

Deep Learning in the Natural Sciences

Report of Contributions

Contribution ID: 1

Type: **not specified**

Exploring Hybrid Deep Learning Architecture for Experimental HEP Data Analysis

Deep learning has shown a promising future in physics' data analysis and is anticipated to revolutionize LHC discoveries.

Designing an optimal algorithm may seem to be the most challenging task in machine learning progress especially in HEP due to the high dimensionality and extreme complexity of the data.

Physical knowledge can be employed in designing and modifying of the algorithm's modules as well as constructing high-level features, however, few researchers suggested that it may be sub-optimal (especially latter case).

Hybrid architectures aims to achieve a complicated target based on fusion of different modules such as Convolutional Neural Network. This topic has been exploited in several computer vision researches, consequently, it can also be considered for Jet physics.

Hybrid Deep Learning Architecture concerned with taking full advantage of expertise on the particular environment of the task.

Primary author: Mr TAHERI YEGANEH, Yavar (Shahid Beheshti University)

Presenter: Mr TAHERI YEGANEH, Yavar (Shahid Beheshti University)

Session Classification: Talk

Contribution ID: 2

Type: **not specified**

Particle identification on the DAMPE experiment

Friday, March 1, 2019 10:20 AM (20 minutes)

The Dark Matter Particle Explorer (DAMPE) is a space-borne particle detector and cosmic rays observatory in operations since 2015, equipped with alongside other instruments a deep calorimeter able to detect electrons up to an energy of 10 TeV and cosmic rays up to 100 TeV. The large proton and ion background in orbit requires a powerful electron identification method. We explore a neural network based approach to an on-orbit particle identification problem. We present the issues that arise from the constraints of particle physics and our experiment, notably the difference between training set based on simulated (Monte Carlo) data, and the application set based on real unlabeled data, leading to a trade-off between performances and general usability.

Primary author: DROZ, David Francois (Universite de Geneve (CH))

Co-authors: TYKHONOV, Andrii (Universite de Geneve (CH)); WU, Xin (Universite de Geneve (CH))

Presenter: DROZ, David Francois (Universite de Geneve (CH))

Session Classification: Talk

Contribution ID: 3

Type: **not specified**

Towards data-driven particle physics classifiers

Friday, March 1, 2019 12:10 PM (20 minutes)

Deep learning in particle physics often relies on imperfect simulations due to the lack of real labelled data, which risks learning mismodeling artifacts rather than the underlying physics. In this talk, I discuss the prospects for training classifiers directly on collider data using mixed samples, drawing from techniques in weak supervision and topic modeling. Using the example of quark versus gluon jet classification, I demonstrate how these ideas allow data-driven classifiers to be trained and actually provide an operational definition of the underlying categories.

Primary author: METODIEV, Eric (Massachusetts Institute of Technology)

Co-authors: THALER, Jesse (MIT); KOMISKE, Patrick (Massachusetts Institute of Technology)

Presenter: METODIEV, Eric (Massachusetts Institute of Technology)

Session Classification: Talk

Contribution ID: 4

Type: **not specified**

A metric for collider events

Friday, March 1, 2019 9:40 AM (20 minutes)

When are two collider events similar? In this talk, I will answer this question by developing a metric between the radiation patterns of events. The metric is based on the well known earth mover's distance, and intuitively is the minimum "work" required to rearrange the energy flow of one event into the other. With a metric in hand, I will discuss and demonstrate numerous tools for analyzing and visualizing the space of events for collider applications.

