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Enhancing Events in Neutrino Telescopes through Deep Learning-Driven Super-Resolution

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Recent discoveries made by neutrino telescopes such as the IceCube Neutrino Observatory relied extensively on machine learning tools to infer physical quantities from the raw photon hits detected. Reconstruction algorithms are limited by the sparse sampling of photons by the optical modules due to the relatively large spacing (10 – 100 m) between them in the detector. In this paper, we propose a novel technique for enhancing the amount of information available to any reconstruction algorithm through the use of deep learning-driven super-resolution of data events. Our strategy embeds additional "virtual"optical modules within the existing physical detector geometry and
trains a convolutional neural network to predict the hits on these virtual optical modules. We show that this technique improves the angular reconstruction of low-energy track and cascade events in a generic ice-based neutrino telescope, though our results readily extend to water-based neutrino telescopes.

Poster prize

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