The 5th IML Machine Learning Workshop

Andrea Wulzer, Anja Butter, David Rousseau, **Fabio Catalano**, Gian Michele Innocenti, Lorenzo Moneta, Michael Aaron Kagan, Pietro Vischia, Riccardo Torre, Simon Akar

9-13 May 2022

The IML

"The Inter-experimental Machine Learning (IML) Working Group **provides a forum** for the machine learning community at the LHC. It **brings together** scientists from the LHC experiments, **connects** them to the data science community, **fosters** inter-experimental common solutions, and **provides** training and benchmarks."

(from the mandate on our webpage https://iml.web.cern.ch/)

➢ Monthly meetings on a variety of subjects
  ○ https://iml.web.cern.ch/meetings

➢ Meetings and other events are advertised in our mailing list
  ○ Self-subscription link available at https://iml.web.cern.ch/forum

IML coordinators

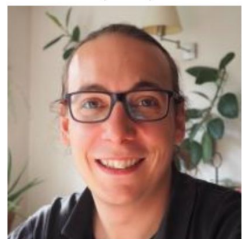Fabio Catalano (ALICE)

New!

Lorenzo Moneta (SFT)
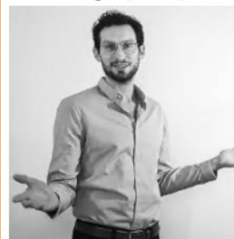
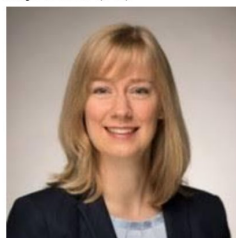Pietro Vischia (CMS)

Simon Akar (LHCb)

Riccardo Torre (TH)

Michael Kagan (ATLAS)

New!

Anja Butter (TH)

New!

➢ Contact us at iml.coordinators@cern.ch if you wish to present at one of our meetings

Advertisement ー PHYSTAT-Anomalies
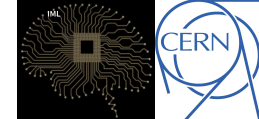
PHYSTAT-Anomalies

24–25 May 2022
Europe/Zurich timezone

Enter your search term 🔍

- Overview
- Timetable
- Contribution List
- Registration
- Participant List
- Videoconference
- Reading Material
- Introduction to Particle Physics for Statisticians

A workshop on model independent searches, bringing together physicists and statisticians

With higher accelerator energies and beam intensities, searches for New Physics (NP) have been a very active area. While there is motivation for NP, so far model-driven searches have successfully excluded increasing volumes of parameter space, but not yielded evidence for new particles. This has led, over the last few years, to the development of model-independent searches. By now, they have become a useful complement to traditional approaches targeting some specific form of NP. In many of the new searches, Machine Learning has played an important role. The aim of this meeting is to compare and contrast the assumptions and performance on these approaches, and to see what can be learned from Goodness of Fit methodology. This meeting will bring together physicists who are active in this field, those who want to be involved in the future, and Statisticians, to discuss the relevant issues.

The meeting is on 24th and 25th May 2022, and will be remote. The PHYSTAT Seminar on 27th April by Mikael Kuusela (CMU) on "Model-Independent Detection of New Physics Signals Using Interpretable Semi-Supervised Classifier Tests" is also part of the PHYSTAT-Anomalies meeting. See https://indico.cern.ch/event/1148820/

➢ PHYSTAT-Anomalies meeting on 24-25 May https://indico.cern.ch/event/1138933/

➢ Held online

➢ Register if interested!

The workshop

"Each spring IML organizes an annual workshop typically comprised of roughly 300 participants, which includes invited data scientists' talks, submitted talks, and tutorials."

