### Lars Holm Nielsen CERN, IT Department









EASITrain Lectures Spring 2018, CERN, Geneva, March 07, 2018

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Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC <sup>\$</sup>

### ATLAS Collaboration

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Higgs boson

ccessfully describe high energy particle interac-

mechanism that breaks electroweak symmetry

been verified experimentally. This mechanism

mass to massive elementary particles, implies

scalar particle, the SM Higgs boson. The search

h, the only elementary particle in the SM that bserved, is one of the highlights of the Large

(LHC) physics programme. the SM Higgs boson mass of  $m_{H} < 158 \text{ GeV}$ 

el (CL) have been set using global fits to pre-

sults [12]. Direct searches at LEP [13], the

the LHC [17,18] have previously excluded, at

d CMS Collaborations reported excesses of

atasets of proton-proton (pp) collisions at

 $\sqrt{s} = 7$  TeV at the LHC, which were compat-

roduction and decay in the mass region cances of 2.9 and 3.1 standard deviations

95% CL, a SM Higg oson with mass below 600 GeV, apart from ween 116 GeV and 127 GeV.

( $\sigma$ ), respectively [17]. The CDF and DØ experiments at the Teva-tron have also recently reported a broad excess in the mass region

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1. Introduc

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124-126 GeV, with

 $(\sigma)$ , respectively [1]

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tions. Howev

oton-proton collisions with the ATLAS detector a integrated luminosities of approximately 4.8 fb = 8 TeV in 2012. Individual searches in the channels  $\nu$  in the 8 TeV data are combined with previously  $b\bar{b}$  and  $\tau^+\tau^-$  in the 7 TeV data and results from v channels in the 7 TeV data. Clear evidence for ss of 126.0±0.4 (stat)±0.4 (sys) GeV is presented

cance of 5.9 standard deviations, corresponding to a backgroun s compatible with the production and decay of the Standard Mod fluctuation probability of  $1.7 \times 10^{-9}$  is c

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120-135 GeV: using the existing LHC constraints, the observed lo cal significances for  $m_H = 125$  GeV are 2.7 $\sigma$  for CDF [14], 1.1 $\sigma$  for Model (SM) of particle physics [1-4] has been D0 [15] and 2.8 $\sigma$  for their combination [1] experiments over the last four decades and has

The previous ATLAS searches in 4.6-4.8 fb<sup>-1</sup> of data at  $\sqrt{s}$  = 7 TeV are combined here with new searches for  $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$ ,  $H \rightarrow \nu \nu$  and  $H \rightarrow WW^{(*)} \rightarrow e \nu \mu \nu$  in the 5.8-5.9 fb<sup>-1</sup> of *nn* collision data taken at  $\sqrt{s} = 8$  TeV between April and June 2012.

The data were recorded with instantaneous lum sities up to  $6.8 \times 10^{33}$  cm<sup>-2</sup> s<sup>-1</sup>; they are therefore affected by multiple pp ons occurring in the same or neighbouring bunch crossings (pile-up). In the 7 TeV data, the average number of interactions per bunch crossing was approximately 10; the average increased to approximately 20 in the 8 TeV data. The reconstruction, identification and isolation criteria used for electrons and photons in the 8 data are improved, making the  $H \rightarrow ZZ^{(*)} \rightarrow 4\ell$  and searches more robust against the increased pile-up ses were re-optimised with simulation and fr at the 8 TeV data.

In the  $H \to WW^{(*)} \to \ell \nu \ell \nu$  cha the increased pile-up derse momentum, E<sup>miss</sup>, resoluteriorates the event missing to antly larger Drell–Yan background in acts. Since the  $e\mu$  channel provides most tion, which results in sig the same-flavour fi the search, only this final state is used in of the sensit the 8 TeV data. The kinematic region in which a the anal boson with a mass between 110 GeV and 140 GeV is

<sup>1</sup> The symbol ℓ stands for electron or muor

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Phys.Lett. B716 (2012) 1-29 (2012-09-17) DOI: 10.1016/j.physletb.2012.08.020 CERN-PH-EP-2012-218 e-Print: arXiv:1207.7214 [hep-ex] | PDF Experiment: CERN-LHC-ATLAS

