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Generative models for transient noise studies in Gravitational Waves detectors

Generative AI techniques have garnered considerable attention for their remarkable ability to synthesize realistic outputs across diverse domains, ranging from images and text to music and beyond, all achieved without explicit human intervention. This capacity, stemming from their aptitude to capture and model nonlinear relationships within data, has led researchers to explore novel solutions to previously insurmountable challenges.

In the realm of gravitational-wave interferometer data analysis, one such challenge arises from non-Gaussian transient noise artifacts, commonly referred to as glitches.These anomalies bear striking resemblance to astrophysical signals in both the time and frequency domains, and, unfortunately, pervade the entirety of the dataset.
In our work, we exploit deep generative algorithms to model and generate glitches in the strain (or main) channel from carefully chosen auxiliary channels using Virgo data. Such generated glitches can then be used for denoising and vetoing purposes by subtracting them from the main channel, thus uncovering the physically interesting data.

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