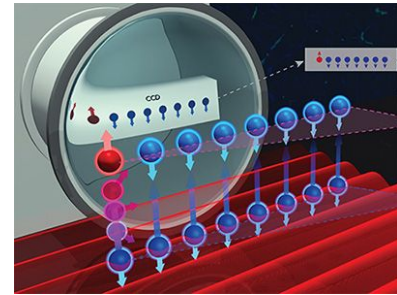
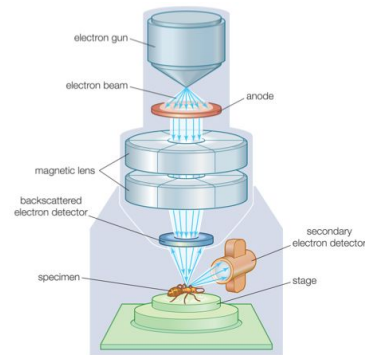
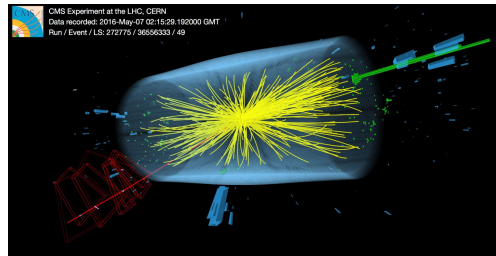
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Mark Neubauer (U. Illinois Urbana-Champaign)
Nhan Tran (Fermilab)

<https://indico.cern.ch/e/FML>



Background

- Scientific applications across particle physics, astrophysics, material sciences, quantum information sciences, fusion energy (and beyond!) utilize data acquisition and in situ processing systems which require very low latency and high data bandwidth custom processing elements and real-time control modules
- Integrating data reduction and control applications with real-time machine learning algorithms can enable significant breakthroughs in the sciences



Goals

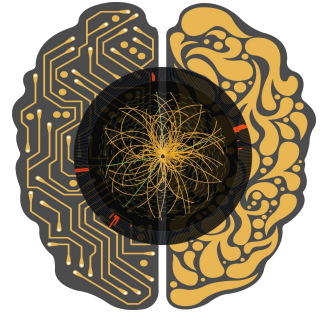
- Address emerging challenges and explore innovative solutions in the field of computer-aided design (CAD) for integrated circuits and systems for ultra low latency and high bandwidth scientific applications
- Bring together researchers, practitioners, and industry experts to exchange ideas, share applications, and discuss the latest advancements in CAD methodologies, algorithms, and tools, and **forge new connections**



Program

Invited

- Community Vision, Needs, and Progress
- Design Tools Perspective: Catapult + HLS4ML for Inference at the Edge
- Designing Hardware for Machine Learning
- Design Tools Perspective: AMD
- Fast ML in the NSF A3D3 Institute
- Real-time ML at the Linac Coherent Light Source



Contributed

- Robust and Efficient Machine Learning for Mission-Critical Applications
- Quantifying the Efficiency of High-Level Synthesis for Machine Learning Inference
- TT-QEC: Transferable Transformer for Quantum Error Correction Code Decoding
- Benchmarking the Robustness of Neural Network-based Partial Differential Equation Solver
- Smart pixel sensors: towards on-sensor filtering of pixel clusters with deep learning
- FKeras: A Sensitivity Analysis Tool for Edge Neural Networks
- FPGA Deployment of LFADS for Real-time Neuroscience Experiments
- Toward Reinforcement Learning-based Rectilinear Macro Placement Under Human Constraints
- ResilienQ: Boosting Fidelity of Quantum State Preparation via Noise-Aware Variational Training