ESR 12: Accelerated Anomaly Detection

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Pratik Jawahar
Supervisors: Caterina Doglioni, Jiri Masik, Maurizio Pierini, Alex Oh, Antonio Boveia

Background

Summer Student - EP-CMX (Junior Year) [Michele Bianco]

Automating QC for GEM Detectors (GE-1/1); GE-1/1 Assembly
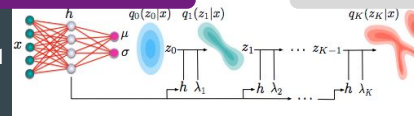
Technical Student - EP-CMG-OS [Maurizio Pierini]

DL based Anomaly Detection for New Physics Searches

Started PhD at UoM-ATLAS [Caterina Doglioni]

Accelerated Anomaly Detection for Dark Matter Searches

2018

2020-2021

2022

2019

2022

Graduated with Bachelor's in Mechanical Engineering (Research Focus: Control Sys), Minor: Cognitive Science [Francesco Fallavollita]
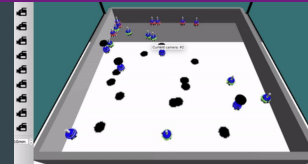
Thesis: Automated Tyre Inflation System

Graduated with a Master's in Robotics (Research Focus: DL) [Carlo Pinciroli]

Thesis: Exogenous Fault Detection in MRS

ATLAS EXPERIMENT

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Masters

- Improving VAEs with Normalizing Flows for New Physics Searches
- Exogenous Fault Detection in Multi Robot Systems with VAEs
- DeepFake Detection
- Audio Analytics - Alcohol Intoxication Detection in Voice Samples
- Road Sign Detection
- Component Detection for Mechanical Systems in Dynamic Environments
- Industrial Manipulator Control for Automated Tyre Inflation
- GEM Detector Automated QC and Assembly; ML based fault detection in QC
- Purcell's Swimmer: Bio-Mimetic Microbot to Enable Swimming in High Reynold's Number Flows

https://www.pratikjawahar.com/

ESR 12: Accelerated Anomaly Detection

- QT: Accelerating tracking algorithms at the LHC
  - Idea: Heterogenous computing solutions to running tracking algorithm on different hardware components (CPU, GPU, FPGA etc.) in an attempt to reduce net run-time
  - Currently working on reproducing the traccc component from the ACTS (A Common Tracking Software) framework on local GPUs
- Accelerated Anomaly Detection at the Trigger Level
  - Previously:
    - Darkmachines Anomaly Detection Challenge: https://scipost.org/SciPostPhys.12.1.043
    - Normalizing Flow to improve VAEs as Anomaly Detectors: https://www.frontiersin.org/articles/10.3389/fdata.2022.803685/full

Improving Variational Autoencoders for New Physics Detection at the LHC With Normalizing Flows

Pratik Jawahar[1*], Thea Aarrestad[1], Nadezda Chernyavskaya[1], Maurizio Pierini[1], Kinga A. Wozniak[1,2], Jennifer Ngadiuba[3,4], Javier Duarte[5] and Steven Tsan[5]

The Dark Machines Anomaly Score Challenge: Benchmark Data and Model Independent Event Classification for the Large Hadron Collider

T. Aarrestad, M. van Beekveld, M. Bona, A. Boveia, S. Caron, J. Davies, A. De Simone, C. Doglioni, J. M. Duarte, A. Farbin, H. Gupta, L. Hendriks, L. Heinrich, J. Howarth, P. Jawahar, A. Jueid, J. Lastow, A. Leinweber, J. Mamuzic, E. Merényi, A. Morandini, P. Moskvitina, C. Nellist, J. Ngadiuba, B. Ostdiek, M. Pierini, B. Ravina, R. Ruiz de Austri, S. Sekmen, M. Touranakou, M. Vaškevičiūtė, R. Vilalta, J. R. Vlimant, R. Verheyen, M. White, E. Wulff, E. Wallin, K. A. Wozniak, Z. Zhang

SciPost Phys. 12, 043 (2022) · published 28 January 2022

Who am I?

- Tennis
  - State NJTA U8-U14
  - Collegiate Nationals - Gold$\times$2 Silver$\times$2
- Hiking
  - Swiss, French Alps
  - Italian Dolomites
  - Spanish Balearic Cliffs
  - Appalachian Trail (Sec)
  - Pacific Northwest
  - American Rockies
  - Sierra Nevada
  - North Wales
  - Yorkshire, Peaks District
- Climbing
  - Bourgogne, Dijon - Sport
  - Chamonix - Sport
  - Mallorca - Sport
  - New York Gunks - Bouldering
  - Yosemite - Bouldering
  - Stanage - Trad
  - North Wales - Trad, Sport
- Noob: Guitars, Music Production, Cardistry, Chess Theory
- Future Work:
  - Paragliding
  - Write an EP (undefined)