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GRB Redshift Estimation using Machine Learning and the Associated Web-App

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Context. Gamma-ray bursts (GRBs), observed at redshifts as high as 9.4, could serve as valuable probes for investigating the distant Universe. However, this necessitates an increase in the number of GRBs with determined redshifts, as currently, only 12% of GRBs have known redshifts due to observational biases. Aims. We aim to address the shortage of GRBs with measured redshifts, enabling us to fully realize their potential as valuable cosmological probes Methods. Following Dainotti et al. (2024c), we have taken a second step to overcome this issue by adding 30 more GRBs to our ensemble supervised machine learning training sample, an increase of 20%, which will help us obtain better redshift estimates. In addition, we have built a freely accessible and user-friendly web app that infers the redshift of long GRBs (LGRBs) with plateau emission using our machine learning model. The web app is the first of its kind for such a study and will allow the community to obtain redshift estimates by entering the GRB parameters in the app. Results. Through our machine learning model, we have successfully estimated redshifts for 276 LGRBs using X-ray afterglow parameters detected by the Neil Gehrels Swift Observatory and increased the sample of LGRBs with known redshifts by 110%. We also perform Monte Carlo simulations to demonstrate the future applicability of this research. Conclusions. The results presented in this research will enable the community to increase the sample of GRBs with known redshift estimates. This can help address many outstanding issues, such as GRB formation rate, luminosity function, and the true nature of low-luminosity GRBs, and enable the application of GRBs as standard candles

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