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Education

FEB 2015 - APRIL 2019 (EXPECTED)

Ph.D., Physics
University of Zurich, Switzerland / CMS experiment, CERN
Supervised by Prof. Dr. Ben Kilminster
Thesis committee: Prof. Dr. Jesse Thaler, Dr. Andreas Hinzmann, Prof. Dr. Florencia Canelli, Prof. Dr. Ben Kilminster
Tentative title: ”Searching for diboson resonances in the all-hadronic final state and a Lorentz invariance based deep neural network for W boson tagging”

FEB 2013 - OCT 2014

M.S., Physics
University of Zurich / Classes at ETH Zurich
Supervised by Prof. Dr. Ben Kilminster
"A dedicated boosted Higgs boson tagging algorithm at CMS"

SEP 2010 - DEC 2012

B.S., Physics
University of Bergen / 1 semester exchange ETH Zurich
Supervised by Prof. Dr. Per Osland
"Unstable Dark Matter in the Milky Way”

Research experience

ANALYSIS

Main author and analyst of the first 13 TeV search for diboson resonances in the all-hadronic final state. High-profile analysis due to excess observed in 8 TeV data. Amongst first 13 TeV analyses published and set the most stringent limits to date for vector boson final states.
2.6 fb^{-1} of 2015 data, published in 10.1007/JHEP03(2017)162

Main author and analyst of first CMS analysis using PUPPI+softdrop groomer, now default for W-tagging. Groomer has better resilience against pile-up and is infrared safe compared to previous algorithm
13 fb^{-1} of early 2016 data, published in CMS-PAS-B2G-16-021
37 fb^{-1} of 2016 data, published in 10.1103/PhysRevD.97.072006

Development of novel multi-dimensional fit method for diboson searches in the all-hadronic final state (July 2017 - present).
80 fb^{-1} of 2016+2017 data, in pre-approval stage.

ALGORITHMS

Worked on a dedicated boosted Higgs tagging algorithm, currently implemented in the CMS software, focusing on tagger p_T/η de-correlation and performance against various backgrounds
July 2014 - July 2015, published in CMS-PAS-BTV-15-002

Commissioned novel PUPPI+softdrop W-tagging algorithm and developed dedicated jet mass corrections currently recommended by the Jet and MET physics object group. Co-author of summary on jet algorithms performance in 13 TeV data. Improved method for calculating data/MC scalefactors for W-tagging, reducing systematics and improving limits of diboson resonance search by up to 40%
Jan-Nov 2016, published in CMS-DP-2016-039, CMS-PAS-JME-16-003

Working with deep neural network for W-tagging taking advantage of two custom layers that do light jet clustering and calculates distances in Minkowski space
Nov 2017 - present, work in progress

HARDWARE

Calibration of the CMS pixel detector charge response after exposure to radiation. Implemented method to handle radiation effects affecting charge-injection (VCAL) system previously not accounted for during calibration. Responsible for 2018 gain calibrations
Jan 2018 - present

Talks and posters

CONFERENCES

"Highlights on searches for new physics with vector bosons and Higgs bosons in boosted topologies", BOOST 2018, July 2018, Paris, France

"W/H tagging at CMS", BOOST 2017, July 2017, Buffalo, USA

"Search for heavy resonances in the W/Z-tagged dijet mass spectrum at CMS", Zurich PhD seminar 2015, Aug 2015, PSI, Switzerland

SEMINARS AND WORKSHOPS

"A search for all-hadronic X→VV with a multi-dimensional fit", B2G Spring Workshop, May 2018, Hamburg (invited)

"Lorentz Invariance Based DNN for W-tagging", Joint CMS/LHCb seminar, May 2018, Zurich (invited)

"Search for heavy resonances in the W/Z/H-tagged dijet mass spectrum", B2G Event, May 2016, LPC Fermilab (invited)

"Search for heavy resonances in the W/Z-tagged dijet mass spectrum", EXOTICA Workshop, Nov 15, Venice

