Contribution ID: **40** Type: **Contributed Oral**

Suppression Without Shaping: DisCo Neural Network Optimization for H->μμ Decay Analysis

Saturday, 15 February 2025 19:00 (15 minutes)

The Higgs boson was discovered in 2012 using data from the Large Hadron Collider (LHC) at CERN. Since its discovery, it has been observed interacting with heavy standard model (SM) particles such as Z and W bosons and heavy quarks. A more interesting search focuses on the Higgs interactions with light SM particles such as the muon manifested in the Higgs-to-dimuon decay path. According to SM predictions, this process is expected to be exceedingly rare. Analyses searching for $H \to \mu\mu$ decay face a challenge in extracting signal from a dominating background of other LHC processes that produce two muons. Previous analyses using boosted decision trees (BDTs) have had limited success to suppress this background.

Neural networks (NNs) present one path to improve over BDT analysis. However, past analyses using NNs have produced shaping in the background near the signal peak. This renders categorized data unreliable for further analysis. One novel method uses NNs trained with a distance correlation (DisCo) loss term. The DisCo loss term punishes the network for shaping the background, leading to better analysis in the end product. This allows more information to be provided for training and is theorized to lead to enhanced background suppression compared to BDTs.

I present on the state of research regarding the use of DisCo NNs to categorize signal and background in the search for $H \to \mu\mu$ decay. In particular, I focus on the meta-parameters of the neural net that are most effective in producing good signal selection. Limited discussion of best practices for choosing meta-parameters is provided.

Your Email

SamuelMoir@cmail.carleton.ca

Affiliation

Carleton University

Supervisor

Dr. Thomas Koffas

Supervisor Email

koffas@physics.carleton.ca

Your current academic level

MSc student

Primary authors: Mr NORMAN, Bryce (Carleton University); MOIR, Samuel (Carleton University); Dr KOFFAS, Thomas (Carleton University)

Presenter: MOIR, Samuel (Carleton University)

Session Classification: Evening 4 - Electroweak/Higgs physics, BSM physics

Track Classification: Electroweak and Higgs Physics