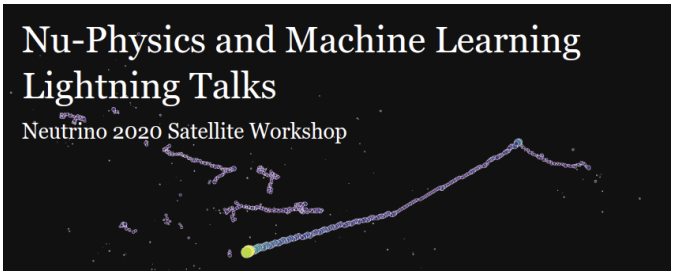


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# Estimating prediction uncertainties for neutron tagging in Super-Kamiokande

Neutrino experiments (particularly Super-Kamiokande) rely on neutron tagging techniques in order to discriminate between neutrinos and antineutrinos. The use of traditional Machine Learning (ML) techniques in order to build data-driven neutron taggers is nowadays a well established procedure which show very good performance. In the language of ML, the idea is to build a classifier which is able to discriminate between neutron events and background events. However, the uncertainty associated with the predictions of such a tagger, which a priori could be sizeable, would affect its ability to classify an event as signal or background and therefore must be considered. In this work in progress, we are addressing this issue by working in a Bayesian approach, which provide a principled uncertainty estimation. Specifically we work with Bayesian Neural Networks together with Variational Inference methods in order to estimate the prediction uncertainties of a neutron tagger, trained with Super-Kamiokande high-energy simulation data. Note, however, that the method developed here will be applicable not only to the problem of neutron classifier, but essentially to any classifier, as neutral-current vs. charged-current interactions, among others.

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