### Abstract (Elsevier)

A search for the Standard Model Higgs boson in proton-proton collisions with the ATLAS detector at the LHC is presented. The datasets used correspond to integrated luminosities of approximately 4.8 fb -1 collected at s=7 TeV in 2011 and 5.8 fb -1 at s=8 TeV in 2012. Individual searches in the channels  $H \rightarrow ZZ(\star) \rightarrow 4\ell$ ,  $H \rightarrow yy$  and  $H \rightarrow WW(*) \rightarrow ev\mu v$  in the 8 TeV data are combined with previously published results of searches for  $H \rightarrow ZZ(*)$ , WW( $\star$ ), bb<sup>-</sup> and T+T- in the 7 TeV data and results from improved analyses of the H $\rightarrow$ ZZ( $\star$ ) $\rightarrow$ 4ℓ and H $\rightarrow$ γγ channels in the 7 TeV data. Clear evidence for the production of a neutral boson with a measured mass of 126.0±0.4(stat)±0.4(sys) GeV is presented. This observation, which has a significance of 5.9 standard deviations, corresponding to a background fluctuation probability of 1.7×10-9, is compatible with the production and decay of the Standard Model Higgs boson. Abstract (arXiv)

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### **Knowledge Extraction And Representation Learning For Music Recommendation** And Classification

Sergio Oramas

Thesis published 2017 via Zenodo

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In this thesis, we address the problems of classifying and recommending music present in large collections. We focus on the semantic enrichment of descriptions associated to musical items (e.g., artists biographies, album reviews, metadata), and the exploitation of multimodal data (e.g., text, audio, images). To this end, we first focus on the problem of linking music-related texts with online knowledge repositories and on the automated construction of music knowledge bases. Then, we show how modeling semantic information may impact musicological studies and helps to outperform purely text-based approaches in music similarity, classification, and recommendation. Next, we focus on learning new data representations from multimodal content using deep learning architectures, addressing the problems of cold-start music recommendation and multi-label music genre classification, combining audio, text, and images. We show how the semantic enrichment of texts and the combination of learned data representations improve the performance on both tasks.	Publication date: November 14, 2017 DOI: DOI 10.5281/zenodo.1100973 Keyword(s):
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### Early detection of human glioma sphere xenografts in mouse brain using diffusion MRI at 14.1 T

Porcari, P; Hegi, M E; Lei, H; Hamou, M-F; Vassallo, I; Capuani, S; Gruetter, R; Mlynarik, V

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Glioma models have provided important insights into human brain cancers. Among the investigative tools, MRI has allowed their characterization and diagnosis. In this study, we investigated whether diffusion MRI might be a useful technique for early detection and characterization of slow-growing and diffuse infiltrative gliomas, such as the proposed new models, LN-2669GS and LN-2540GS glioma sphere xenografts. Tumours grown in these models are not visible in conventional T2 weighted or contrast-enhanced T1 -weighted MRI at 14.1 T. Diffusion-weighted imaging and diffusion tensor imaging protocols were optimized for contrast by exploring long diffusion times sensitive for probing the microstructural alterations induced in the normal brain by the slow infiltration of glioma sphere cells. Compared with T2 -weighted images, tumours were properly identified in their early stage of growth using diffusion MRI, and confirmed by localized proton MR spectroscopy as well as immunohistochemistry. The first evidence of tumour presence was revealed for both glioma sphere xenograft models three months after tumour implantation, while no necrosis, oedema or haemorrhage were detected either by MRI or by histology. Moreover, different values of diffusion indices, such as mean diffusivity and fractional anisotropy, were obtained in tumours grown from LN-2669GS and LN-2540GS glioma sphere lines. These observations highlighted diverse tumour microstructures for both xenograft models, which were reflected in histology. This study demonstrates the ability of diffusion MRI techniques to identify and investigate early stages of slow-growing, invasive tumours in the mouse brain, thus providing a potential imaging biomarker for early detection of tumours in humans.