Primary authors: KOMISKE, Patrick (Massachusetts Institute of Technology); METHODIEV, Eric (Massachusetts Institute of Technology); THALER, Jesse (MIT)

Presenter: KOMISKE, Patrick (Massachusetts Institute of Technology)

Session Classification: Talk

Contribution ID: 5

Type: **not specified**

Collision Course: Particle Physics as a Machine-Learning Testbed

Thursday, February 28, 2019 1:20 PM (40 minutes)

Presenter: THALER, Jesse (MIT)

Session Classification: Talk

Contribution ID: 6

Type: **not specified**

Opening

Thursday, February 28, 2019 1:00 PM (20 minutes)

Presenters: KASIECZKA, Gregor (Hamburg University (DE)); BRUEGGEN, Marcus

Session Classification: Talk

Contribution ID: 7

Type: **not specified**

Machine Learning Techniques in Cosmological Simulation

Thursday, February 28, 2019 2:00 PM (40 minutes)

Presenter: GHELLER, Claudio

Session Classification: Talk

Contribution ID: 8

Type: **not specified**

Low-dose X-ray Imaging with Deep Neural Networks

Thursday, February 28, 2019 2:40 PM (20 minutes)

Presenter: YANG, Xiaogang

Session Classification: Talk

Contribution ID: 9

Type: **not specified**

Machine Learning Techniques in Astroparticle Physics

Thursday, February 28, 2019 3:40 PM (40 minutes)

Presenter: ELSAESSER, Dominik

Session Classification: Talk

Contribution ID: **10**

Type: **not specified**

Rise of the Tagging Machines

Thursday, February 28, 2019 4:20 PM (40 minutes)

Presenters: PLEHN, Tilman (Heidelberg University); PLEHN, Tilman

Session Classification: Talk

Contribution ID: 11

Type: **not specified**

Machine Learning for Diffractive Imaging and Crystallography

Thursday, February 28, 2019 5:00 PM (40 minutes)

Presenter: MAIA, Filipe

Session Classification: Talk

Contribution ID: 12

Type: **not specified**

Deep Learning in Particle and Astroparticle Physics

Friday, March 1, 2019 9:00 AM (40 minutes)

Presenter: ERDMANN, Martin (Rheinisch Westfaelische Tech. Hoch. (DE))

Session Classification: Talk

Contribution ID: 13

Type: **not specified**

Autoencoding New Physics

Friday, March 1, 2019 12:30 PM (20 minutes)

Presenters: THOMPSON, Jennifer (ITP Heidelberg); THOMPSON, Jennifer (ITP Heidelberg)

Session Classification: Talk

Contribution ID: 14

Type: **not specified**

Radio Galaxy Classifications with Deep Learning

Friday, March 1, 2019 10:00 AM (20 minutes)

Presenter: LUKIC, Vesna

Session Classification: Talk

Contribution ID: 15

Type: **not specified**

Machine learning with augmentation for boosting di-Higgs searches at the LHC

Friday, March 1, 2019 10:40 AM (20 minutes)

Presenter: CHO, Won Sang (Seoul National University)

Session Classification: Talk

Contribution ID: 16

Type: **not specified**

Application of Generative Models to Natural Science

Friday, March 1, 2019 11:30 AM (40 minutes)

Presenters: RATNIKOV, Fedor; RATNIKOV, Fedor (Yandex School of Data Analysis (RU))

Session Classification: Talk

Contribution ID: 17

Type: **not specified**

CNN Classification of X-ray Selected Clusters

Friday, March 1, 2019 12:50 PM (20 minutes)

Presenter: KOSIBA, Matej

Session Classification: Talk

Contribution ID: 18

Type: **not specified**

Closing Discussion

Friday, March 1, 2019 1:10 PM (20 minutes)

Presenter: SCHLEPER, Peter (Hamburg University (DE))

Session Classification: Talk

Contribution ID: 19

Type: **not specified**

Deep Learning Basics I

Thursday, February 28, 2019 10:15 AM (45 minutes)

Presenter: KASIECZKA, Gregor (Hamburg University (DE))

Session Classification: Pre-Workshop introduction and arrival

Contribution ID: 20

Type: **not specified**

Deep Learning Basics II

Thursday, February 28, 2019 11:15 AM (45 minutes)

Presenter: KASIECZKA, Gregor (Hamburg University (DE))

Session Classification: Pre-Workshop introduction and arrival

Contribution ID: 21

Type: **not specified**

Registration & Sign-Up

Thursday, February 28, 2019 10:00 AM (3 hours)

Session Classification: Pre-Workshop introduction and arrival