UNIVERSITY OF DELAWARE
BARTOL RESEARCH INSTITUTE

Contribution ID: **9** Type: **Talk**

Deep Learning for Classification and Denoising of Cosmic-Ray Radio Signals

Thursday, 3 February 2022 14:45 (30 minutes)

Radio emission, produced mainly as a result of the geomagnetic deflection of oppositely charged particles within the cosmic-ray air showers, is contaminated by backgrounds such as the continuous Galactic background and thermal noise. This irreducible background poses a significant challenge for radio detection of air showers. To mitigate this effect of background we employ machine learning (ML) techniques. These techniques such as convolutional neural networks (CNNs) have been widely used to analyze visual imagery. It is only recently that these techniques have been adopted in many fields of science for the purpose of recognizing different patterns in the data. In this work, we use CNNs with the following two goals: to classify waveforms with signals against those that include only noise and to extract the underlying radio signals from the contaminated traces. To produce the required dataset for training the models, we use CoREAS simulations which calculate the radio signals from air showers. For background we considered Cane Model for average Galactic noise, with an additional thermal component. Both signal and background traces are filtered in the 50 - 350 MHz frequency band before training. With these ML models, we aim to improve the detection threshold and also the reconstruction efficiency of the radio technique for cosmic-ray air showers.

Type of Contribution

talk

Primary author: REHMAN, Abdul (University of Delaware)

Co-authors: COLEMAN, Alan (University of Delaware); SCHROEDER, Frank (University of Delaware / Karlsruhe Institute of Technology)

Presenter: REHMAN, Abdul (University of Delaware)

Session Classification: Thursday