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Review of neural network methods for the BaikalGVD experiment

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Baikal-GVD is a neutrino telescope with an effective volume of approximately 1 km^3, located in Lake Baikal. This experiment leverages a neural network-based approach to address multiple challenges in data analysis:

1. Suppression of noise hits of the optical modules (OMs) caused by the natural luminescence of the medium, while preserving signal hits generated by Cherenkov radiation;
2. selection of events caused by neutrinos against the dominant background of events caused by extensive air showers;
3. Reconstruction of the neutrino's arrival direction;
4. Reconstruction of neutrino energy.

Monte Carlo simulations demonstrate that the developed neural networks achieve performance metrics comparable to traditional methods. Futhermore, for task 1, the neural network surpasses standard techniques (achieving 99.5% "precision" metric versus 95%). For task 2, a novel method developed that estimates the total number of neutrino-induced events in a dataset and the associated error. In task 4, a neural network model is developed to predict the energy of neutrino events along with an estimate of the prediction error, corresponding to one standard deviation.

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