Rapidly assessing strong earthquake damage has been a long-standing goal of seismology. A novel approach involves exploiting satellite spatial detection, as we present, here, for the May 2008 Wenchuan, China earthquake. In past results, satellite interferometric synthetic aperture radar (InSAR) detected most of the crustal deformations, but failed in coherent-loss regions where extreme damage occurred. The regions where failures occurred were irregularly distributed over fault zones spanning 200 km in length and ~10 to 30 km in width within mountainous areas. Here, we show that regions where past failures have occurred are detectable using a pixel-offset analysis, where larger offset displacements corresponded to heavily damaged regions of a Modified Mercalli Intensity (MMI) of IX or greater. In this study, landslides and coseismic fault scarps were attributed to locations where larger offsets were identified. We proposed a spatial observational relationship between offset displacement to seismic intensity as a simple index to estimate damage situations that larger offset displacements of ~1, ~2, and ~3 m roughly corresponded to higher seismic intensity regions of IX, X, and XI, respectively. Using this observational frame of reference, we found that heavily damaged regions extended westward of high mountainous areas, where little information was available. The findings obtained from spatial detection improved the seismic intensity distribution and suggest the possibility of rapidly assessing strong earthquake damage following a mega inland earthquake. With coordinated efforts to improve spatial observations, timely seismic intensity information can be made available to mitigate disasters.