Contribution ID: **507** Type: **Poster**

Enhancing searches for astrophysical neutrino sources in IceCube with machine learning and improved spatial modeling

Searches for astrophysical neutrino sources in IceCube rely on an unbinned likelihood that consists of an energy and spatial component. Accurate modeling of the detector, ice, and spatial distributions leads to improved directional and energy reconstructions that result in increased sensitivity. In this work, we utilize our best knowledge of the detector ice properties and detector calibrations to reconstruct in-ice particle showers. The spatial component of the likelihood is parameterized either by a 2D Gaussian or a von Mises Fisher (vMF) distribution at small and large angular uncertainties, respectively. Here, we use a gradient-boosted decision tree with a vMF spatial likelihood loss function, reparameterized through two coordinate transformations, to predict per-event point spread functions (PSF). Additionally, for template-based analyses, the PSFs are used to smear the underlying templates. Parameterizing these templates with analytical functions allows for analytical smearing and interpolation between various model parameters. We discuss the applications in the context of the Cygnus Cocoon source extension.

Collaboration(s)

IceCube

Authors: SEEN, Leo (University of Wisconsin - Madison); KARLE, Albrecht (University of Wisconsin - Madison); LU, Lu (University of Wisconsin-Madison); THIESMEYER, Matthias (University of Wisconsin - Madison); YUAN, Tianlu (University of Wisconsin - Madison)

Presenter: SEEN, Leo (University of Wisconsin - Madison)

Session Classification: PO-2

Track Classification: Neutrino Astronomy & Physics