➢ First time we meet in person in a while!
  ○ Last year workshop postponed, year before workshop fully virtual
  ○ 537 registered participants from many continents!
  ○ 66 contributions (tutorials, plenary, workshop)

➢ This edition is in hybrid mode
  ○ One zoom room for the whole workshop https://indico.cern.ch/event/1078970/videoconference/

➢ All talks will be recorded and later (in the next weeks) linked in the agenda
  ○ By remaining connected you certify that you are OK with being recorded and with the recordings being made public
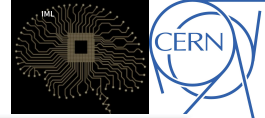
Monday 9th

Tutorials: JAX and Differentiable Programming	David Rousseau, Dr Pietro Vischia
500/1-001 - Main Auditorium, CERN	15:30 - 18:00

Tuesday 10th

Opening of the workshop	Andrea Wulzer et al.
500/1-001 - Main Auditorium, CERN	09:00 - 09:10
Future applications of ML in HEP	Tommaso Dorigo
500/1-001 - Main Auditorium, CERN	09:10 - 09:50
Discussion	
500/1-001 - Main Auditorium, CERN	09:50 - 10:00
ML in Cosmology	Christoph Weniger
500/1-001 - Main Auditorium, CERN	10:00 - 10:40
Discussion	
500/1-001 - Main Auditorium, CERN	10:40 - 10:50
Coffee Break	
500/1-001 - Main Auditorium, CERN	10:50 - 11:20
Quantum ML	Sofia Vallecorsa
500/1-001 - Main Auditorium, CERN	11:20 - 12:00
Discussion	
500/1-001 - Main Auditorium, CERN	12:00 - 12:10
Differentiable Physics Simulations for Deep Learning	Nils Thürey
500/1-001 - Main Auditorium, CERN	13:30 - 14:05
Discussion	
500/1-001 - Main Auditorium, CERN	14:05 - 14:15
How to drive scientific progress with community-driven open source projects: the scikit-learn approach Alexandre Gramfort	
Discussion	
500/1-001 - Main Auditorium, CERN	14:45 - 14:55
Hardware and software challenges for massive-scale AI	Laurent Daudet
500/1-001 - Main Auditorium, CERN	14:55 - 15:25
Discussion	
500/1-001 - Main Auditorium, CERN	15:25 - 15:35

Wednesday 11th

Foundation models	John R. Smith
500/1-001 - Main Auditorium, CERN	14:00 - 14:50
Discussion	
500/1-001 - Main Auditorium, CERN	14:50 - 15:00

The workshop ─ Data Science seminar

Wednesday 11th

EP-IT Data science seminars

Beyond Pick and Place - Tackling Robotic Stacking of Diverse Shapes

by Coline Devin (DeepMind)

📅 Wednesday 11 May 2022, 11:00 → 12:00 Europe/Zurich

📍 500/1-001 - Main Auditorium (CERN)

Description   Applying deep learning to robotics is difficult for many reasons; challenges include collecting data at scale, reproducing experiments, and training models that are robust to varying environments. In this talk, I will discuss our new object stacking benchmark task. We generate a challenging and diverse set of objects, selected to require strategies beyond a simple "pick-and-place" solution. In a large experimental study based on this benchmark, we investigate what choices matter for learning vision-based agents in simulated environments, and what factors affect transfer from the simulated to the real robot. Finally, we develop reinforcement learning algorithms to efficiently transfer behaviours from one set of objects to another and from simulation to the real world, given a fixed data budget.

Coline Devin is a research scientist at DeepMind. Her research focuses on reinforcement learning and imitation learning for robotics both in simulation and in the real world. She received her PhD from the University of California, Berkeley where she worked on deep learning methods for compositional robotic agents.

Organised by   M. Girone, M. Elsing, L. Moneta, M. Pierini

Videoconference   EP/IT Data Science Seminar   ▶ Join

The workshop — Thematic sessions

➢ 56 high-quality abstracts
- ○ Regular talk: 20'+5' discussion
- ○ Short talk: 10'+5' discussion
- ○ Lightning talk: 3'+2' discussion

➢ We will organize topical IML meetings where some of the lightning talks will have full time
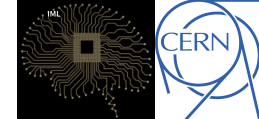- ○ We'll start contacting you in the next weeks (we have your contact information)

Wednesday 11th

Conditional Invertible Network for Neutrino Regression	Mr Matthew Leigh
4/3-006 - TH Conference Room, CERN	09:00 - 09:25

Uncertainty Aware Learning for High Energy Physics With A Cautionary Tale	Aishik Ghosh 📎
4/3-006 - TH Conference Room, CERN	09:25 - 09:30

