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Combining Gravitational Wave Events with their Electromagnetic Counterparts: A Realistic Joint False-Alarm Rate KENDALL ACKLEY, STEPHEN EIKENBERRY, SERGEY KLIMENKO, University of Florida, LIGO TEAM — We present a false-alarm rate for a joint detection of gravitational wave (GW) events and associated electromagnetic (EM) counterparts for Advanced LIGO and Virgo (LV) observations during the first years of operation. Using simulated GW events and their recostructed probability skymaps, we tile over the error regions using sets of archival wide-field telescope survey images and recover the number of astrophysical transients to be expected during LV-EM followup. With the known GW event injection coordinates we inject artificial electromagnetic (EM) sources at that site based on theoretical and observational models on a one-to-one basis. We calculate the EM false-alarm probability using an unsupervised machine learning algorithm based on shapelet analysis which has shown to be a strong discriminator between astrophysical transients and image artifacts while reducing the set of transients to be manually vetted by five orders of magnitude. We also show the performance of our method in context with other machine-learned transient classification and reduction algorithms, showing comparability without the need for a large set of training data opening the possibility for next-generation telescopes to take advantage of this pipeline for LV-EM followup missions.

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