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## Can point cloud data be used to calculate time to failure of a landslide?

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Point cloud data capturing ground surface elevation at two instants in time are commonly used to identify the occurrence of landslides, identify their spatial extent, and to provide an estimate of the volume of depletion/accretion. In this study, it is hypothesized that this same point cloud data has the potential to yield much more valuable quantitative information regarding landslide behaviour, including the direction, magnitude, and rate of surface displacement. Given point cloud data contains roughness information, shaded projections (hillshade images) of the slope at two or more instants in time can be processed using digital image correlation (DIC) to track displacement in the plane of the projection. If multiple view angles are used to generate the hill shade images, 3D surface displacements of the landslide surface should theoretically be resolved. Furthermore, if point clouds are generated with sufficiently high temporal resolution, it should be possible to estimate the time to failure. We explore this hypothesis in field experiment conducted in Tsukuba, Japan in which we bring a 3.5 m high earth dam to shear failure under high reservoir levels and extreme rainfall. Point clouds of the downstream dam surface generated at high temporal resolution were successfully used to calculate the 3D displacement of the dam surface, and to calculate the time of failure using the inverse-velocity method to within four minutes of the observed slope failure.