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Resonant anomaly detection without background sculpting

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We introduce a new technique named Latent CATHODE (LaCATHODE) for performing "enhanced bump hunts", a type of resonant anomaly search that combines conventional one-dimensional bump hunts with a model-agnostic anomaly score in an auxiliary feature space where potential signals could also be localized. The main advantage of LaCATHODE over existing methods is that it provides an anomaly score that is well behaved when evaluating it beyond the signal region, which is essential to prevent the sculpting of background distributions in the bump hunt. LaCATHODE accomplishes this by constructing the anomaly score directly in the latent space learned by a conditional normalizing flow trained on sideband regions. We demonstrate the superior stability and comparable performance of LaCATHODE for enhanced bump hunting on the LHC Olympics R&D dataset.

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