Learning New Physics aware of systematic uncertainties	Gaia Grosso
4/3-006 - TH Conference Room, CERN	09:30 - 09:45

Learning Optimal Test Statistics in the Presence of Nuisance Parameters	Lukas Alexander Heinrich
4/3-006 - TH Conference Room, CERN	09:45 - 10:00

Spatio-Temporal Anomaly Detection for the DQM of the CMS Experiment via Graph Networks	Mulugeta Asres
4/3-006 - TH Conference Room, CERN	10:00 - 10:25

Truncated Marginal Neural Ratio Estimation with swyft	Benjamin Kurt Miller
500/1-001 - Main Auditorium, CERN	15:00 - 15:25

Summary of Learning To Discover workshop	David Rousseau
500/1-001 - Main Auditorium, CERN	15:25 - 15:50

Autoencoders for semivisible jet detection	Jeremi Niedziela
500/1-001 - Main Auditorium, CERN	15:50 - 15:55

Invariant Representation Driven Neural Classifier for Anti-QCD Jet Tagging	Taoli Cheng 📎
500/1-001 - Main Auditorium, CERN	15:55 - 16:00

Coffee Break	
500/1-001 - Main Auditorium, CERN	16:00 - 16:30

Cosmological Simulation-Based Inference with Truncated Marginal Neural Ratio Estimation	Alex Cole
500/1-001 - Main Auditorium, CERN	16:30 - 16:55

CURTAINs for you Sliding Window: Constructing Unobserved Regions by Transporting Adjacent INtervals to improve th...	
Johnny Raine et al.	

Object condensation for end-to-end reconstruction in high occupancy calorimeters with graph neural networks	
Shah Rukh Qasim	

Anomaly detection for the quality control of silicon sensor wafers for the CMS HGCAL upgrade	Sonja Grönroos
500/1-001 - Main Auditorium, CERN	17:45 - 18:00

Clustering for interpreting complex high-energy physics models	Walter Hopkins
500/1-001 - Main Auditorium, CERN	18:00 - 18:05

Tuesday 10th

Particle-based Fast Jet Simulation at the LHC with Variational Autoencoders	Breno Orzari
500/1-001 - Main Auditorium, CERN	16:05 - 16:20

Hadrons, Better, Faster, Stronger	Engin Eren
500/1-001 - Main Auditorium, CERN	16:20 - 16:45

SUPA: A Lightweight Diagnostic Simulator for Machine Learning in Particle Physics.	Mr Atul Kumar Sinha
500/1-001 - Main Auditorium, CERN	16:45 - 17:10

Calibrating stochastic simulations with optimal transport	Philipp Windischhofer 📎
500/1-001 - Main Auditorium, CERN	17:10 - 17:35