INFORMAL SEMINARS

"PUPPI+softdrop for W-tagging", LPC chat, Oct 2016, Fermilab

"Grooming optimisation", LPC chat, Aug 2015, Fermilab

POSTERS

"LoLa: Lorentz Invariance Based DNN for heavy-resonance tagging", UZH Open Day, Nov 2017, Zurich, https://www.physik.uzh.ch/en/news/news/Open-Day17 Poster 5, Awarded "Best Poster"

"Search for heavy resonances in the W/Z-tagged dijet mass spectrum at CMS", ESHEP2015, Sep 2015, Bulgaria

Organized events

WORKSHOPS & COURSES

"How to do ultrafast Deep Neural Network inference on FPGAs", main organizer, https://indico.cern.ch/event/FPGA4HEP, Feb 2019

"Machine Learning for High Energy Physics - a mini course", main organizer, https://indico.cern.ch/e/ML4HEP, Feb 2019

Selected publications

MAIN AUTHOR

"Search for massive resonances decaying into WW, WZ , ZZ , qW, and qZ with dijet final states at √ s = 13 TeV" (35.9 fb^{-1}), Physical Review D, *DOI: https://doi.org/10.1103/PhysRevD.97.072006*

"Search for massive resonances decaying into WW, WZ or ZZ bosons in proton-proton collisions at s√=13 TeV" (2.6 fb^{-1}), Journal of High Energy Physics, *DOI: https://doi.org/10.1007/JHEP03(2017)162*

"Jet algorithms performance in 13 TeV data", CMS Physics Analysis Summary, *https://cds.cern.ch/record/2256875*

"W-tagging performance in 13 TeV", CMS Detector Performance Note, CMS-DP-2016-039, *https://cds.cern.ch/record/2202970*

DIRECT CONTRIBUTOR

"Identification of double-b quark jets in boosted event topologies", CMS Physics Analysis Summary, *https://cds.cern.ch/record/2195743*

"Search for low-mass resonances decaying to boosted jets", Physical Review Letters, *DOI: https://doi.org/10.1103/PhysRevLett.119.111802*

THESES

"Searching for diboson resonances in the all-hadronic final state and a Lorentz invariance based deep neural network for W-tagging", *Ph.D. Thesis, April 2019 (expected)*

"A dedicated boosted Higgs boson tagging algorithm at CMS", M.S. Thesis, Oct 2014, *https://thaarres.web.cern.ch/thaarres/MasterThesis_TAarrestad.pdf*

POPULAR ARTICLES

"Vis oss fysikkens skjønnhet", article in Norways second largest newspaper Bergens Tidene, Oct 2011, *https://www.bt.no/btmeninger/kronikk/i/G0rnq/Vis-oss-fysikkens-skjonnhet*

Mentoring

MAIN SUPERVISOR

"Deep Neural Network to Identify High-Energy B Hadrons via their Hit Multiplicity Increase through Pixel Detection Layers", Bachelor Thesis, M. Sommerhalder, Feb-Aug 2018, UZH

"A Deep Neural Network capable of discriminating between jets coming from the decay of longitudinally and transversely polarized W or Z bosons with a large Lorentz boost", CERN Summer Student, July 2018, Jan De Boer, Copenhagen University

Teaching experience

Physics Lab for bachelor students, teacher, Feb-Dec 2015
Physics I for bachelor students, teaching assistant, Jan-Dec 2016
Physics II for chemists, classroom assistant, Feb 2017 - current

Skills

COMPUTING

Python, C++, Bash, Keras, TensorFlow, Theano, TMVA, ROOT, CMSSW. Familiarity with Pandas, scikit-learn, NumPy, SciPy, SQLite, Cython

LANGUAGES

Norwegian (fluent), English (fluent), German (fluent)

Schools

"Machine Learning for High Energy Physics" (Aug 2018, Oxford)
"Scientific Programming in Python" (June 2016, Zurich)
"CERN School of High Energy Physics" (Sep 2015, Bulgaria)
"Scientific Writing" (May 2015, Zurich)
"CMS Data Analysis School" (Jan 2013, CERN)