Executive Summary

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

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❏ Detection and reconstruction efficiency of cosmic-ray (CR) air-showers, using radio techniques, suffers from the irreducible background which continuously contaminates the radio signals.

❏ In this work we show results of two networks. The first one, called the *Classifier,* is used to identify the traces with radio signals pulse. True Positive (TP) and False Positive (FP) rates computed using the trained Classifier is shown in the top right plot.

❏ The other network we work on is called the *Denoiser,* which is trained in order to recover the underlying signal waveform from the noisy traces. Two quantities, Peak time difference, $\Delta t = T_{\text{Measured}} - T_{\text{True}}$, and Power ratio $= \dfrac{[P_S - P_N]_{\text{Measured}}}{[P_S - P_N]_{\text{True}}}$, are computed and compared with the traditional methods.

❏ Improvement in the power ratio accuracy is observed especially in the important range of low SNR values, and the timing accuracy is improved for all SNR values. The timing accuracy comparison is shown here in the bottom right plot.