The workshop ー Thematic sessions

Thursday 12th

Calomplification: The Power of Generative Calorimeter Models	*Sebastian Guido Bieringer*
4/3-006 - TH Conference Room, CERN	09:00 - 09:25
How to generate all possible simulations with GANs?	*Jan Michal Dubinski*
4/3-006 - TH Conference Room, CERN	09:25 - 09:30
Information-theoretic stochastic contrastive conditional GAN (InfoSCC-GAN) for physical data generation	*Vitaliy Kinakh*
4/3-006 - TH Conference Room, CERN	09:30 - 09:55
IEA-GAN: Intra-Event Aware GAN for the Fast Simulation of PXD Background at Belle II	*Hosein Hashemi*
4/3-006 - TH Conference Room, CERN	09:55 - 10:10
Coffee Break	
500/1-001 - Main Auditorium, CERN	10:10 - 10:35
An infra-red and collinear safe message passing neural network	*Mr Vishal Singh Ngairangbam*
500/1-001 - Main Auditorium, CERN	10:35 - 11:00
Quarks and gluons in the Lund plane	*Adam Takacs et al.*
500/1-001 - Main Auditorium, CERN	11:00 - 11:15
Targeting Multi-Loop Integrals with Neural Networks	*Ramon Winterhalder*
500/1-001 - Main Auditorium, CERN	11:15 - 11:40
Towards a Deep Learning Model for Hadronization	*Andrzej Konrad Siodmok*
500/1-001 - Main Auditorium, CERN	11:40 - 12:05
Using Machine Learning techniques in phenomenological studies in flavour physics	*Jorge Alda Gallo*
500/1-001 - Main Auditorium, CERN	12:05 - 12:10
Turbo-Sim: a generalised generative model with a physical latent space	*Guillaume Quétant*
500/1-001 - Main Auditorium, CERN	13:30 - 13:55
Funnels: Exact maximum likelihood with dimensionality reduction	*Samuel Byrne Klein*
500/1-001 - Main Auditorium, CERN	13:55 - 14:20
ML-based Correction to Accelerate Geant4 Calorimeter Simulations	*Evangelos Kourlitis*
500/1-001 - Main Auditorium, CERN	14:20 - 14:25
Particle identification with machine learning in ALICE Run 3	*Maja Kabus*
500/1-001 - Main Auditorium, CERN	14:25 - 14:50
Data-driven machine learning algorithms for the calibration of space-charge distortion fluctuations in the ALICE TPC *Marian Ivanov*	
Coffee Break	
500/1-001 - Main Auditorium, CERN	15:10 - 15:40
FPGA acceleration of the CMS DNN based LLP Jet Algorithm for the LHC High-Luminosity upgrade	*Tarik Ourida*
4/3-006 - TH Conference Room, CERN	15:40 - 16:05
Ephemeral Learning - Augmenting Triggers with Online-Trained Normalizing Flows	*Sascha Daniel Diefenbacher*
4/3-006 - TH Conference Room, CERN	16:05 - 16:20
Optimized Deep Learning Inference on High Level Trigger at the LHC: Computing time and Resource assessment *Syed Anwar Ul Hasan*	
Unsupervised learning for real-time SUEP detection in a High Level Trigger system at the LHC	*Simranjit Singh Chhibra*
4/3-006 - TH Conference Room, CERN	16:35 - 16:40
Neural network based primary vertex reconstruction with FPGAs for the upgrade of the CMS level-1 trigger system *Matthias Komm*	
Multi-objective optimization for the CMS High Granularity Calorimeter Level 1 trigger	*Alexandre Hakimi*
4/3-006 - TH Conference Room, CERN	16:55 - 17:00

Friday 13th

|	
Neural network distributed training and optimization library (NNLO)	*Irena Veljanovic*
500/1-001 - Main Auditorium, CERN	09:00 - 09:25
MLaaS4HEP: Machine Learning as a Service for HEP	*Luca Giommi*
500/1-001 - Main Auditorium, CERN	09:25 - 09:30
Quantum Machine Learning algorithms in the latent space of HEP events	*Kinga Anna Wozniak*
500/1-001 - Main Auditorium, CERN	09:30 - 09:55
GNN-based algorithm for full-event filtering and interpretation at the LHCb trigger	*Julian Garcia Pardinas*
500/1-001 - Main Auditorium, CERN	09:55 - 10:20
Graph Neural Network Track Reconstruction for the ATLAS ITk Detector	*Daniel Thomas Murnane*
500/1-001 - Main Auditorium, CERN	10:20 - 10:45
Coffee Break	
500/1-001 - Main Auditorium, CERN	10:45 - 11:15
Application of artificial intelligence in the reconstruction of signals from the PADME electromagnetic calorimeter *Kalina Stoimenova*	
Semi-supervised Graph Neural Networks for Pileup Noise Removal	*Garyfallia Paspalaki*
500/1-001 - Main Auditorium, CERN	11:20 - 11:25
CBM performance for (multi-)strange hadron measurements using Machine Learning techniques	*Shahid Khan*
500/1-001 - Main Auditorium, CERN	11:25 - 11:30
Leveraging universality of jet taggers through transfer learning	*Dr Frederic Alexandre Dreyer et al.*
500/1-001 - Main Auditorium, CERN	11:30 - 11:55
Particle Transformer for Jet Tagging	*Sitian Qian*
500/1-001 - Main Auditorium, CERN	11:55 - 12:20
Supervised Single-Shot SUEP detection	*Chad Wells Freer et al.*
500/1-001 - Main Auditorium, CERN	12:20 - 12:25
Using Graph autoencoders to trigger on new physics at the LHC	*Muhammad-Hassan Shahid*
500/1-001 - Main Auditorium, CERN	12:25 - 12:30
Likelihood-Free Frequentist Inference for Calorimetric Muon Energy Measurement	*Luca Masserano*
500/1-001 - Main Auditorium, CERN	14:00 - 14:25
Two-level graphs for muon-tomography inference	*Dr Giles Chatham Strong*
500/1-001 - Main Auditorium, CERN	14:25 - 14:50
Electron identification in ATLAS using a deep neural network	*Lukas Ehrke*
500/1-001 - Main Auditorium, CERN	14:50 - 14:55
Tracking of Proton Traces in a Digital Tracking Calorimeter using Reinforcement Learning	*Tobias Kortus*
500/1-001 - Main Auditorium, CERN	14:55 - 15:10
Point Cloud Deep Learning Methods for Pion Reconstruction in the ATLAS Detector	*Mariel Pettee*
500/1-001 - Main Auditorium, CERN	15:10 - 15:35
Explaining machine-learned particle-flow reconstruction	*Farouk Mokhtar*
500/1-001 - Main Auditorium, CERN	15:35 - 16:00
Closing session: Closing session	
500/1-001 - Main Auditorium, CERN	16:00 - 16:30

