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Neural Network Approaches for Event Classification Onboard EUSO-SPB2

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The Extreme Universe Space Observatory Super Pressure Balloon 2 (EUSO-SPB2) is under development, and will prototype instrumentation for future satellite-based missions, including the Probe of Extreme Multi-Messenger Astrophysics (POEMMA). EUSO-SPB2 will consist of two telescopes. The first is a Cherenkov telescope (CT) being developed to identify and estimate the background sources for future below-the-limb very high energy (E>10 PeV) astrophysical neutrino observations. The second is a fluorescence telescope (FT) being developed for detection of Ultra High Energy Cosmic Rays (UHECRs).

Super pressure balloons (SPB) are inherently risky due to the lack of flight controls compared to other orbital and suborbital crafts. The recovery of data from the instrument is only possible if the mission is terminated over land, therefore the only guaranteed data is what can be downloaded during the flight. Limited satellite based telemetry being shared between the two telescopes and housekeeping data results in roughly 1% of events recorded with the FT being downloaded during the flight. This necessitates onboard classification schemes to assign priority to data to be downloaded, which can be run using the limited computational resources of the SPB. We implement several architectures to achieve classification including convolutional, recurrent and Long Short Term Memory (LSTM) neural networks. These networks were trained using a large library of simulated EAS signals and both simulated noise and data taken from previous EUSO experiments. Ultimately, the neural network approach shows great promise but will require additional pre-flight testing in order to be fully validated.

Type of Contribution

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