Abstract Submitted
for the SES19 Meeting of
The American Physical Society

Using Bayesian Neural Networks to Make Predictions from Supersymmetry Theories[1] BRADEN KRONHEIM, ALEXANDER KARBO, MICHELLE KUCHERA, RAGHURAM RAMANUJAN, Davidson College — One of the goals in current particle physics research is to obtain evidence for theories beyond the Standard Model (BSM). Many of these theories are high dimensional, which makes searching through their possible predictions difficult. For this project, machine learning was used to make predictions from a simplified supersymmetric model, namely the phenomenological Minimal Supersymmetric Standard Model (pMSSM), a BSM theory with 19 free parameters. Specifically, a Tensorflow implementation of Bayesian Neural Networks was developed for this project to leverage modern day Graphics Processing Units in both the training and prediction phase and obtain confidence intervals. This algorithm was then used to learn to predict cross sections for arbitrary pMSSM parameter combinations, the mass of the Higgs boson they create, and the theoretical validity of the points. All three targets were predicted to a high degree of accuracy with 4.27 percent error or less and can now be used to make predictions significantly faster than traditional methods, with the cross section prediction occurring over 10 million times faster than previous algorithms. These results demonstrate the potential for machine learning to help probe these high dimensional spaces in BSM theories.

[1]This work is funded in part by the Davidson Research Initiative.

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Date submitted: 30 Sep 2019 Electronic form version 1.4