➢ Very packed schedule

➢ Speakers:
  ○ Please stay in the allotted time
  ○ We will notify you in the chat/live

➢ Zoom participants:
  ○ Normal Zoom meeting
  ○ You can unmute yourself
  ○ Raise your hand or write in chat for questions

In person participants

TH Conference Room

Main Auditorium

You are here!

Cafeteria
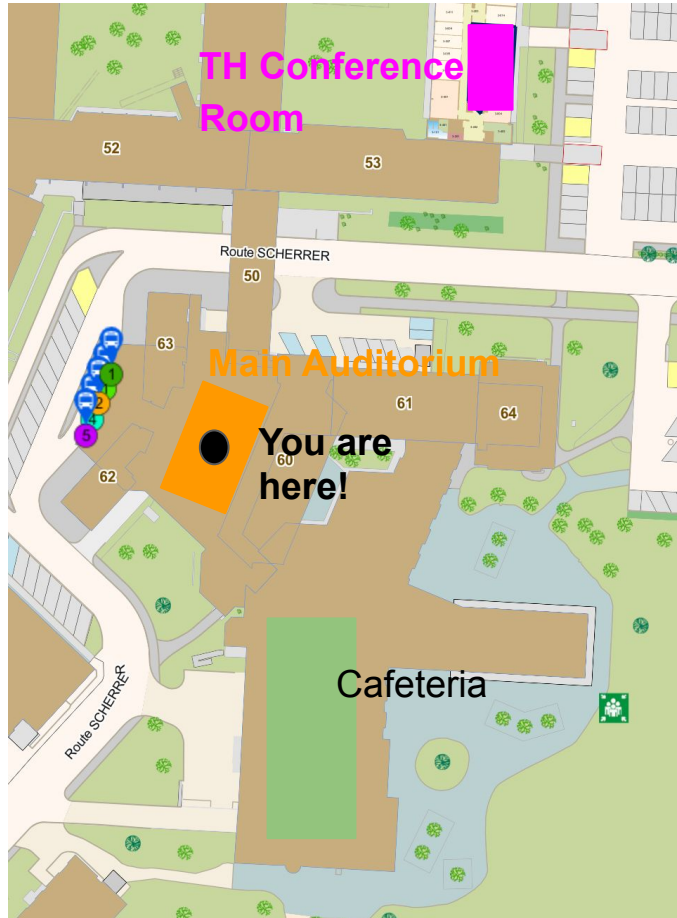
➢ We will move between the Main Auditorium 500/1-001 and the TH Conference Room 4/3-006 during the workshop
  ○ CERN map at https://maps.web.cern.ch/

➢ In the TH Conference Room (across the street) on:
  ○ Wed 11th 9:00-10:30
  ○ Thu 12th 9:00-10:10 and 15:40-17:00

➢ All other sessions are in the Main Auditorium

Thanks for the attention

Have fun!