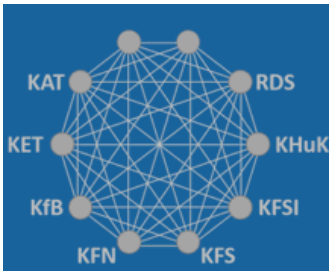

Contribution ID: **31** Type: **not specified**

NN decisions that are robust against systematic uncertainties in the NN feature space

Wednesday 1 January 2025 10:00 (5 minutes)

We are interested in neural network (NN) applications with usually not more than a few hundred input features and large (usually) synthetic training samples. The features are subject to systematic uncertainties, which have to be accounted for in the NN decision taking. In preliminary publications we have investigated the following areas of interest:

- What input features to an NN are most influential for its decision taking [1]?
- Methods to make the NN aware of systematic uncertainties during training, via the loss function [2].
- Methods to move closer with the NN training objective to the full likelihood, including all systematic uncertainties, as the actual objective of the measurement [3].

Our studies are based on a PhD thesis [4] and three Master's theses [5]. We foresee to establish the full subject of our research proposal with an application for future measurements of differential cross sections for Higgs boson production at the LHC in mind, which can serve as demonstration of the usefulness and importance of this research for any field where high credibility and tight monitoring of NN decision taking are desirable.

[1] https://arxiv.org/abs/1803.08782
[2] https://arxiv.org/abs/1907.11674
[3] https://arxiv.org/abs/2003.07186
[4] https://cds.cern.ch/record/2751100?ln=de
[5] https://publish.etp.kit.edu/record/21436, https://publish.etp.kit.edu/record/21950, https://publish.etp.kit.edu/record/22042

List of Committees:

Please describe your expertise/areas in which you would like to contribute / advise.

Likelihood analyses of large and precise data sets; determination and assessment of systematic uncertainties; diagnostics of NN decision taking (a.k.a. unboxing NNs).

Do you consent to the data usage and public abstract data posting in the ErUM-Data Community Information Exchange?

Yes

In ErUM-Data, what kind of data are you dealing with?

High-energy physics proton-proton collision data of the LHC. Events are rich in structure and statistically independent. The data sets are very large.

What is your expertise in computing and / or software development?

Big data analyses of the LHC data (see above) in C++, and python. ML applications in high-energy physics environments. Work with worldwide distributed, heterogeneous, large computing infrastructures (in terms of hard disc, RAM, CPU, and GPU), use of opportunistic resources.

What is your field and role?

University professor/staff position.

Your ErUM - Committee is

KET - Komitee für Elementarteilchenphysik

Please describe areas in which you can contribute to "data handling"teaching.

Distributed computing infrastructures; ML applications for high-energy physics.

My current most burning research question, I like to find partners for, is:

NN decisions that are robust against systematic uncertainties in the NN feature space.

Please describe areas in which you would like to improve your knowledge / skills.

Robust NN trainings with complex loss functions; binned and unbinned likelihoods with systematic uncertainties in form of constrained nuisance parameters in the likelihood as loss functions.

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