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Brovelli Sebastien; Dorogi Yves; Feiner Adam-Scott; Golay Philippe; Stiefel Friedrich; Bonsack Charles; Michaud Laurent

This dataset is related to "Multifaceted intervention for patients admitted to an emergency unit for suicide attempt: an exploratory study" (Brovelli S., Dorogi Y., Feiner A.-S., Golay P., Stiefel F., Bonsack C. & Michaud L.)

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### When do agents outperform centralized algorithms? - A systematic empirical evaluation in logistics - code

### Rinde R.S. van Lon

Code for 'When do agents outperform centralized algorithms? - A systematic empirical evaluation in logistics'. Rinde R.S. van Lon and Tom Holvoet. Journal of Autonomous Agents and Multi-Agent Systems (2017).

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Version 2 10.5281/zenodo.5

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576389	May 17, 2017
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# Funding / Horizon 2020

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## GitHub

Makefile

setup.py

README.md

requirements.txt

requirements\_dev.txt

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	Prepared for submission to JHEP	📮 svenkreiss / decou	ple
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	A Novel Approach to Higgs Coupling Measurements	T 44 commits	》 <b>4</b> branches
	Kyle Cranmer, <sup>a</sup> Sven Kreiss, <sup>a</sup> David López-Val, <sup>b</sup> and Tilman Plehn <sup>c</sup>	Branch: master - New p	pull request
	Control for Cosmology of Intel Physics, Rev For One Charles, Solar & Catholique de Louvain, Belgium <sup>c</sup> Institut für Theoretische Physik, Universität Heidelberg, Germany	svenkreiss Add Attribu	ition and License section.
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https://github.com/svenkreiss/decouple.

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First version to wo	ork with pip.				3 years ago
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Add Attribution an	nd License section.				3 years ago
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GitHub

Inielsen/Kibet-F1000Research

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### O Inielsen/decouple

DOI 10.5281/zenodo.582569

### **GitHub / Releases**

v50 Inielsen/decouple: Test release

DOI: 10.5281/zenodo.582569

Test release

Payload Metadata

### JSON Export

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### {

"description": "This repository contains the software implementation for our paper A Novel Appro ach to Higgs Coupling Measurements (Cranmer, Kreiss, Lopez-Val, Plehn), arXiv:1401.0080 [hep-ph]. It contains tools to apply the discussed methods to new models and contains a Makefile to recreate the

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44

## CERN?

### Zenodo is offered by CERN as part of its mission to make available the results of its work

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1. The Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto. The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available.

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## Behind Zenodo



## INVENIO)

- **CERN Data Centre**

- <u>Services</u>
- - Physics.

- ~300PB disk - ~200PB tape -~110k CPUs - Digital repositories - Data preservation for High-Energy

### Zenodo: Open in every sense!

### Built by Science. For Science.

### Don't do it yourself



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## DIY time

- Account:
  - Get an ORCID: <u>http://orcid.org</u>
  - Log in on Zenodo: <u>https://sandbox.zenodo.org</u>
- Upload:
  - Files: Format, Description.
  - Creators, Version, DOI
  - License: Choose standard license (never sign a Copyright Transfer Agreement)
  - Linking: Grants, Other resources

Start early

53

### Jupyter Notebook

### Initialize the API client and make a query

Using our just created helper classes we can now create a Zenodo API client:

```
In [2]: api = ZenodoClient()
```

### Simple search

Using the API client we can now execute queries against Zenodo search API:

```
In [3]: result = api.search('North Carolina State University')
         result.total
```

Out[3]: 105681

### Phrase search

The query string is exactly like you would type in the Zenodo search box. The underlying search engine on Zenodo is Elasticsearch, which has a powerful query syntax. Above, we are searching for 4 terms, let's instead make it into a phrase search:

```
In [4]: result = api.search('"North Carolina State University"')
        result.total
```

Out[4]: 1504

### Field search

```
In [5]: ncsu_query = '+creators.affiliation:("NCSU" "NC State University" "North Carolina State University") +doi:10.5281*'
         result = api.search(ncsu query)
        result.total
```

Out[5]: 63

Notice the query string. Here is a couple of points:





### <u>Resources</u>

http://www.datacarpentry.org https://software-carpentry.org

55