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ML techniques for the WZ leptonic analyses in ATLAS

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Measurements of production of multiple electroweak bosons at the LHC constitute a stringent test of the electroweak sector and provide model-independent means to search for new physics at the TeV scale.

In particular, the full leptonic WZ process is among the most suitable channels for such studies. This talk reviews some promising approches investigated to tackle the challenges specific to this channel in the context of the full LHC Run2 pp dataset collected by the ATLAS Experiment, totalling to ~140 fb^-1 at sqrt(s)=13TeV, which is a perfect playground to test the latest development in machine learning for particle physics.

Firstly, the presence of a leptonically decaying W requires the reconstruction of the unknown component along the beam axis of the neutrino momentum. This reconstruction can only be approximated. In this talk the possibility of using regression methods based on deep neural networks to estimate the neutrino longitudinal momentum is explored.

Additionally, as for the study of the WZ production through vector boson scattering is concerned, the modelling of the associated hadronic radiation by current Monte Carlo simulation presents large uncertainties. Methods based on adversarial neural networks in order to reduce the impact of such systematic uncertainties are investigated.

Last but not least, to fully exploit the kinematic information of the event to distinguish the electroweak production from the main sources of irreducible backgrounds (the dominant one being the WZjj production containing also QCD vertexes) specific neural network architectures that use the 4-momenta of the final state particles to extract discriminating features are tested.

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