Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Search for paired diphoton resonances using Machine Learning techniques[1] STEVEN CLARK, MARC OSHERSON, EVA HALKIADAKIS, SCOTT THOMAS, Rutgers University, CMS COLLABORATION — We describe a general search for the production of new Beyond Standard Model resonances in a multiphoton final state. The analysis uses data collected with the CMS detector at the CERN LHC from proton-proton collisions at a center-of-mass energy of 13 TeV. The benchmark signal model considered is in an extended higgs sector which has an approximate global symmetry and spontaneous symmetry breaking, resulting in two new scalar particles. The heavier of these (X) has a large branching fraction to the lighter (a), which has Higgs-like couplings. This search focuses on the process $X \to aa \to (\gamma\gamma)(\gamma\gamma)$ and on the region where the relative mass of the new particles results in final-state photons that have little separation and cannot be reconstructed with standard reconstruction algorithms. Thus, we develop novel Machine Learning methods in the form of Convolutional Neural Networks (CNN) to identify these merged multiphoton objects. The CNNs are used to identify merged pairs of photons and reconstruct the invariant mass of the pair. The network inputs are images created from energy deposits in the electromagnetic calorimeter. Initial results show the CNNs have strong discriminating power and we are able to well reconstruct the mass spectra of both resonances.

[1]"This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE- 1842213. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation."

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Date submitted: 21 Dec 2020 Electronic form version 1.4