



# IML News

## IML Working Group Monthly Meeting

April 27, 2021

### IML Coordinators

Gian Michele Innocenti (ALICE), David Rousseau (ATLAS), Pietro Vischia (CMS), Simon Akar (LHCb), Lorenzo Moneta (SFT), Riccardo Torre (TH), Andrea Wulzer (TH)

# Past Meetings and Workshops

- Website: <https://iml.web.cern.ch>
- Agenda: <https://iml.web.cern.ch/meetings>
- Past meetings

Machine Learning	<b>IML Machine Learning Working Group</b>	Tuesday, March 16, 2021 - 15:00	Virtual (zoom only)
Machine Learning	<b>IML Machine Learning Working Group</b>	Tuesday, February 16, 2021 - 15:00	Virtual (zoom only)
Machine Learning	<b>IML Machine Learning Working Group</b>	Monday, November 23, 2020 - 15:00	Virtual (everywhere and nowhere)
Machine Learning	<b>IML Machine Learning Working Group</b>	Tuesday, September 8, 2020 - 15:00	CERN
Machine Learning	<b>IML Machine Learning Working Group</b>	Tuesday, July 7, 2020 - 15:00	CERN

- Past workshops

LPCC Workshops	<b>4th Inter-experiment Machine Learning Workshop</b>	Monday, October 19, 2020 - 09:00	
LPCC Workshops	<b>3rd IML Machine Learning Workshop</b>	Monday, April 15, 2019 - 09:00	CERN
Machine Learning	<b>2nd IML Machine Learning Workshop</b>	Monday, April 9, 2018 - 09:00	CERN
Machine Learning	<b>IML Machine Learning Workshop</b>	Monday, March 20, 2017 - 09:00	CERN


# Today's agenda

- Topic: New Physics searches with ML
- Agenda: <https://indico.cern.ch/event/1025534/>

## IML Machine Learning Working Group

Tuesday 27 Apr 2021, 15:00 → 18:05 Europe/Zurich  
Virtual (zoom only)

Description Meeting will be by video only on Zoom.

Videconferene Rooms  IML Machine Learning Working Group ▶ Join

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**15:00** → 15:05 **News** 🕒 5m

**Speakers:** Andrea Wulzer (CERN and EPFL), David Rousseau (LAL-Orsay, FR), Gian Michele Innocenti (CERN), Lorenzo Moneta (CERN), Loukas Gouskos (CERN), Dr Pietro Vischia (Universite Catholique de Louvain (UCL) (BE)), Riccardo Torre (CERN), Simon Akar (University of Cincinnati (US))

**15:05** → 15:30 **Anomaly detection at L1 Trigger with Autoencoders** 🕒 25m

We discuss how to adapt and deploy anomaly detection strategies based on Deep Autoencoders on atypical real-time event selection system at the Large Hadron Collider. Considering as a benchmark an inclusive data stream, pre-filtered requiring the presence of one lepton, we discuss different strategies to detect new physics events as anomalies. Using the hls4ml library, we show how resource consumption and latency match the constraints of a typical LHC real-time environment.

**Speaker:** Ms Ema Puljak (University of Zagreb (HR))

**15:30** → 15:35 **Question time** 🕒 5m

**15:35** → 16:00 **Learning New Physics from an Imperfect Machine** 🕒 25m

We show how to deal with uncertainties on the Reference Model predictions in an agnostic new physics search strategy based on artificial neural networks. Our approach builds directly on the profile likelihood treatment of uncertainties as nuisance parameters for hypothesis testing that is routinely employed in high-energy physics. After presenting the conceptual foundations of our method, we illustrate all aspects of its implementation and extensively study its performances on a toy one-dimensional problem. We show how to implement it in a multivariate setup by studying the impact of two typical sources of experimental uncertainties in two-body final states at the LHC.

**Speaker:** Gaia Grosso (Universita e INFN, Padova (IT))

**16:00** → 16:05 **Question time** 🕒 5m

**16:05** → 16:30 **Boosting new physics sensitivity with Variational Autoencoders** 🕒 25m

We show how an anomaly detection algorithm could be integrated in a typical search for new physics in events with jets at the CERN Large Hadron Collider (LHC). We assume that an anomaly detection algorithm is given, trained to identify rare jet types, such as jets originating from the decay of a highly boosted massive particle. We show how this algorithm could be integrated in a search without disrupting the background-estimate strategy while enhancing the sensitivity to new physics. As an example, we consider convolutional variational autoencoders (VAEs) applied to dijet events. The proposed procedure can be generalized to any final state with jets. Once applied to real data, it could contribute to extend the sensitivity of the LHC experiments to previously uncovered new physics scenarios, e.g., broad-resonance and non-resonant jet production from new physics processes.

**Speaker:** Kinga Anna Wozniak (University of Vienna (AT))

**16:30** → 16:35 **Question time** 🕒 5m

# Next meeting

- Date: June 1, 2021 @ 15.00 (CERN time)
- Topic: TBD

Contact us at [iml.coordinators@cern.ch](mailto:iml.coordinators@cern.ch) if you are interested in giving a presentation