

Status of TA3 - WP 1: Statistical Methods

- continuing development of the Bayesian Analysis Toolkit (BAT.jl)
- last release in August: v3.3.0
- currently preparing next larger release with major restructuring of codebase:
 - allowing sampling algorithms to work in transformed phase spaces, e.g. transformations coming from Normalizing Flows (aiming for release early in October)
- BAT.jl as a test case for onboarding software to OSSR:
 - process is straightforward and should be completed soon
 - still not finished due to minor discussions among BAT.jl developers about the required codemeta.json file (postponed meetings due to summer break & conferences)

- DESTINY (astrophysical database) released as a PUNCH service
- Ongoing user support for PUNCH_ASTRO compute projects (code optimization and benchmarking program)
- Organization of the TERA24 virtual meeting on exascale computing in astrophysics (with tutorials on JUPITER, AthenaPK, PLUTO, Idefix, and AI)
- Presented results from our work, “Towards FAIR Astrophysical Simulations”, at an international conference
- Ongoing work on qcd_ml (machine-learning library for lattice QCD)
- Benchmarking in JUREAP program (early access to JUPITER at FZ Jülich)
- Preparation of another lattice QCD use case based on an ML project
- Active members (list is not exhaustive!)
 - Bielefeld: Olaf Kaczmarek, Christian Schmidt-Sonntag, Simran Singh
 - Garching: Salvatore Cielo, Stephan Hachinger
 - Jülich: Annika Hagemeyer, Stefan Krieg, Giovanni Pederiva, Susanne Pfalzner, Frank Wagner
 - Regensburg: Daniel Knüttel, Tilo Wettig

Foundation Models in PUNCH



Universität Hamburg

DER FORSCHUNG | DER LEHRE | DER BILDUNG

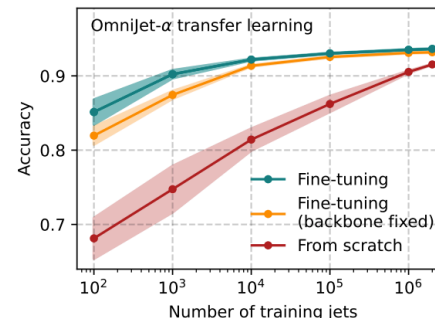
- After publication of Omnijet-Alpha in spring, continued development on foundation models:

Extension of **data set** (including CMS Open Data), **tasks**, and **input objects**

Studies of different **architectures**

Several publications in pipeline for winter 2024

- High **visibility of foundation model work**:
 - Talk at ACAT
 - Talk and poster at EUCaifCon
 - Seminar talk in Munich (ORIGINS Data Science Lab), GraphNeT workshop, and CERN DM workshop
 - Session & introduction at Aspen Workshop
 - PUNCH Lunch
 - Keynote by Hallin at upcoming foundation model conference <https://indico.in2p3.fr/event/33412/>
 - Several talks at ML4Jets <https://indico.cern.ch/event/1386125/>
 - Submission for ML4PS @ NeurIPS



Omnijet-Alpha now published
Mach. Learn.: Sci. Technol. 5
035031 (2024)



Fundamental Physics in the Era of Big Data and Machine Learning at Aspen

<https://aspenphys.org/summer-workshops/#event2401>



Upcoming workshop
(invited foundation model keynote)

Gregor Kasieczka (He/Him) - You
Professor for Machine Learning in Particle Physics
2d · 3d

Tune in to **Anna Hallin's** PUNCH lunch tomorrow on "Foundation models for HEP: Leveraging the power behind large language models for physics" as part of our **#NFDI** consortium

PUNCHLunch –
the online lunch seminar of the PUNCHNFDI Consortium
Every first Thursday, 12:30-13:30 hrs. keynote and discussion

Thursday, 19 September 2024, 12:30 hrs:
Anna Hallin (University of Hamburg)
Foundation models for HEP
Leveraging the power behind large language models for physics

Abstract:
Foundation models are machine learning models designed to handle a wide range of datasets and tasks. After being pre-trained on a specific task on a specific dataset, these models can be fine-tuned for various downstream applications, including different tasks and datasets. Developing such models for physics data could significantly enhance performance in the field and substantially cut down the necessary training time and data requirements. In this talk, I will give an introduction to foundation models, provide an overview of the foundation models that exist for particle physics today, and discuss some challenges and outlooks for the future.

Connection details:
2024 Meeting "PUNCHLunch seminar": <https://indico.desy.de/event/6644/>
Webinar ID: 919 1865 4877, passcode: 481872
Next event: To be confirmed

Connect to PUNCHNFDI:
Newsletter: News-PUNCH@desy.de Mail: punch@desy.de Web: www.punch4de.de

PUNCH Lunch talk by
Anna Hallin on 19.6.

Status of TA3 - WP 4: Across Dataset Analyses

- Paper “Constructing model-agnostic likelihoods, a method for the reinterpretation of particle physics results” published in *Eur.Phys.J.C* 84 (2024) 7, 693 in July
- New method now applied to constrain new physics models by reinterpretation of Belle II $B \rightarrow K \nu \bar{\nu}$ result
- In publication process in the collaboration