

Machine Based algorithm for characterizing and precursory monitoring of landslides

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Landslides routinely cause significant damage to life and property. Various studies have evaluated mechanisms that trigger landslides. It is now established that a large proportion landslides are caused by a combination of anthropogenic activities and environmental factors such as rain and earthquakes. Das and Tordesillas (2019) proposed a machine based algorithm to characterize and provide precursory warnings for a rockfall type of landslide. In this work we extend this algorithm (Section 3.4) to include relatively short but serially correlated displacement signals sampled with using the interferometric synthetic aperture radars (InSAR) embedded within the sentinel group of satellites. The generalized version of the algorithm is based on spectral analysis of time series. The resulting algorithm is applied to 2019 Brumadinho Tailing Dam collapse. The algorithm identifies several potential risk milestones going back to about July, 2018, eventually concluding with two retrospective estimates of risk, t_R (27 Feb 2018 - 26 Aug 2018) for definitive but emergent risk and t_I (27 Jun 2018 - 24 Dec 2018) for imminent risk of collapse of the system. We posit that the combination of spectral methods and second order statistical properties of displacement signals can reveal tantalizing signs of transition into an unstable regime and argue that this algorithm can also be used for intervention with a view to mitigate the chances of a potential disaster.